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CA Final

Advanced Financial Management

New Questions by ICAI

Relevant for May 25

- Latest 5 Exam Papers, RTPs & MTPs
- MCQs: BoS Knowledge Portals
- SM 2024 & 2025 Amendments: Capital Budgeting & Real Options

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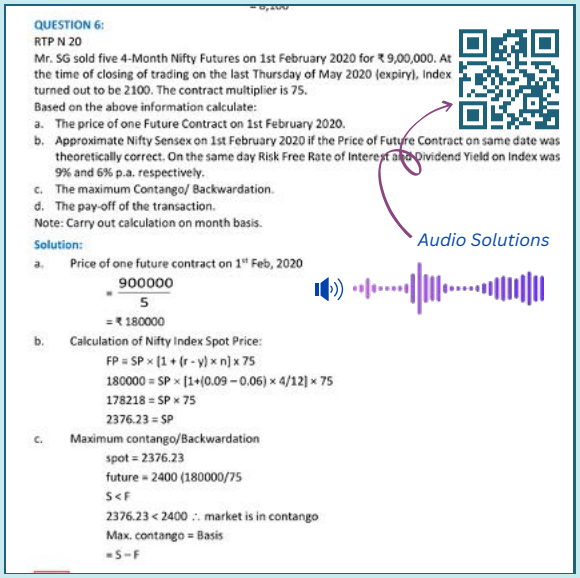


QUESTION 6:

RTP N 20

Mr. SG sold five 4-Month Nifty Futures on 1st February 2020 for ₹ 9,00,000. At the time of closing of trading on the last Thursday of May 2020 (expiry), Index turned out to be 2100. The contract multiplier is 75.

Based on the above information calculate:

a. The price of one Future Contract on 1st February 2020.

b. Approximate Nifty Sensex on 1st February 2020 if the Price of Future Contract on same date was theoretically correct. On the same day Risk Free Rate of Interest and Dividend Yield on Index was 9% and 6% p.a. respectively.

c. The maximum Contango/ Backwardation.

d. The pay-off of the transaction.

Note: Carry out calculation on month basis.

Solution:

a. Price of one future contract on 1st Feb, 2020

$= \frac{900000}{5}$

= ₹ 180000

b. Calculation of Nifty Index Spot Price:

FP = SP × [1 + (r - y) × n] x 75

180000 = SP × [1+(0.09 – 0.06) × 4/12] × 75

178218 = SP × 75

2376.23 = SP

c. Maximum contango/Backwardation

spot = 2376.23

future = 2400 (180000/75

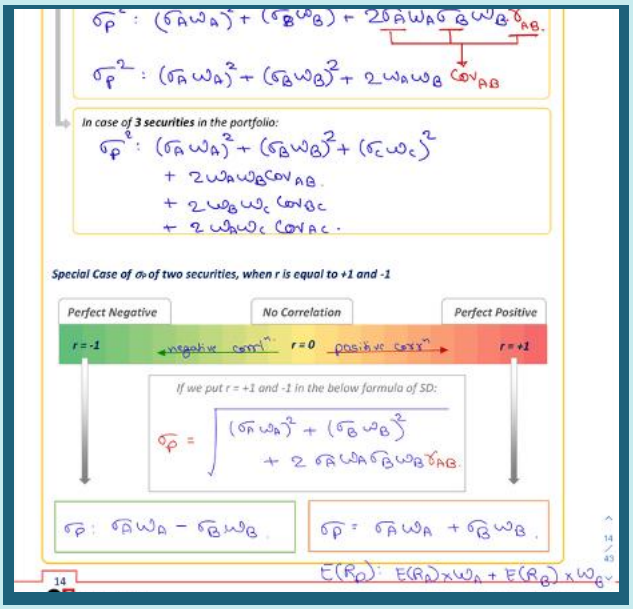
S < F

2376.23 < 2400 ∴ market is in contango

Max. contango = Basis

= S – F

Audio Solutions



$\sigma_p^2 : (\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2 w_A w_B \sigma_{AB}$

In case of 3 securities in the portfolio:

$\sigma_p^2 : (\sigma_A w_A)^2 + (\sigma_B w_B)^2 + (\sigma_C w_C)^2 + 2 w_A w_B Cov_{AB} + 2 w_B w_C Cov_{BC} + 2 w_A w_C Cov_{AC}$

Special Case of σ_p of two securities, when r is equal to +1 and -1

Perfect Negative | No Correlation | Perfect Positive

r = -1 | negative corr^n | r = 0 | positive corr^n | r = +1

If we put r = +1 and -1 in the below formula of SD:

$\sigma_p = \sqrt{(\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2 \sigma_A w_A \sigma_B w_B \gamma_{AB}}$

$\sigma_p : \sigma_A w_A - \sigma_B w_B$ | $\sigma_p = \sigma_A w_A + \sigma_B w_B$

$E(R_p) : E(R_A) \times w_A + E(R_B) \times w_B$

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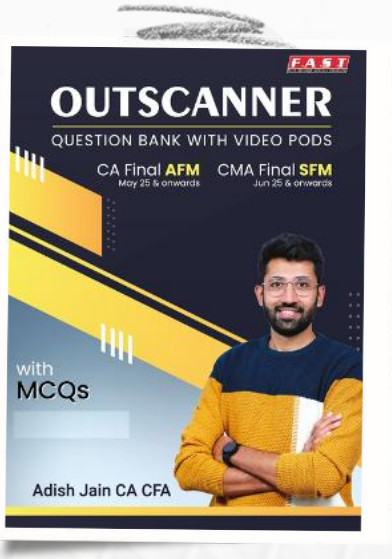

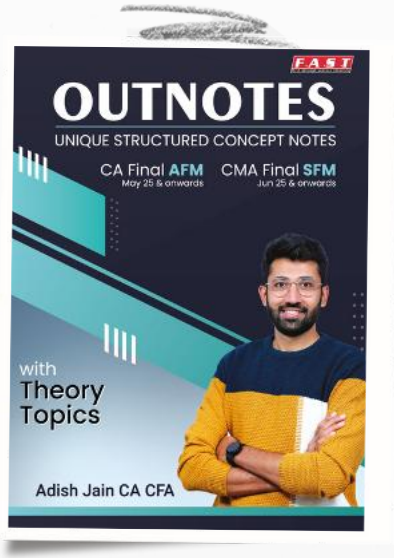

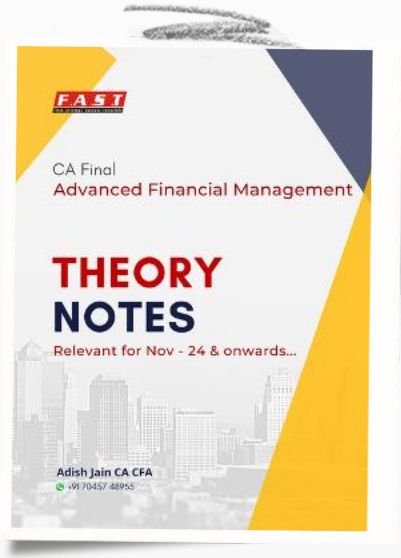

New Questions in Exams Paper, RTPs and MTPs of Past 5 Attempts

May 25 – MTP

QUESTION 1:

Mr. Ramesh, a 40-year-old investor, has invested ₹10,00,000 in an actively managed Equity Mutual Fund. The fund has an Expense Ratio of 2.50% and follows the Nifty 50 Index as its benchmark. Upon analyzing the Fund details, he comes across the concept of Tracking Error (TE) and finds out that the same Fund has a Tracking Error (TE) of 3.20%.

A few months later, Mr. Ramesh receives a notification that the Fund has implemented Side Pocketing. The Fund has an exposure of 15% of his investment in a debt instrument of XYZ Ltd, a company facing a severe financial crisis. Since XYZ Ltd has defaulted on its payments, the Fund Manager has moved this portion into a side pocket.

Following the decision of Fund Manager, Mr. Ramesh decides to reconsider any of the following option:

1. Should he stay invested in this Fund and wait for the Side-Pocketed assets to recover?
2. Should he switch to a Passive Index Fund that has a lower Tracking Error and lower Expense Ratio
3. Should he redeem his remaining liquid holdings and invest in a better-performing actively Managed Fund?

Based on the above scenario and given his current situation, choose the most appropriate answer for the following multiple-choice questions:

1. Is it necessary for investors to pay close attention to the Expense Ratio of a Mutual Fund because……..
   - **A. a high expense ratio can significantly reduce net returns over time.**
   - B. a higher expense ratio always guarantees better fund performance.
   - C. the expense ratio only matters in the first year of investment.
   - D. funds with higher expense ratios are always risk-free.
2. The Fund has been …… in replicating return on Nifty 50.
   - A. Successful
   - **B. Unsuccessful**
   - C. Can't say
   - D. Data is insufficient
3. After the decision of Fund Manager for side-pocketing the equivalent portion of Mr. Ramesh's investment shall_____
   - A. remains illiquid until the Fund Manager decides to sell it or the company recovers.
   - B. be immediately written off, and the Mr. Ramesh loses that portion.
   - **C. be returned to Mr. Ramesh in proportion to his holdings.**
   - D. be moved into a different Mutual Fund Scheme with no risk.
4. If Mr. Ramesh switches to a Passive Index Fund with an expense ratio of 0.8%, then he will save annually compared to his current Expense Ratio of 2.50%?
   - A. ₹ 8,000
   - B. ₹ 10,000
   - **C. ₹ 17,000**
   - D. ₹ 18,000
5. The advantage for Mr. Ramesh to switch over to a Passive Index Fund shall be____
   - **A. lower expense ratio and lower tracking error.**
   - B. guaranteed recovery of side-pocketed assets.

C. higher risk exposure compared to active funds.
D. avoiding capital gains tax on redemption.

QUESTION 2:

On 20.10.2024, the credit balance of an Indian bank in NOSTRO account with LMN Bank in London was £ 1,60,000 and the overbought position was £ 1,00,000. During the day, the following transactions have taken place:

Events	Time	Amount (£)
DD Purchased	11:08	50,000
Purchased a bill on London	11:50	150,000
Sold forward TT	13:15	100,000
Forward purchased contract cancelled	13:55	50,000
Remitted by TT	14:45	85,000
Draft in London cancelled	15:00	40,000

Based on the above scenario, choose the most appropriate answer for the following multiple-choice questions:

1. How much was the total amount of purchase commitments made during the day by the Indian Bank?
   A. £ 2,00,000
   B. £ 1,50,000
   C. £ 3,40,000
   D. £ 50,000

2. The final cash balance in the NOSTRO account at the end of 20.10.24 stands at …….
   A. £ 85,000
   B. £ 75,000
   C. £ 20,000
   D. £ 160,000

3. The transaction took place at …….shall affect both exchange & cash position of the bank with LMN Bank.
   A. 11:08
   B. 11:50
   C. 14:45
   D. 15:00

4. If at the end of day bank is required to maintain a credit balance of £ 20,000 in the NOSTRO account, then it…….
   A. shall buy forward £ 15,000
   B. shall sell spot TT £ 55,000
   C. shall buy spot TT £ 55,000
   D. shall sell forward £ 55,000

5. If bank takes required steps to maintain a credit balance of £ 20,000 in the Nostro account, then what additional step was required to achieve the overbought position of £ 65,000?
   A. Buying forward £ 15,000
   B. Selling forward £ 65,000
   C. Buying forward £ 60,000
   D. Selling forward £ 15,000

QUESTION 3:

Zenith Capital, a boutique investment firm, manages portfolios for high-net-worth individuals (HNIs). Their lead portfolio manager, Mr. R, has been closely analyzing market trends to optimize returns for their fixed-income portfolio. Over the past few months, he has observed fluctuations in interest rates and anticipates a significant shift in the near future.

To optimise returns, Mr. R is considering three different investment strategies for clients having ₹ 10 crore of fund and are interested in Fixed Income Portfolio. Each strategy is designed to align with the client's risk appetite and future liquidity needs.

Strategy A: Investing the entire ₹ 10 crore in a single bond with a 7-year maturity to match a specific financial obligation in the future.

Strategy B: Allocating ₹ 5 crore in short-term bonds (1-year maturity) and ₹ 5 crore in long-term bonds (7-year maturity) to balance risk and return.

Strategy C: Spreading the ₹ 10 crore investment equally across bonds with maturities of 1 to 5 years to ensure periodic liquidity.

Meanwhile, Mr. R is also considering forecasting models to predict interest rate movements. He is evaluating economic indicators such as inflation, historical rate trends, and a combination of multiple economic factors to enhance the firm's forecasting accuracy.

Mr. R suggested Strategy B for Mr. H (a HNI) having a sum of ₹ 10 crore for investment in Fixed Income Portfolio. As per the strategy half amount on fund is proposed to be invested in 7-year bonds yielding 8% per annum and balance in 1-year short term bond yielding 6% per annum. Interest on these bonds is compounded annually.

Based on the above case scenario, choose the correct answer to the following questions:

1. What is the primary objective of an active bond portfolio strategy?
   - A. To maintain a fixed return irrespective of market conditions
   - **B. To outperform the market by making informed investment decisions**
   - C. To minimize volatility and ensure steady returns
   - D. To invest in government bonds only

2. If any HNI follows Strategy A, then ……of fixed-income portfolio strategy is being followed.
   - A. Barbell Strategy
   - B. Ladder Strategy
   - **C. Bullet Strategy**
   - D. Duration Matching

3. In the Barbell Strategy, the funds are typically allocated……..
   - A. by making entire investment in bonds with the same maturity period.
   - **B. by dividing investment equally between short-term and long-term bonds.**
   - C. by dividing equal amount in bonds with different maturity periods.
   - D. by investing only in short-term bonds.

4. In the ladder Strategy, the funds are typically allocated……..
   - A. by making entire investment in bonds with the same maturity period.
   - B. by dividing investment equally between short-term and long-term bonds.
   - **C. by dividing equal amount in bonds with different maturity periods.**
   - D. by investing only in short-term bonds.

5. It is expected that interest rate in coming 8 years are expected to fall by 25 bps each year and if Mr. H does not withdraw any amount from the Fund during these 7 years the total value of the investment at the end of the 7th year shall be approximately……

   A. ₹ 15.036 crore
   B. ₹ 15.721 crore
   C. ₹ 15.739 crore
   D. ₹ 15.829 crore

QUESTION 4:

Before proceeding, they believe a thorough analysis of options in the securities available to ensure a higher return while minimizing risk.

To achieve this objective, it formed a team consisting of following persons with respective assigned tasks:

Mr. A – He is entrusted with the task of analysing various Macro-economic factors e.g. historical performance of the economies in the past/ present and expectations in future, growth of different sectors of the economies in future with signs of stagnation/degradation at present. In addition to that he also analysed the trends in peoples' income and expenditure.

Ms. B – After receiving inputs/ recommendations from Mr. A she is entrusted with the task of assessment regarding all the conditions and factors relating to demand of the particular product, cost structure of the industry and other economic and Government constraints in the same country.

Mr. C – After receiving inputs/ recommendations from Ms. B he is entrusted with the task of careful examination of the company's quantitative and qualitative fundamentals. Which includes a comparison of price earning ratios of different companies. Further, In addition to examine the financial solvency, liquidity of the company he is also advised for the evaluation of future growth prospects of the company identified.

Based on the above case scenario, choose the correct answer to the following questions:

1. If Mr. A want to evaluate the impact of macroeconomic trends on their potential investment. Which of the following factors is least likely to influence their decision?

   A. Growth rates of national income
   B. Inflation rates
   C. Market speculation trends
   D. Barometer indicators

2. The investor learns that inflation is expected to rise. Based on economic analysis, how might this affect their stock investment decision?

   A. Stock prices are expected to decline due to reduced consumer demand
   B. Stock prices are expected to rise as stocks act as a hedge against inflation
   C. Stock prices will remain unaffected as inflation only affects bond markets
   D. Stock prices will become highly volatile, but long-term growth remains unchanged

3. Which of the techniques shall be primarily used by Ms. B to carry out the required analysis at his part?

   A. Anticipatory Surveys
   B. Indicator Approach
   C. Input-Output Analysis
   D. Decision Tree Analysis

4. Mr. A while analyzing industry growth, finds that certain indicators tend to peak before the economy's overall growth. These indicators are best classified as.....
   A. Lagging indicators
   B. Leading indicators
   C. Coincidental indicators
   D. Random indicators

5. Specifically, the team of Mr. A, Ms. B, and Mr. C are entrusted with the task of carrying out.....
   A. Fundamental Analysis
   B. Technical Analysis
   C. Market Analysis
   D. Security Analysis

May 25 – RTP

QUESTION 5:

M 10 | RTP M 25

ABC, a large business house is planning to sell its wholly owned subsidiary KLM. Another large business entity XYZ has expressed its interest in making a bid for KLM. XYZ expects that after acquisition the annual earning of KLM will increase by 10%.

Following information, ignoring any potential synergistic benefits arising out of possible acquisitions, are available:

a. Profit after tax for KLM for the financial year which has just ended is estimated to be ₹ 10 crore.
b. KLM's after tax profit has an increasing trend of 7% each year and the same is expected to continue.
c. Estimated post tax market return is 10% and risk free rate is 4%. These rates are expected to continue.
d. Corporate tax rate is 30%

	XYZ	ABC	Proxy entity for KLM in the same line of business
No. of shares	100 lakhs	80 lakhs	--
Current share price (₹)	287	375	--
Dividend pay out	40%	50%	50%
Debt : Equity at market values	1 : 2	1 : 3	1:04
P/E ratio	10	13	12
Equity beta	1	1. 1	1.1

Assume gearing level of KLM to be the same as for ABC and a debt beta of zero.

You are required to calculate:

a. Appropriate cost of equity for KLM based on the data available for the proxy entity.
b. A range of values for KLM both before and after any potential synergistic benefits to XYZ of the acquisition.
c. Compute the market value of KLM as a part of ABC.

Note: Round off calculation up to 2 decimal and compute figure in ₹ crores.

(a) To calculate cost of equity for KLM first we shall calculate β of KLM as follows:

β (equity ungeared for the proxy company) = 1.1 X 4 / [4 + (1 – 0.3)] = 0.94

0.94 = β equity geared X 3/ [3 + (1 - 0.3)]

β equity geared = 1.16

Cost of equity = 0.04 + 1.16 X (0.10 – 0.04)

= 10.96%

(b) Based on the data available range of valuation can be computed using P/E and dividend-based valuation approach.

(i) P/E valuation

(Based on earning of ₹ 10 Crore)

	Using proxy entity's P/E	**Using XYZ's P/E**
Pre synergistic value	= 12 X ₹ 10 Crore = ₹ 120 Crore	= 10 X ₹ 10 Crore = ₹ 100 Crore
Post synergistic value	= 12 X ₹ 10 Crore X 1.1 = ₹ 132 Crore	= 10 X ₹ 10 Crore X 1.1 = ₹ 110 Crore

(ii) Divided valuation model

	Based on 50% pay-out	**Based on 40% pay-out**
Pre synergistic value	$= \frac{0.5 \times 10 \times 1.07}{0.1096-0.07}$ = ₹ 135.10 Crore	$= \frac{0.4 \times 10 \times 1.07}{0.1096-0.07}$ = ₹ 108.08 Crore
Post synergistic value	$= \frac{0.5 \times 10 \times 1.1 \times 1.07}{0.1096-0.07}$ = ₹ 148.61 Crore	$= \frac{0.4 \times 10 \times 1.1 \times 1.07}{0.1096-0.07}$ = ₹ 118.89 Crore

(c) Market Price

Although no information is available about the value of KLM, it may be possible to calculate a market value based on proportion of earnings of ABC that is generated by KLM.

Market value of ABC = 80 Lakh Shares X ₹ 375 = ₹ 300 Crore

Post-tax earnings of ABC = ₹ 300 crore/13 = ₹ 23.08 Crore

If market value of ABC is allocated to KLM in the proportion of relative earning of KLM to that of ABC, KLM would have a market value of ₹ 300 crore X [10/23.08] = ₹ 129.98 Crore.

KLM's Post Tax earning = ₹ 10 Crore.

If ABC's P/E ratio is applied to it, the market value of KLM becomes ₹ 10 Crore X 13 = ₹ 130 Crore.

Nov 24 – Exam Paper

QUESTION 6:

Z Ltd. paid a dividend of 5 for the current year. The dividend is expected to grow at 25% for the next 6 years and at 10% per annum thereafter. The return of government bond is 13% per annum and market return is expected to be around 20%. The correlation between market return and Z Ltd. share return is 0.3733. The standard deviation of market return and Z Ltd. shares is 12% and 18% respectively.

Round off to two decimal places.

From the information given above, choose the correct answer to the Question no. 1 to 5:

1. What is the intrinsic value of Z Ltd. shares?
   - A. **₹156.69**
   - B. ₹303.14
   - C. ₹349.62
   - D. ₹341.30

2. What is the present value at the end of 4th year?
   - A. ₹23.71
   - B. ₹12.56
   - C. **₹6.53**
   - D. ₹6.99

3. What is the expected return of Z Ltd shares?
   - A. 15%
   - B. 23.92%
   - C. **16.92%**
   - D. 16.5%

4. What is value in perpetuity at the start of the 6^{th} year?
   - A. ₹156.69
   - B. **₹303.14**
   - C. ₹ 349.62
   - D. ₹341.30

5. If current market price of the shares is 315 than stock is
   - A. **Over valued**
   - B. Under valued
   - C. Fairley valued
   - D. Cannot be determined

QUESTION 7:

The following information is available in respect of Bond 1 and Bond 2

	Bond 1	Bond 2
Face value, redeemable value at par	₹1000	₹1000
Coupon rate, payable annually (%)	6%	10%
Time to maturity (years)	5	3

An investor has the portfolio consisting of 75% of Bond 1 and 25% of Bond 2. The current YTMs prevailing in the market is 10%.

Year (n):	1	2	3	4	5
PVIF (10%, n):	0.9091	0.8264	0.7513	0.6830	0.6209

From the information given above, choose the correct answer to the Question no. 6 to 9:

1. New price of the portfolio if YTM changes from 10% of 10.5% based on the duration is:
   - A. **₹ 870.12**
   - B. ₹ 902.36
   - C. ₹ 1832.23
   - D. ₹ 1864.45

2. What should be the price and duration of Bond-2?
   - A. ₹ 826.43 and 2.49
   - B. **₹ 1,000 and 2.74**
   - C. ₹ 924.85 and 2.74
   - D. ₹ 1000 and 2.49

3. What should be the price and duration of Bond – 1?
   - A **₹ 848.34 and 4.43**
   - B. ₹ 811.09 and 4.38
   - C. ₹ 1,227.44 and 4.43
   - D. ₹ 658.15 and 3.90.

4. What will be the price sensitivity of the portfolio?
   - A. -4.027
   - B. -2.491
   - C. **-3.643**
   - D. -3.981

QUESTION 8:

Based on the following information, choose the correct answer from the following questions:

Situation	Action	Exercise Price	Premium	Spot Price
I	Exercised	140	20	160
II	Exercised	200	15	175
III	Lapsed	300	25	400

From the information given above, choose the correct answer to the Question no. 10 to 12:

1. In Situation III, the investor's position and the amount of profit / loss is:
   - A. **Put option, ₹(25)**
   - B. Call option, ₹75
   - C. Short position, ₹100
   - D. Long position, ₹(100)

2. In situation I, the investor's position and amount of profit or loss is:
   A. Put option and ₹20
   B. **Call option and ₹0**
   C. Put option and ₹0
   D. Call option and ₹20

3. In situation II, the investor's position and the amount of profit / loss is:
   A. **Put option and ₹10**
   B. Call option and ₹10
   C. Put option and ₹25
   D. Call option and ₹25

QUESTION 9:

The following is the data regarding Three Securities.

Stock	Expected Return (%)	Std. deviation	Correlation with the Market return
A	19%	2.50	0.840
B	13.50%	2.00	0.540
C	11.00%	0.80	0.975
Market risk	-	1.20	-
Market rate of return	14.00%	-	-
Risk tree rate	9.00%	-	-

a. Advise which of the above stocks are over, under or correctly valued in the market?
b. What will be strategy would you like to recommend?

Solution:

a) Calculation of Beta and Required rate of return:

Security	Beta	Required rate of return: $R_j = R_f + \beta (R_m - R_f)$
A	$= \frac{0.840 \times 2.50}{1.20} = 1.75$	= 9% + 1.75 (14% - 9%) = 17.75%
B	$= \frac{0.540 \times 2.00}{1.20} = 0.90$	= 9% + 0.90 (14% - 9%) = 13.50%
C	$= \frac{0.975 \times 2.00}{1.20} = 0.65$	= 9% + 0.65 (14% -b%) = 12.25%

Stock	Required rate of return %	Expected rate of return%	valuation
A	17.75%	19.00%	Under Valued
B	13.50%	13.50%	Correctly Valued
C	12.25%	11.00%	Over Valued

b) Strategy:

Stock	Decision
A	Buy
B	Hold

C	Sell

QUESTION 10:

Mr. X invested ₹ 1,00,000 at a face value of ₹ 10 per unit in a dividend reinvestment plan in a mutual fund during its initial public offering on 1st July, 2022. On 31st March, 2023, the mutual fund declared a dividend of 10%. At that time Mr. X calculated his holding period return to be 115%.

On 31st March, 2024 the mutual fund declared a dividend of 20% and Mr. X redeemed all his investment and calculated his holding period return to be 193.134%.

You are required to calculate

a. The NAVs as on 31.03.2023 and 31.03.2024.

b. Calculate the total units redeemed.

Solution:

a) **Calculation of NAV on 31st March 2023 (NAV_1):**

Number of units on 1st July 2022 (n_0) = 1,00,000/10 = 10,000 units

Dividend reinvested = 10,000 × 10 × 10% = ₹ 10,000

Number of units reinvested $= \frac{10,000}{NAV_1}$

Number of units on 31st March 2023 (n_1) $= 10,000 + \frac{10,000}{NAV_1}$

Now, calculation of NAV_1:

Holding Yield $= \frac{(NAV_1 \times n_1) - (NAV_0 \times n_0)}{(NAV_0 \times n_0)} \times 100$

$$115 = \frac{(NAV_1 \times [10,000 + \frac{10,000}{NAV_1}]) - 1,00,000}{1,00,000} \times 100$$

NAV_1 = ₹ 20.5

Calculation of NAV on 31st match 2024 (NAV_2):

Number of units on 31st March 2023 (n_1) $= 10,000 + \frac{10,000}{20.5}$

= 10,487.80 units

Dividend reinvested = 10,487.8 × 10 × 20% = ₹ 20,975.6

Number of units reinvested $= \frac{20,975.6}{NAV_2}$

Number of units on 31st March 2024 (n_2) $= 10,487.8 + \frac{20,975.6}{NAV_2}$

Now, calculation of NAV_2:

Holding Yield $= \frac{(NAV_2 \times n_2) - (NAV_0 \times n_0)}{(NAV_0 \times n_0)} \times 100$

$$193.134 = \frac{(NAV_2 \times [10,487.8 + \frac{20,975.6}{NAV_2}]) - 1,00,000}{1,00,000} \times 100$$

NAV_2 = ₹ 25.95

b) Number of units redeemed on 31st March 2024 (n_2) = $10,487.8 + \frac{20,975.6}{25.95}$

= 11,296.11 units

QUESTION 11:

PQ Ltd. expects sales of ₹ 100 lakhs in the year 1. The same will increase by ₹ 20 lakhs per year over the next four years. At the end of 5 years the project would be wound up. The Deprecation will be charged at 20% p.a. on straight line method.

The expenses excluding the depreciation will be 40% of the sales. There will be no salvage value of the plant. PQ Ltd. proposes to invest in the plant an amount where the Net Present Value will be Zero.

Corporate Tax rate is 30%.

You are required to calculate the investment which can be made in the plant.

Solution:

Self-note: The question is missing the data of discounting rate. That is why suggested answer has solved the question without calculating PV of future cash inflows. Alternatively, the question can also be solved assuming any other discounting rate.

Expected Sales & Cost excluding depreciation (₹ Lakhs)

Year	Expected Sales	Expected expenses @ 40%
1	100	40
2	120	48
3	140	56
4	160	64
5	180	72

Cash Inflow from the Project

Let the cost of the plant = P

The, Depreciation per year = 0.20P

Accordingly, annual CFAT will be (₹ Lakhs):

Year	Sales	Expenses	Depn	PBT	Tax @ 30%	PAT	Depn	CFAT
1	100	40	0.20P	60 – 0.20P	18 - 0.06P	42 – 0.14P	0.20P	42+ 0.06P
2	120	48	0.20P	72 – 0.20P	21.6 – 0.06P	50.4 – 0.14P	0.20P	50.40 + 0.06P
3	140	56	0.20P	84 – 0.20P	25.2 – 0.06P	58.8 – 0.14P	0.20P	58.80 + 0.06P
4	160	64	0.20P	96 – 0.20P	28.8 – 0.06P	67.2 – 0.14P	0.20P	67.20 + 0.06P
5	180	72	0.20P	108 – 0.20P	32.4 – 0.06P	75.6 – 0.14P	0.20P	75.60 + 0.06P
PV of Net Cash Inflows								294 + 0.30P

For NPV to be zero, PV of Cash OF (i.e., investment in plant) = PV of Cash Inflows

Accordingly, P = 294 + 0.30P

P = 420

Thus, the required investment to be made in plant shall be ₹420 lakhs.

QUESTION 12:

XY Ltd. is planning to expand its operations in view of growing demand for its products. For this purpose, it is considering to borrow an amount of ₹ 100 crores for a period of 3 months in the coming 6 months' time from now. The current rate of interest is 8% per annum but due to inflation it may go up in 6 months' time. The company wants to hedge itself against the likely increase in interest rate.

The company's Bankers quoted an FRA (Forward Rate Agreement) at 8.20% per annum.

You are required to calculate due to FRA:

a. The actual interest rate if the Banker pays to XY Ltd. an amount of ₹ 9,78,952.52

b. The actual interest rate if XY Ltd. will pay to the Banker a sum of ₹ 9,80,872.98

Solution:

a) Position of XY Ltd = Long i.e., Contract to borrow.

Self-note: Since, XY Ltd had a gain on settlement, it means that FR would be lower than RR. It means RR – FR i.e., gain would be a positive number.

Calculation of actual interest rate (RR):

$$\text{Gain} = \frac{NP \times (RR - FR) \times n/12)}{1 + RR \times n/12}$$

$$9,78,952.52 = \frac{1,00,00,00,000 \times (RR - 0.082) \times 3/12}{1 + RR \times 3/12}$$

RR = 0.086 or 8.6%

b) Position of XY Ltd = Long i.e., Contract to borrow.

Self-note: Since, XY Ltd had a loss on settlement, it means that FR would be higher than RR. It means RR – FR i.e., loss would be a negative number.

Calculation of actual interest rate (RR):

$$-9,80,872.98 = \frac{1,00,00,00,000 \times (RR - 0.082) \times 3/12}{1 + RR \times 3/12}$$

RR = 0.078 or 7.8%

QUESTION 13:

Economic Value Added (EVA) of ABC Ltd was ₹ 31,10,000.

Following is the capital structure of ABC Ltd. at the end of current financial year:

Equity (Share Capital + Reserves & Surplus)	₹ 170 lakhs
Debt (Coupon Rate 10%)	₹ 80 lakhs
Invested Capital	₹ 250 lakhs

Following data is given to estimate the cost of equity capital:

Beta of ABC Ltd.	0.90
Risk-free rate (i.e. current yield on Govt. Bonds)	8%
Average market risk premium	10%

Economic Value Added (EVA) of ABC Ltd was ₹ 31,10,000.

The applicable corporate income tax rate is 30%.

You are required to calculate the Profit After Tax of ABC Ltd.

Solution:

Calculation of WACC:

k_e $= R_f + \beta \times (R_m - R_f)$

$= 8 + 0.90 \times 10 = 17\%$

k_d $= 10 \times (1 - 0.30) = 7.00\%$

WACC $= 17 \times \frac{170}{250} + 7 \times \frac{80}{250} = 13.80\%$

Now, calculating EBIT using EVA:

EVA = EBIT × (1 - t) – Invested Capital × WACC

31,10,000 = [EBIT × (1 – 0.3)] – (2,50,00,000 x 0.1380)

EBIT = ₹ 93,71,429

Calculation of profit after Tax (₹)

Operating Profit	93,71,429
Less: Interest	8,00,000
Profit before Tax	85,71,429
Less: Tax @ 30%	25,71,429
Profit after Tax	60,00,000

QUESTION 14:

PQR Ltd. is considering a project in US, which involve an initial investment of ₹ 124.50 Crore. The project will have useful life of 5 years. Current spot exchange rate is INR/USD is 83. The risk free rate in US is 4.186 % and the same in India is 6.9768%. Cash inflows in USD from the project are as follows

Year	1	2	3	4	5
Cash inflow	30,00,000	40,00,000	50,00,000	60,00,000	70,00,000

PQR Ltd. is expecting net surplus of 1858.08 lakh to be received after closure of the project. There is no salvage value. PQR Ltd. want to take a forward cover to protect itself from exchange rate fluctuations.

n	**1**	**2**	**3**	**4**	**5**
PVIF(6.976%, n)	0.935	0.874	0.817	0.764	0.714
PVIF(4.186%,n)	0.959	0.921	0.884	0.849	0.815
PVIF(12%, n)	0.893	0.797	0.712	0.636	0.567
PVIF(15%, n)	0.870	0.756	0.658	0.572	0.497

You are required to recommend the INR/USD rate for the forward cover?

Solution:

Self-note: This question has following ambiguities:

1. *The data of discounting rate is missing in the question which is why institute has made a random assumption of 12%. Alternatively, some other rate may also be assumed.*
2. *The $ cash flows of all the years are to be converted to rupee using same ₹/$ forward rate.*
3. *Amount of ₹ 1858.08 lakh does not seem to be NPV based on its language given in question.*

Let the ₹/$ forward rate for every year be F.

Annual Cash inflows (in lakhs):

Year	$ CFs	₹ CFs
1	30.00	30.00F
2	40.00	40.00F
3	50.00	50.00F

4	60.00	60.00F
5	70.00	70.00F

Back-calculating the Forward rate (F) using NPV assuming a discount rate of 12% (₹ lakhs):

Year	CFs	PVF@12%	DCFs
0	- 12450	1.00	- 12450
1	30F	0.893	26.79F
2	40F	0.797	31.88F
3	50F	0.712	35.60F
4	60F	0.636	38.16F
5	70F	0.567	39.69F
			172.12F - 12450

Now, NPV = 172.12F – 12450

1858.08 = 172.12F – 12450

F = 83.13

Recommendation: Forward cover the rate of ₹/$ 83.13 is recommended.

QUESTION 15:

Mohan buys 10,000 shares of X Ltd. @ ₹ 25 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. @₹ 40 per share having a beta value of 2. He obtains a complete hedge by buying 25 Nifty Futures. He closes out his position at the closing price of the next day when the share of X Ltd. has fallen by 4% and Nifty Futures has dropped by 2.50%. In the process he suffered a loss of ₹ 16,625.

You are required to determine

a. The value of the Nifty future
b. Initial cash outlay
c. Cash inflow at the close out
d. Percentage Gain/ loss to Shares of A Ltd. at the time of closure
e. Price of A Ltd on closure.

Solution:

a) Position and MV of holdings:

Security	position	No. of shares	MPS	Market Value	Beta
X	Long	10,000	25	2,50,000	1.5
A	Short	- 5,000	40	- 2,00,000	2
Net PF Value				50,000	

$$\beta_p = \frac{\beta_X \times MV_X + \beta_A \times MV_A}{MV_X + MV_A}$$

$$= \frac{1.5 \times 2,50,000 + 2 \times (-2,00,000)}{2,50,000 + (-2,00,000)}$$

= - 0.5 times

Calculating price of futures using hedging formula:

$$\text{No. of contract} = V_P \times \frac{\beta_T - \beta_P}{F \times M}$$

$$+ 25 = \frac{50,000 \times (0 - (-0.5))}{P_F}$$

P_F = ₹ 1,000

b) Initial Cash Outlay = 2,50,000 + (-2,00,000) + (1,000 × 25)
= 75,000

Self-note: Position in futures ideally should not be considered in Cash Outlay. But suggested answer has done it.

c) Cash Inflow at closeout:
Profit/(loss) = IF at close out – Initial OF
- 16,625 = IF – 75,000
IF = 58,375

d) Gain loss on share A

	Total Loss			16,625
Less:	Loss on X	(2.5L × 4%)	=	10,000
Less:	Loss on Futures	(25 × 1,000 × 2.5%)	=	625
	Loss on A			₹ 6,000

Loss in % $= \frac{6,000}{2,00,000} = 3\%$

e) Price on closure = 40 + 3% = ₹ 41.2

QUESTION 16:

A Portfolio Manager (PM) has three mutual funds in his portfolio. Following are the details of these three mutual funds:

Particulars	Growth fund	Balanced fund	Regular fund	Market
Average Return (%)	7.5	6.3	5.4	
Variance				50.41
Sharpe Ratio	-0.15	-0.36	-0.48	
Treynor's Ratio	-2	-3	-4.80	

The yield on 182 days Treasury bill is 9 per cent per annum.
You are required to calculate
a. Variance of the Funds
b. Coefficient of Determination of the Funds

Solution:

	Growth	Balanced	Regular
a) Sharpe Ratio $= \frac{E(r) - R_f}{\sigma_p}$	$-0.15 = \frac{7.5 - 9}{\sigma_G}$ $\sigma_G = 10\%$ $\sigma_G^2 = 100\%$	$-0.36 = \frac{6.3 - 9}{\sigma_B}$ $\sigma_B = 7.5\%$ $\sigma_B^2 = 56.25\%$	$-0.48 = \frac{5.4 - 9}{\sigma_R}$ $\sigma_R = 7.5\%$ $\sigma_R^2 = 56.25\%$
b) Treynor ratio $= \frac{E(R) - R_f}{\beta_p}$	$-2 = \frac{7.5 - 9}{\beta_G}$ $\beta_G = 0.75$ times	$-3 = \frac{7.5 - 9}{\beta_B}$ $\beta_B = 0.9$ times	$-4.8 = \frac{7.5 - 9}{\beta_R}$ $\beta_R = 0.75$ times

$\beta_s = r_{(s,m)} \times \frac{\sigma_s}{\sigma_m}$	$0.75 = r_{G,m} \times \frac{10}{7.1}$ $r_{G,m} = 0.5325$	$0.9 = r_{B,m} \times \frac{7.5}{7.1}$ $r_{B,m} = 0.852$	$0.75 = r_{R,m} \times \frac{7.5}{7.1}$ $r_{R,m} = 0.710$
Coefficient of determination	$r_{G,m}^2 = 0.2836$	$r_{B,m}^2 = 0.7259$	$r_{R,m}^2 = 0.504$

QUESTION 17:

True Life Inc., a US based company, has won a contract to implement a project in India. The project will require an initial investment of ₹ 8000 million. The whole project along with the equipment will be sold to the Indian Government for ₹ 9600 million in one-year time. Since the Indian Government will pay for the amount in Indian Rupee (₹), the company is worried about exposure due to exchange rate volatility.

a. Construct a swap that will help the True Life Inc. to reduce the exchange rate risk.

b. Assume that the Indian Government offers a swap at spot rate which is INR/USD 80 in one year. The spot rate after one year is expected to be INR/USD 84. Further, you may also assume that the True Life Inc. can also take a USD loan at 6% per annum.

ADVISE whether the company should opt for this option or just do nothing.

Solution:

(i) The following swap arrangement can be entered by True Life Inc.

(1) Swap a US$ loan today at an agreed rate with any party to obtain Indian Rupees (₹) to make initial investment.

(2) After one year swap back the Indian Rupees with US$ at the agreed rate. In Such Case the company is exposed only on the profit earned from the project.

(ii) **With the Swap**

	Year 0 (Million US$)	Year 1 (Million US$)
Buy ₹8000 million at spot rate of 1 USS = ₹80	(100.00)	--------
Swap ₹8000 million back at agreed rate of ₹ 80		100.00
sell ₹1600 million at 1 US$ = ₹84		19.05
Interest on $100 loan @6% for one year		(6.00)
	(100.00)	**113.05**

Net result is a net receipt of IJS$ 13.05 million

Without the swap

	Year 0 (Million US$)	Year 1 (Million US$)
Buy 8000 million at spot rate of 1 1US$ = ₹80	(100.00)	
Sell 9600 million at 1 US$ = ₹84		114.29
Interest on $100 loan @6% for one year		(6.00)
	(100.00)	**108.29**

Net result is a net receipt of US$ 8.29 million.

Decision: Since the net receipt is higher in swap option the company should opt for the same.

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QUESTION 18:

The Asset Management Company of the mutual fund (MF) has declared a dividend of 9.98% on the units under the dividend reinvestment plan for the year ended 31st March 2021. The investors are issued additional units for the dividend at the rate of closing Net Asset Value (NAV) for the year as per the conditions of the scheme.
The closing NAV was ₹ 24.95 as on 31st March 2021. An investor Mr. X who is having 20,800 units at the year-end has made an investment in the units before the declaration of the dividend at the rate of opening NAV plus an entry load of ₹ 0.04. The NAV has appreciated by 25% during the year.
Assume the face value of the unit as ₹ 10.00.
Based on above Case Scenario, answer the following questions:

1. The Opening NAV of the Asset Management Company shall be ……
(a) ₹ 20.24
(b) ₹ 19.96
(c) ₹ 18.75
(d) ₹ 17.65

Ans. (b)

2. The Number of the units purchased shall be …….
(a) 18750
(b) 17500
(c) 20450
(d) 20000

Ans. (d)

3. Original amount of the investment shall be ……
(a) ₹ 4,00,000
(b) ₹ 6,50,000
(c) ₹ 3,55,000
(d) ₹ 5,65,000

Ans. (a)

4. Which of the following statement about Expense ratio is/ are incorrect:
(i) It is the percentage of income that were spent to run a mutual fund.
(ii) It includes advisory fees, travel costs, registrar fees , custodian fees, etc.
(iii) It includes Brokerage costs for trading of Portfolio.
(iv) High Expense Ratio can seriously undermine the performance of a mutual fund scheme.
(a) (i), (ii), (iii)
(b) (i), (iii)
(c) only (iii)
(d) only (i)

Ans. (c)

5 . ……considers and uses downside deviation instead of total standard deviation in denominator.
(a) Expense Ratio

(b) Sharpe Ratio
(c) Treynor Ratio
(d) Sortino Ratio

Ans. (d)

QUESTION 19:

Suppose you are a risk manager at a financial institution, and your company has loaned a significant amount of ₹ 500 crore to a company X Ltd. for a period of 3 years at 6-month at MCLR plus 200 bps. You are concerned about X Ltd.'s ability to repay the debt due to recent market volatility. To protect your institution from potential default, you decide to purchase a Credit Default Swap (CDS) from ABC Bank Ltd. for same notional amount at a premium quoted at 1% per year through cash settlement.

On the respective reset dates for the same period actual MCLR interest rate comes out as follows:

Reset	MCLR
1	9.75%
2	10.00%
3	10.25%
4	10.35%
5	10.50%
6	10.60%

Based on above case scenario answer the following questions:

1. The primary purpose of a Credit Default Swap (CDS) is.....
(a) to increase the value of bonds.
(b) to protect against default risk of a debt obligation.
(c) to provide guaranteed profit to the buyer.
(d) to create a new form of loan.

Ans. (b)

2. Which of the following statements is true about CDS contracts?
(a) CDS contracts cannot be used for speculation.
(b) CDS contracts are governed by government regulations.
(c) CDS contracts are private agreements between two parties.
(d) CDS contracts eliminate all risks for the buyer.

Ans. (c)

3. Which organization publishes the guidelines and rules for conducting Credit Default Swap transactions?
(a) Federal Reserve
(b) International Swap and Derivative Association (ISDA)
(c) Securities and Exchange Commission (SEC)
(d) World Trade Organization (WTO)

Ans. (b)

4. Assuming no default occurs the total premium your company will pay during the designated loan period shall be.....
(a) ₹ 5 crore
(b) ₹ 10 crore
(c) ₹ 15 crore
(d) ₹ 30 crore

Ans. (c)

5. Suppose if the lender defaults somewhere in the beginning of third year of loan (after payment of interest upto 2 years) and the market value of a reference loans falls to 75% of its par value, then ABC Bank will pay your company .....in a cash settlement.

(a) ₹ 15 crore
(b) ₹ 30 crore
(c) ₹ 125 crore
(d) ₹ 500 crore

Ans. (c)

QUESTION 20:

You are an investment analyst working for a financial advisory firm. You have been asked to analyze the bond market's yield curve to assist your clients in making investment decisions. The yield curve represents the relationship between the interest rates (yield) and the time to maturity for debt securities, usually government bonds.
For simplicity, assume the following yield data for government bonds over various maturities (measured in years):
Yield Curve Table

Maturity (Years)	Yield (%)
1 Year	3.00%
2 Years	4.00%
3 Years	5.00%
5 Years	6.00%
7 Years	6.40%
10 Years	7.00%
15 Years	7.40%
30 Years	7.60%

Based on above case scenario answer the following questions:

1. The main characteristic of a normal yield curve is…….

(a) Short-term yields are higher than long-term yields.
(b) Short-term yields are lower than long-term yields.
(c) Yields remain the same across all maturities.
(d) Yields fluctuate randomly over different maturities.

Ans. (b)

2. Based on the revised yield data, what is the yield spread between the 10-year bond and the 1-year bond?

(a) 2.0%
(b) 3.5%
(c) 4.0%
(d) 5.0%

Ans. (c)

3. An inverted yield curve typically indicates……

(a) Economic growth
(b) Economic uncertainty
(c) An upcoming recession
(d) Inflationary pressure

Ans. (c)

4. If an investor is looking to invest for 2 years starting 3 years from now, the forward rate he would expect shall be……

(a) 7.41%
(b) 7.52%
(c) 7.76%
(d) 7.93%

Ans. (b)

5. If an investor is looking to invest for 2 years starting 5 years from now, the forward rate he would expect shall be……

(a) 7.41%
(b) 7.52%
(c) 7.76%
(d) 7.93%

Ans. (a)

QUESTION 21:

You as an investor purchased a 4-month European Call Option on the equity shares of X Ltd. for ₹ 10, of which the current market price is ₹ 132 per share and the exercise price ₹ 150. You expect the price to range between ₹ 120 to ₹ 190. The expected share price of X Ltd. and related probability is given below:

Expected Price (₹)	120	140	160	180	190
Probability	0.05	0.20	0.50	0.10	0.15

Based on above case scenario answer the following questions:

1. Expected price of share of X Ltd. at the end of 4 months shall be…….
   a. ₹ 160.00
   b. ₹ 160.50
   c. ₹ 158.00
   d. ₹ 140.00

2. Suppose if the exercise price prevails at the end of 4 months the Value of Call Option shall be……
   a. ₹ 0
   b. ₹ 18
   c. ₹ 10
   d. ₹ 14

3. In case the option is held to its maturity, the expected value of the call option shall be……
   a. ₹ 0
   b. ₹ 18
   c. ₹ 10
   d. ₹ 14

4. In the given different scenarios of expected prices of share of X Ltd. at the time of maturity the option shall be in-the-money in …… scenarios.
   a. two
   b. three
   c. five
   d. In none of the scenario

5. In the given different scenarios of expected prices of share of X Ltd. at the time of maturity the option shall be at-the-money in …… scenarios.
   a. two
   b. three
   c. five
   d. In none of the scenario

QUESTION 22:

The ABC Startup has the following expected profits (₹) under different scenarios along respective probabilities

Year	Best Case		Base Case		Worst Case	
	Revenue	Expenses	Revenue	Expenses	Revenue	Expenses
1	100,00,000	80,00,000	100,00,000	90,00,000	100,00,000	95,00,000
2	120,00,000	92,40,000	110,00,000	95,70,000	102,00,000	98,94,000
3	144,00,000	108,00,000	121,00,000	102,85,000	104,04,000	101,95,920
Probability	30%		60%		10%	

You are required to suggest the value of ABC Startup using First Chicago Method assuming that:

a. Applicable discounting rate is 20%.
b. Startup is located in Tax-free Zone.
c. The multiple for Terminal is 10.
d. No depreciable assets are held by the ABC Startup.

Note:

1. Present Value Factor (PVF)

Year	1	2	3
PVF@20%	0.8333	0.6944	0.5787

2. Round off the calculation to whole numbers.

Solution:

Valuation of Startup under different scenarios:

a) Best Case Scenario

	Year 1	Year 2	Year 3	
Revenue	₹ 1,00,00,000	₹ 1,20,00,000	₹ 1,44,00,000	
Expenses	₹ 80,00,000	₹ 92,40,000	₹ 1,08,00,000	
Cash Flow/ Earnings	₹ 20,00,000	₹ 27,60,000	₹ 36,00,000	
Terminal Value				₹ 3,60,00,000
PVF @ 20%	0.8333	0.6944	0.5787	0.5787
PV	₹ 16,66,600	₹ 19,16,544	₹ 20,83,320	₹ 2,08,33,200
Value of Startup				₹ 2,64,99,664

b) Base Case Scenario

	Year 1	Year 2	Year 3	
Revenue	₹ 1,00,00,000	₹ 1,10,00,000	₹ 1,21,00,000	
Expenses	₹ 90,00,000	₹ 95,70,000	₹ 1,02,85,000	

Cash Flow/ Earnings	₹ 10,00,000	₹ 14,30,000	₹ 18,15,000	
Terminal Value				₹ 1,81,50,000
PVF @ 20%	0.8333	0.6944	0.5787	0.5787
PV	₹ 8,33,300	₹ 9,92,992	₹ 10,50,341	₹ 1,05,03,405
Value of Startup				₹ 1,33,80,038

c) Worst Case Scenario

	Year 1	Year 2	Year 3	
Revenue	₹ 1,00,00,000	₹ 1,02,00,000	₹ 1,04,04,000	
Expenses	₹ 95,00,000	₹ 98,94,000	₹ 1,01,95,920	
Cash Flow/ Earnings	₹ 5,00,000	₹ 3,06,000	₹ 2,08,080	
Terminal Value				₹ 20,80,800
PVF @ 20%	0.8333	0.6944	0.5787	0.5787
PV	₹ 4,16,650	₹ 2,12,486	₹ 1,20,416	₹ 12,04,159
Value of Startup				₹ 19,53,711

Value of ABC Startup as per First Chicago Method:

= 0.30 x ₹ 2,64,99,664 + 0.60 x ₹ 133,80,038 + 0.10 x ₹ 19,53,711

= ₹ 1,61,73,293

Nov 24 – RTP

QUESTION 23:

Two friends, Mr. A and Mr. N were discussing about the risks of market. While Mr. A is sort of risk averse, Mr. N is an aggressive investor and believes in taking risk.

Mr. N said we cannot diversify the market risk at all, and he quoted the Modern Portfolio Approach. Both friends analyze the market data for the few months and came out with expected returns on two stocks for a particular market.

Market Return	Aggressive	Defensive
7%	4%	9%
25%	40%	18%

Based on the above scenario, answer the following questions:

1. The Beta of Defensive stock is……

(a) 2
(b) 0.5
(c) 4
(d) 1

Ans. (b)

2. If the market return is equally likely to be 7% or 25% then expected return of Aggressive stock shall be……..

(a) 18%
(b) 13.50%
(c) 22%
(d) 11%

Ans. (c)

3. The Alpha of the Defensive stocks is…….

(a) -10%
(b) 22%
(c) 5.50%
(d) 12%

Ans. (c)

4. The Modern Portfolio Theory was propounded by ……

(a) William Sharpe
(b) Black Scholes
(c) Stephen Ross
(d) Harry Markowitz

Ans. (d)

5. As per Capital Market Line (CML) Theory the Portfolios lying on the CML over the market portfolio are called …….

(a) Lending Portfolios
(b) Borrowing Portfolios
(c) Diversified Portfolios
(d) Risk- Free Portfolios

Ans. (c)

May 24 – MTP

QUESTION 24:

ABC Ltd. is planning to expand its business and therefore raising fund by issuing a convertible bond of ₹ 10 crore. An investor "Mr. X" is interested to invest in the bond of ABC Ltd. Mr. X has following data related to the convertible bond.

The data given below relates to a convertible bond:

Face value	₹ 250
Coupon rate	12%
No. of shares per bond	20
Market price of share	₹ 12
Straight value of bond	₹ 235
Market price of convertible bond	₹ 265
Maturity	5 Years

You, being an expert of the matter, are required to answer his questions. Select the most appropriate alternative:

1. The percentage of downside risk of the bond is approximately……..

(a) 10.42%
(b) 6.38%
(c) 2.13%
(d) **12.77%**

2. The conversion premium in percentage term of the bond is……..

(a) 12.77%
(b) **10.42%**
(c) 2.18%
(d) 13.45%

3. The conversion parity price of the stock is…….
(a) ₹ 11.75
(b) ₹ 12.00
(c) **₹ 13.25**
(d) ₹ 12.50

4. If he wants a yield of 15% the maximum price he should be ready to pay for is…… .
(a) 217.41
(b) **224.81**
(c) 240.00
(d) 232.32

QUESTION 25:

Suppose you are a financial consultant and following 3 clients have approached to you seeking advise on the investment to be made in securities. All these clients have different background and risk appetite as well as perception to the market.

- Client A wants to invest in Fixed income avenues and therefore he is looking at the credit rating of the securities as well as financial ratios such as interest coverage, earning power etc and the general prospect of the industry.
- Client B wants to earn a fixed income over a period of time by holding the security till its maturity.
- Client C wants to earn more by taking more risk. Therefore, he is more interested to invest in stocks. He believes that Price reflects all information found in the record of past prices and volumes.

On the basis of above information, choose the most appropriate answer to the MCQs.

1. The main factor to be considered in selecting fixed income avenue for client A shall be……..
(a) Yield to maturity
(b) **Risk of Default**
(c) Tax Shield
(d) Liquidity

2. The main factor that have to be evaluated in the selection of Bond for Client B shall be……..
(a) **Yield to maturity**
(b) Risk of Default
(c) Tax Shield
(d) Liquidity

3. If Weak form efficiency is prevailing in the market then which approach is best for selection of Equity Shares?
(a) Technical Analysis
(b) **Fundamental Analysis**
(c) Random selection Analysis
(d) None of the above.

QUESTION 26:

On the basis of the following information:

Current dividend (Do) = ₹5
Discount rate (k) = 10.5%
Growth rate (g) = 4%

(i) Calculate the present value of stock of ABC Ltd.

(ii) Evaluate whether the stock is overvalued if stock price is ₹ 70, ROE = 18% and EPS (E_0) = ₹ 4.50 applying:

(1) PE Multiple Approach and

(2) Earning Growth Model (using discount rate of 10.5%).

Solution:

(i) Present Value of the stock of ABC Ltd. is:-

$$Vo = \frac{5(1.04)}{0.105-0.04} = ₹80/-$$

(ii) (A) Value of stock under the PE Multiple Approach

Particulars	
Actual Stock Price	₹ 70.00
Return on equity	18%
EPS	₹ 4.50
PE Multiple (1/Return on Equity) = 1/18%	5.56
Market Price per Share	₹ 25.02

Since, Actual Stock Price is higher, hence it is overvalued.

(B) Value of the Stock under the Earnings Growth Model

Particulars	
Actual Stock Price	₹ 70.00
Return on equity	18%
EPS	₹ 4.50
Growth Rate	4%
Market Price per Share [EPS ×(1+g)]/(Ke – g) = ₹ 4.50x 1.04 / (0.105-0.04)	₹ 72

Since, Actual Stock Price is lower, hence it is slightly undervalued.

QUESTION 27:

A US parent company has subsidiaries in France, Germany, UK and Italy. The amounts due to and from the affiliates is converted into a common currency viz. US dollar and entered in the following matrix.

Inter Subsidiary Payments Matrix (US $ Thousands)

		Paying affiliate				
		France	Germany	UK	Italy	**Total**
Receiving affiliat	France	---	80	120	200	400
	Germany	120	---	80	160	360
	UK	160	120	---	140	420
	Italy	200	60	120	---	380

	Total	480	260	320	500	**1560**

The treasurer of US Parent company is suggesting that by applying Multilateral Netting system the company can save a lot of transfer/ exchange costs. The company's Board agreed with Treasurer's proposal.
From the above case scenario, choose the most appropriate answer of following MCQs.

1. Before applying Multilateral Netting it is necessary to apply…….
   A. Unilateral Netting
   B. Bilateral Netting
   C. Multilateral Netting
   D. Interest Rate Swapping

2. Through Multinational Netting these transfers will be reduced to …….
   A. $ 50,000
   B. $ 100,000
   C. $ 150,000
   D. $ 200,000

3. The Net Payment/ Net Receipts for France after netting off shall be…….
   A. Net Receipt $ 40,000
   B. Net Payment $ 80,000
   C. Net Payment $ 40,000
   D. Net Receipt $ 80,000

4. The Net Payment/ Net Receipts for Italy after netting off shall be…….
   A. Net Receipt $ 60,000
   B. Net Payment $ 120,000
   C. Net Payment $ 60,000
   D. Net Receipt $ 120,000

5. Suppose if the transfer charges are 0.01% of the amount transferred then by applying multilateral netting techniques there will be reduction in overall cost of transfer by …….
   A. US $ 136
   B. US $ 156
   C. US $ 1,360
   D. US $ 1,560

QUESTION 28:

Your client is holding the following securities:

Particulars of Securities	Cost	Dividends/ Interest	Market price at the end of holding period	Beta
	₹	₹	₹	
Equity Shares:				
G Ltd.	20,000	1,450	19,600	0.6
S Ltd.	30,000	1,000	30,400	0.8
B Ltd.	28,000	1,400	32,000	0.6
GOI Bonds	72,000	5,060	71,980	0.01

Evaluate:
a. Risk free rate of return.

b. Expected rate of return of each security (except GOI Bond), using the Capital Asset Pricing Model (CAPM).

Note:

(1) Use weighted average Beta in calculations.

(2) Round off calculations upto 3 decimal points.

Solution:

Particulars of Securities	Cost ₹	Market Price	Capital gain	Dividend/ Interest
G Ltd.	20,000	19,600	(400)	1,450
S Ltd.	30,000	30,400	400	1,000
B Ltd.	28,000	32,000	4,000	1,400
GOI Bonds	72,000	71,980	(20)	5,060
Total	1,50,000	1,53,980	3,980	8,910

a) Risk free return [Return on Govt. Security (GOI Bond)]

$$= \frac{5{,}060+(72{,}000-71{,}980)}{72{,}000} = 7\%$$

b) Weighted Average of Beta

= 0.6 x 19,600/1,53,980 + 0.8 x 30,400/1,53,980
+ 0.60 x 32,000/1,53,980 + 0.01 x 71,980/1,53,980
= 0.364

Average Return on Portfolio = (8,910+3,980) / 1,50,000 x 100% = 8.593%

Calculating Market Return:

8.593% = 7% + (R_m – 7%) x 0.364

R_m = 11.376%

Expected Rate of Return for each security is

Rate of Return = Rf + β (Rm – Rf)

G Ltd. = 7 + 0.6 (11.376 – 7) = 9.626%

S Ltd. = 7 + 0.8 (11.376 – 7) = 10.501%

B Ltd. = 7 + 0.6 (11.376 – 7) = 9.626%

QUESTION 29:

A mutual fund company introduces two schemes i.e. Dividend plan (Plan-D) and Bonus plan (Plan-B). The face value of the unit is ₹ 10. On 1-4-2018 Mr. K invested ₹ 2,00,000 each in Plan-D and Plan-B when the NAV was ₹ 38.20 and ₹ 35.60 respectively. Both the plans matured on 31-3-2023.

Particulars of dividend and bonus declared over the period are as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value (₹)	
			Plan D	Plan B
30-09-2018	10	---	39.10	35.60
30-06-2019	---	1:5	41.15	36.25
31-03-2020	15	---	44.20	33.10
15-09-2021	13	---	45.05	37.25
30-10-2021	---	1:8	42.70	38.30
27-03-2022	16	---	44.80	39.10
11-04-2022	---	1:10	40.25	38.90
31-03-2023	---	---	40.40	39.70

Evaluate the Effective Yield Per Annum in respect of the above two plans.

Note:

1. Use following PV Factors:
PVIF (2%,5) = 0.9057, PVIF (4%,5) = 0.8219, PVIF (8%,5)
= 0.6806, PVIF (13%,5) = 0.5428

2. Round off calculations upto 2 decimal points.

Solution:

Plan – D

Unit acquired = $\frac{2,00,000}{38.20}$ = 5235.60

Date	Units held	Dividend		Re- investment Rate	New Units	Total Units
		%	Amount			
01.04.2018						5235.60
30.09.2018	5235.60	10	5235.60	39.10	133.90	5369.50
31.03.2020	5369.50	15	8054.25	44.20	182.22	5551.72
15.09.2021	5551.72	13	7217.24	45.05	160.20	5711.92
27.03.2022	5711.92	16	9139.07	44.80	204.00	5915.92
31.03.2023	Maturity Value	(₹ 40.40 X 5915.92)				₹ 2,39,003.17

Approximate Effective Yield = $\frac{2,39,003.17 - 2,00,000}{2,00,000}$ X $\frac{1}{5}$ X 100

= 3.90%

Now more accurate effective yield can be computed by using the IRR method as follows:

At Rate of:		PV of Maturity Value is:
2%	→	2,16,465.17
? = 3.64%	←	2,00,000.00
4%	→	1,96,436.71

Accurate Effective Yield = 3.64%

Plan – B

Date	Particulars	Calculation Working	No. of Units	NAV (₹)
01.04.2018	Investment	₹ 2,00,000/35.60 =	5617.98	35.60
30.06.2019	Bonus	5617.98/5 =	1123.60	36.25
			6741.58	
30.10.2021	"	6741.58/8 =	842.70	38.30
			7584.28	
11.04.2022	"	7584.28/10 =	758.43	38.90
			8342.71	
31.03.2023	Maturity Value	8342.71 x ₹ 39.70 =		3,31,205.59

Approximate Effective Yield = $\frac{1,31,205.59}{2,00,000}$ X $\frac{1}{5}$ X 100

= 13.12%

Now more accurate effective yield can be computed by using the IRR method as follows:

At Rate of:		PV of Maturity Value is:
8%	→	2,25,418.52
? = 10.78%	←	2,00,000.00
13%	→	1,79,778.39

Accurate Effective Yield = 10.78%

May 24 – RTP

QUESTION 30:

Grow More Ltd. an NBFC is in the need of funds and hence it sold its receivables to MAC Financial Corporation (MFC) for ₹ 100 million. MFC created a trust for this purpose called General Investment Trust (GIT) through which it issued

securities carrying a different level of risk and return to the investors. Further, this structure also permits the GIT to reinvest surplus funds for short term as per their requirement.

MFC also appointed a third party, Safeguard Pvt. Ltd. (SPL) to collect the payment due from obligor(s) and passes it to GIT. It will also follow up with defaulting obligor and if required initiate appropriate legal action against them.

Based on above scenario, answer the following questions:

1. The securitized instrument issued for ₹ 100 million by the GIT falls under category of …….
   A. Pass Through certificate (PTCs)
   B. Pay Through Security (PTS)
   C. Stripped Security
   D. Debt Fund.

2. In the above scenario, the Originator is…….
   A. Grow More Ltd.
   B. MAC Financial Corporation (MFC)
   C. General Investment Trust (GIT)
   D. Safeguard Pvt. Ltd.

3. In the above scenario, the General Investment Trust (GIT) is a/an…….
   A. Obligor
   B. Originator
   C. Special Purpose Vehicle (SPV)
   D. Receiving and Paying Agent (RPA)

5. In the above scenario, the Safeguard Pvt. Ltd. (SPL) is a/an……
   A. Obligor
   B. Originator
   C. Special Purpose Vehicle (SPV)
   D. Receiving and Paying Agent (RPA)

6. Which of the following statement holds true?
   A. When Yield to Maturity in market rises, prices of Principle Only (PO) Securities tend to rise.
   B. When Yield to Maturity in market rises, prices of Principle Only (PO) Securities tend to fall.
   C. When Yield to Maturity in market falls, prices of Principle Only (PO) Securities tend to fall.
   D. **When Yield to Maturity in market falls, prices of Principle Only (PO) Securities remain the same.**

QUESTION 31:

You are a financial analyst at a prominent investment firm and have been tasked with empirically verifying the weak form of Efficient Market Hypothesis (EMH) Theory for the XYZ Stock Index, a collection of diverse stocks. You decided to conduct three different tests to assess whether the stock market follows the principles of the weak form of EMH.

Test 1:

For the past five years, you collected daily price changes of the stocks in the XYZ Stock Index. You calculated correlation coefficients for different lag periods and analyzed whether past price changes exhibit any significant correlation with future price changes. You considered price changes to be serially independent. The results indicated that most auto

correlation coefficients are close to zero and statistically insignificant, suggesting those past price changes do not predict future price changes.

Test 2:
You further investigated the randomness of price changes in the XYZ Stock Index. Analyzing the sequence of daily price changes, you count the number of runs where price changes are consistently positive or negative. Upon comparing the observed number of runs with the expected number based on randomness, you find that they align closely, supporting the idea that price changes follow a random pattern.

Test 3:
To examine the efficacy of trading strategies based on historical price trends, you implemented a simple trading rule for the XYZ Stock Index. The rule involves buying when the price crosses a moving average of 5% threshold and selling when it crosses another 7% threshold. Over a period of testing, you computed the returns generated by the trading strategy. The results revealed that the returns are not consistently better than random chance, implying that past price trends do not reliably predict future price movements.

Conclusion:
After conducting the three tests the evidence supports the weak form of Efficient Market Theory for the XYZ Stock Index you concluded that past price trends do not reliably predict future price movements.

Based on the above information answer the following questions:

1. Test 1 is ……
   - A. **Serial Correlation test**
   - B. Filter Rules test
   - C. Run test
   - D. Variance Ratio test

2. Test 2 is …….
   - A. Serial Correlation test
   - B. Filter Rules test
   - **C. Run test**
   - D. Variance Ratio test

3. Test 3 is ……
   - A. Serial Correlation test
   - **B. Filter Rules test**
   - C. Run test
   - D. Variance Ratio test.

4. The Filter Rule Test should not be applied for buy and hold strategy if…….
   - A. the behaviour of stock price changes is predictable.
   - B. the behaviour of stock price changes is dependent on past trends.
   - C. the behaviour of stock price changes is correlated.
   - **D. the behaviour of stock price changes is random.**

5. Results of your studies support the……
   - A. Semi-strong EMH Theory
   - B. Strong EMH Theory

C. Random Walk Theory

D. Markowitz Theory

QUESTION 32:

Mr. Amit is happy with the investment in a company as it is paying good dividend for the last few years. Last year it paid a dividend of ₹ 2 per share. The share is currently trading at ₹ 150 per share. He is of view that if he applies dividend discount model, the share is undervalued. As a financial expert examine his view that dividend discount model represents the fair value.

You being an expert is required to evaluate the market value of the share of the company.

Profit after tax of the company	₹ 290 crores
Equity capital of company	₹ 1,300 crores
Par value of share	₹ 40 each
Debt ratio of company (Debt/ Debt + Equity)	27%
Long run growth rate of the company	8%
Beta 0.1; risk free interest rate	8.7%
Market returns	10.3%
Capital expenditure per share	₹ 47
Depreciation per share	₹ 39
Change in Working capital	₹ 3.45 per share

Note: Round off figures (e.g. EPS etc.) upto 2 decimal points.

Solution:

No. of Shares $= \frac{₹\ 1{,}300 \text{ crores}}{₹\ 40} = 32.50$ Crores

EPS $= \frac{\text{PAT}}{\text{No. of shares}} = \frac{290\text{crores}}{32.5\text{crores}} = ₹8.92$

Calculation of value per share using Free Cash Flow to Equity as basis:

FCFE = Net income – [(1-b) (capex – dep) + (1-b) (ΔWC)]

= 8.92 – [(1-0.27) (47-39) + (1-0.27) (3.45)]

= ₹ 0.564

$K_e = R_f + ß\ (R_m - R_f)$

= 8.7 + 0.1 (10.3 – 8.7) = 8.86%

Po $= \frac{FCFE(1+g)}{K_e - g} = \frac{0.56(1.08)}{0.0886 - 0.08} = ₹70.33$

Calculation of value per share using dividend discount model:

Po $= \frac{D_0(1+g)}{K_e - g} = \frac{2(1.08)}{0.0886-.08} = ₹251.16$

From the above we can see that value per share on the basis of dividend discount model is more than the value per share on the basis of free cash flow to equity model.

In the dividend discount model, the analyst considers the stream of expected dividends to value the company's stock. It is assumed that the company follows a consistent dividend payout ratio which can be less than the actual cash available with the firm.

A stock's intrinsic value based on the dividend discount model may not represent the fair value for the shareholders because dividends are distributed in the form of cash from profits. In case the company is maintaining healthy cash in its balance sheet then it means that dividend pay-out is low which could result in undervaluation of the stock.

In the case of free cash flow to equity model a stock is valued on the cash flow available for distribution after all the reinvestment needs of capex and incremental working capital are met. Thus, using the free cash flow to equity model provides a better measure for valuations in comparison to the dividend discount model.

Thus, the view of Mr. Amit that dividend discount model represents the fair value is incorrect. The share is not under-valued rather it is overvalued if we take "free cash flow to equity model" into consideration.

Nov 23 – Exam paper

QUESTION 33:

N 23 | M 11 | RTP

An investor has categorized all the available stock in the market into the following types and the estimated weights of the categories of stocks in the market index are given below. Further, the sensitivity of returns of these categories of stocks to two factors Inflation and Stock Market are also given below:

Category	Weight in Market Index	Factor 1 (Inflation)			Factor 2 (Stock Market)		
		Beta 1	Expected Value (%)	Actual Value (%)	Beta 2	Expected Value (%)	Actual Value (%)
Small Cap	20%	1.2	6.7	6.7	0.8	10	10.5
Medium Cap	30%	1.75	4.5	6	0.9	7	8
Large Cap	15%	1.3	6.75	8	1.165	9	10
Flexi Cap	35%	1.7	7	6.5	0.85	8.85	9.75

Risk Free Rate of Interest is 7.50%.

Round off to 2 decimals.

You are required to calculate:

a. Expected return on the market index for both the factors.

b. Expected return on the market index under Arbitrage Pricing Theory (Existing Scenario)

c. Expected return on the market index under Arbitrage Pricing Theory, if the composition of the Portfolio is changed to 25% equally in all four categories.

d. Which alternative (Existing or Changed) will be more profitable?

Solution:

a. E(R) on market index for Factor 1 $= 6.7 \times 0.2 + 4.5 \times 0.3 + 6.75 \times 0.15 + 7 \times 0.35$

$= 6.15\%$

E(R) on market index for Factor 2 $= 10 \times 0.2 + 7 \times 0.3 + 9 \times 0.15 + 8.85 \times 0.35$

$= 8.55\%$

b. $E(R_m)$ using arbitrage pricing theory:

$E(R) = R_f + \beta_1 \times RFP_1 + \beta_2 \times RFP_2 + \beta_3 \times RFP_3$

Small Cap: $= 7.5 + 1.2\ (6.7 - 6.7) + 0.8\ (10.5 - 10) = 7.9\%$

Medium Cap $= 7.5 + 1.75\ (6 - 4.5) + 0.9\ (8 - 7) = 11.03\%$

Large Cap $= 7.5 + 1.3\ (8 - 6.75) + 1.165\ (10 - 9) = 10.29\%$

Flexi Cap $= 7.5 + 1.7\ (6.5 - 7) + 0.85\ (9.75 - 8.85) = 7.42\%$

E(R) on market index $= 7.9 \times 0.2 + 11.03 \times 0.3 + 10.29 \times 0.15 + 7.42 \times 0.35$

$= 9.03\%$

c. E(R) on market index at equal weight:

$= 7.9 \times 0.25 + 11.03 \times 0.25 + 10.29 \times 0.25 + 7.42 \times 0.25$

$= 9.16\%$

d. Changed alternative (investing 25% equally in all four categories,) is more profitable than existing composition since it has higher rate of expected return.

QUESTION 34:

N 23 | M 11 | RTP

The following information is available pertaining to shares of Omni Limited:

Current Market Price	₹ 420
Strike Price	₹ 450
Maximum Price in 3m time	₹ 525
Minimum Price in in 3m time	₹ 378
Continuously Compounded Rate of Return (p.a.) (%)	8%
e^{rt}	1.0202

a. Calculate the 3 months call option by using Binomial Method and Risk Neutral Method. Are the calculated values under both the models are same?

b. What will be the value as per binomial model if given option is a put option?

c. State also clearly the basis of Valuation of options under these models.

Solution:

a. Value of option using Binomial Model:

Binomial Tree:

At month 0	At month 3	Call payoff	Put Payoff
$S_0 = 420$ Exercise price = 450	$S_u = 525$	75	0
	$S_d = 378$	0	72

Delta of Call: $= \frac{75 - 0}{525 - 378} = 0.5102$

Risk-less hedged portfolio will be: 0.5102 share of Omni Ltd Long & 1 Call option short

Let the value of Call option be X

Particulars	Today		At the end of 3m		
	Action	Amount	Action	525	378
0.5102 shares	Buy	214.28	Sell	267.86	192.86
1 call option	Sell	(X)	Settle	(75)	(0)
Total OF		214.28 - X	Total IF	192.86	192.86

Value of investment today = PF of Future CFs

$214.28 - X = \frac{192.86}{e^{rt}}$

$214.28 - X = \frac{192.86}{1.0202}$

$X = 25.24$

Value of call option (X) = ₹ 25.24

Value of option using Risk Neutral Model:

Binomial Tree:

At month 0		At month 3	Call payoff	Put Payoff
S_0 = 420 Exercise price = 450	p = 0.3434	S_u = 525	75	0
	(1-p) = 0.6566	S_d = 378	0	72

Calculation of $R = e^{rt} = e^{0.08 \times 3/12} = e^{0.02} = 1.0202$

$$420 = \frac{p \times 525 + (1 - p) \times 378}{1.0202}$$

P = 34.34%

1 – P = 1 – 34.34% = 65.66%

$$V_C = \frac{75 \times 0.3434 + 0 \times 0.6566}{1.0202} = ₹ 25.25$$

Value of call option (X) = ₹ 25.24

Conclusion: Value of option under both the model is same.

b. Delta of Put: $= \frac{0 - 72}{525 - 378} = 0.4898$

Risk-less hedged portfolio will be: 0.4898 share of Omni Ltd Long & 1 Put option Long

Let the value of Put option be X

Particulars	Today		At the end of 3m		
	Action	Amount	Action	525	378
0.4898 shares	Buy	205.72	Sell	257.14	185.14
1 put option	Buy	X	Settle	0	72
Total OF		205.72 + X	Total IF	257.14	257.14

Value of investment today = PF of Future CFs

$$205.72 + X = \frac{257.14}{e^{rt}}$$

$$205.72 + X = \frac{257.14}{1.0202}$$

X = 46.33

Value of put option is ₹ 46.33

c. Basis of valuation of Options:

- Binomial model uses an approach called "Risk less Hedge Approach" to find the price of the option, by creating a portfolio which will have same value at expiration irrespective of any price. Hedge means to create an equal and opposite position for protecting the value of portfolio.
- In Risk Neutral Model, valuation of options is based on arbitrage and is therefore independent of risk preferences; one should be able to value options assuming any set of risk preferences and get the same answer.

QUESTION 35:

N 23

Mr. K has invested in three Mutual fund schemes as per details below:

Particulars	MF A	MF B	MF C

Date of investment	01.06.2022	01.07.2022	01.08.2022
Net Asset Value (NAV) at entry date	₹ 11	₹ 10.5	₹ 12
Dividend received upto 31-03-2023	₹ 12,500	₹ 17,000	₹ 4,000
NAV as at 31-03-2023	₹ 11.25	₹ 11.48	₹ 10.80
Increase/(Decrease) in NAV (₹)	₹ 22,727,27	₹ 93,333.33	(₹ 50,000)
Effective Yield per annum	4.2296%	14.6978%	-13.8190%

Ignore Entry/Exit load expenditure.

Assume 365 days in a year. Round off the investment to nearest ₹100.

You are required to calculate:

a. The amount of investment made initially by Mr. S in these schemes.

b. Number of units invested in the three schemes by Mr. S.

Advise also whether he can continue to hold this investment or can he redeem now.

Solution:

Amount of investment & number of units invested

Particulars		MF A	MF B	MF C
(a)	Opening NAV (₹)	₹ 11	₹ 10.5	₹ 12
(b)	Closing NAV (₹)	₹ 11.25	₹ 11.48	₹ 10.80
(c)	Increase in NAV per unit (₹) [b – a]	₹ 0.25	₹ 0.98	(₹ 1.20)
(d)	Total Inc./(Dec.) in NAV (₹)	22,727,27	93,333.33	(50,000)
(e)	No. of units invested [d/c]	90,909.08	95,238.09	41,666.67
(f)	Amount of Investment [a x e]	10,00,000	10,00,000	5,00,000

Advice: Since there is no entry and exit load, he can sell the MF B and MF C and continue to hold investment in MF A.

QUESTION 36:

N 23

A Japanese company imports hi-tech printer cartridges from US worth $ 1 million. The chief financial officer of the company wishes to know the best strategy for protection against uncertainty, for the payment that has to be made at the end of 3 months. Financial team of the company has collected the following options for evaluation:

Table 1: Exchange rates quoted in Forex Market:

¥/$ Quotation	Bid Price	Ask Price
Spot rates	146.03	146.63
3m Forward	144.03	145.00
6m Forward	146.35	146.70

Table 2: Option Market rates for European option with 3 months expiry:

	Strike Price (X) ¥/$	Premium (%) for Call & Put Options
Call & Put	145.20	1.6766% (Call) & 1.7414% (Put)
Call & Put	146.00	1.3505% (Call) & 2.1006% (Put)

The expected spot price at expiry is ¥/$: 144.90/145.05

Suggest the best strategy for CFO of the Japanese Company to protect against uncertainty, with respect to the following alternatives:

a. Forward Hedge
b. Buy 3 months call, X-145.20
c. Sell 3 months put, X = 145.20
d. Buy call & sell put both having X = 146.00

Solution:

a) Forward Hedge

Amount payable after 3 months $ 1,000,000
3-month applicable buying rate ¥ 145/$
Amount payable in Yen ¥ 145 m

b) Buy 3-month call option X = ¥ 145.20

If expected spot price after 3 month is ¥ 145.05, then company would not exercise its option.
Accordingly, the cost of import will be

Buying Yen in spot Market after 3 months	¥ 145.05 m
Add: Premium Paid ($ 1 m x 1.6766% x ¥ 145.20)	¥ 2.43 m
	¥ 147.48 m

c) Selling 3 month Put at X = ¥ 145.20

If expected spot price after 3 month ¥ 144.90, then Put Option buyer will exercise his /her option.
Accordingly, the import Bill will be:

Buying US$ under put option	¥ 145.20 m
Less: Premium Received ($ 1 m x 1.7414% x ¥ 145.20)	¥ 2.53 m
	¥ 142.67 m

d) Buying Call and selling Put at X = ¥ 146

Net Premium receipt

If expected spot Rate expiry happens to be ¥ 144.90/145.05, then call option will be lapsed and Put option by buyer will be exercised.
Accordingly, the import bill will be:

Buying US$ under Put Option	¥ 146.00 m
Add: Premium paid on call option = ¥ 146.00 x 1.3505%	¥ 1.9717 m
Less: Premium Receipt on Put option = ¥ 146.00 x 2.1006%	(¥ 3.0669 m)
	¥ 144.9048 m

Decision: Since expected outflow is least in case of selling Put option, the same strategy is recommended.

QUESTION 37:

N 23 | M 21 | N 18 | N 10 | N 08 | RTP

Suppose a dealer bank quotes for a generic swap "AIC 8%/8.20% vs. 6M LIBOR Flat". Notional principal amount of swap is ₹ 1 Million, and the same is for a period of three years, reset after every six months. In this context, answer the following questions:

a. Interpret the dealer bank quote.
b. If a firm is buying a swap, what is the nature of cash flows?
c. If a firm is selling a swap, what is the nature of cash flows?

d. Calculate semi-annual fixed payment for the buyer of swap at the end of every six months.

e. If the six-month period from the effective date of swap to the settlement date comprises of 181 days and that the corresponding LIBOR was 5% on the effective date of swap, then what will be the first floating rate payment for the buyer?

f. If the settlement is on "Net Basis", how much the buyer of swap has to pay or receive at the end of first six months?

[Assume 30/360 days basis]

Solution:

a) Interpretation of dealer bank quote:

- AIC in the dealer bank quote refers to 'All in cost' i.e. cost of swap all inclusive.
- First part of the quote i.e. '8%/8.20% refers to the fixed leg part and the second part of the quote i.e., '6m LIBOR Flat' refers to the floating leg part.
- The difference in the fixed rates i.e. 20 bps refers to the margin charged by the Bank on the fixed leg of transactions.
- The term 'flat' on the floating leg quote, indicates that the Bank does not charge any commission on the floating leg. Therefore, bank charges 20 bps for transacting swap as a whole.

b) A buyer of swap pays 'Fixed' cash flows and receives 'Floating'. As per the quote, the buyer would pay 8.2% (higher of 8%, 8.2%) to the Bank and would receive '6M LIBOR' against it.

c) A seller of swap pays 'floating' cash flows and receives 'fixed'. As per the quote, the seller would pay '6M LIBOR' to the bank and would receive 8% (lower of 8%, 8.2%) against it.

d) Semi-annual Payment every six-month for buyer of Swap:

$$= 10,00,000 \times 8.20\% \times \frac{180}{360}$$

$$= ₹\ 41,000$$

e) Floating Rate Payment

$$= 10,00,000 \times 0.05 \times \frac{181}{360}$$

$$= ₹\ 25,138$$

f) Net Settlement buyer will pay:

$$= 41,000 - 25,138 = ₹\ 15,862$$

Nov 23 – MTP

QUESTION 38:

MTP N 23

VK Ltd. is an Indian company which is planning to set up a manufacturing plant through its subsidiary in the small country Farland, (where hitherto it was exporting) in view of growing demand for its product and competition from other MNCs. The currency of Farland is the Farroh (Fr.).

An initial investment of Fr. 80 million in plant and machinery would be required. In addition to that the initial investment in working capital of Fr. 6 million would be also required which shall be financed through a loan from a local bank of Farland, at interest rate of 10% p.a. The working capital shall also be subject to inflation. At the end of 5 years, the subsidiary would be taken over by the Govt. of Farland for a price of Fr. 2 million. The part of the proceeds would be used to pay off the bank loan.

It is expected that subsidiary shall produce Net Cash Flows from Operations of Fr. 30 million per year at current price level over the five-year period, before allowing for Farland inflation of 8% per year. Depreciation on Plant and Machinery shall be charged at 20% per year on straight line basis. As a result of setting up the subsidiary, VK Ltd. expects to lose after-tax export income from Farland of INR 8,00,000 per year in current price terms, before allowing for India

inflation of 3%. Profits in Farland are taxed at a rate of 20% after allowing deduction for interest and depreciation. All after-tax cash profits are remitted to the India at the end of each year. Indian tax @ 30% is charged on profit earned, but due to tax treaty between Farland and the India the tax paid in Farland is allowed to be set off against any India Tax liability. Taxation is paid in the year in which the liability arises. VK Ltd. requires foreign investments to be discounted at 12%. The current exchange rate is Fr.2.5/INR and the Farroh is expected to depreciate against INR by 5% per year.

Advise should VK Ltd. undertake the investment in Farland or not.

Note: 1. Present Figures in thousands multiple.
2. Round off all calculations.
3. PVF @12%

Year	1	2	3	4	5
PVF	0.893	0.797	0.712	0.636	0.567

Solution:

Calculation of the project cash flows for VK Ltd.'s subsidiary in Farland (Fr.'000)

Year	-	1	2	3	4	5
Cash flows from operations		32,400	34,992	37,791	40,815	44,080
Depreciation		-16,000	-16,000	-16,000	-16,000	-16,000
Interest		-600	-600	-600	-600	-600
Profit before Tax		15,800	18,392	21,191	24,215	27,480
Farland Tax		-3,160	-3,678	-4,238	-4,843	-5,496
Profit after Tax		12,640	14,714	16,953	19,372	21,984
Add back Depreciation		16,000	16,000	16,000	16,000	16,000
		28,640	30,714	32,953	35,372	37,984
Initial Investment	-80,000					
Working Capital Investment	-6,000					
Change in WC		-480	-518	-560	-605	-653
Loan Capital						-6,000
Sale of Subsidiary						2,000
	-86,000	28,160	30,196	32,393	34,767	33,331

Expected Exchange Rates

Year	Rate
0	2.5
1	$2.50 \times 1.05 = 2.63$
2	$2.50 \times (1.05)^2 = 2.76$
3	$2.50 \times (1.05)^3 = 2.89$
4	$2.50 \times (1.05)^4 = 3.04$
5	$2.50 \times (1.05)^5 = 3.19$

Calculation of Tax paid in India

Year	1	2	3	4	5
PBT (Fr)	15,800	18,392	21,191	24,215	27,480
Tax @ 10%	1,580	1,839	2,119	2,422	2,748
Exchange rate	2.63	2.76	2.89	3.04	3.19
Tax in India (₹ '000)	601	666	733	797	861

Calculation Net Present Value (NPV) for VK Ltd.'s subsidiary at parent company level

Year	0	1	2	3	4	5
Project Cash Flows (Fr. '000)	-80,000	28,160	30,196	32,393	34,767	33,331
Exchange Rate (Fr./₹)	2.50	2.63	2.76	2.89	3.04	3.19
Cash Invested from India (₹ '000)	-32,000	--	--	--	--	--
Cash Received in India (₹ '000)	--	10,707	10,941	11,209	11,437	10,449
Tax in India (₹ '000)		601	666	733	797	861
	-32,000	10,106	10,275	10,476	10,640	9,588
Lost export after tax (₹ '000)		824	849	874	900	927
Parent Cash Flow	-32,000	9,282	9,426	9,602	9,740	8,661
PVF	1.000	0.893	0.797	0.712	0.636	0.567
	-32,000	8,289	7,513	6,837	6,195	4,911
NPV						1,745

Decision: Since NPV of the project is positive it should be accepted.

QUESTION 39:

MTP N 23

Following information is related to the Convertible Bond of A Ltd. which is currently priced at ₹ 1060 per Bond:

(1) Conversion Parity Price - ₹ 53

(2) Conversion Premium – 10.41667%

(3) Percentage of Downside Risk with respect to Straight Value of Bond – 12.766%

Calculate:

a. No. of shares on Conversion.

b. Current Market Price Per Share of A Ltd.

c. Straight Value of Bond

Solution:

a. The No. of share on Conversion

$$\text{Conversion Parity Price} = \frac{\text{Bond Price}}{\text{No. of shares on Conversion}}$$

$$₹\ 53 = \frac{1060}{\text{No. of shares on Conversion}}$$

No. of shares on Conversion = 20

b. Market Price Per Share of A Ltd.

$$\text{Conversion Premium} = \frac{\text{Conversion Price of Share - CMP of share}}{\text{CMP of share}}$$

$$0.1041667 = \frac{53 - \text{CMP}}{\text{CMP}}$$

$$\text{CMP} = ₹\ 48 \text{ per share}$$

c. Straight Value of Bond

$$\text{Percentage of Downside Risk} = \frac{\text{Market Price of Bond - Straight Value of Bond}}{\text{Straight Value of Bond}}$$

$$0.12766 = \frac{1060 - \text{Straight Value of Bond}}{\text{Straight Value of Bond}}$$

Straight Value of Bond = ₹ 940 per Bond

QUESTION 40:

MTP N 23 | M 12 | RTP

Indira has a fund of ₹ 3 lacs which she wants to invest in share market with rebalancing target after every 10 days to start with for a period of one month from now. She has 3 close friends who have advised following different strategies:

a. Buy and Hold strategy

b. Constant Ratio

c. CPPI

Suppose she immediately starts with investment in Bonds (non-fluctuating) and Equity and decides to rebalance her portfolio after each 10 days and to invest in Nifty as equity component changes in tandem with that of Nifty. Further, Bond has no Beta.

As on date (i.e. beginning of month) Nifty is 5326 and minimum Nifty within a month can be most be 4793.40. If she chooses CPPI she will use "2" as the multiplier. If she chooses Constant Ratio plan she will maintain the ratio of 60:40 in Equity and Bonds respectively. Further, portfolio will be rebalanced each time Nifty is changed by 5% as compared to the previous Nifty.

You are required to evaluate Portfolio Position of Indira under each of the Strategies suggested by her friends and highlight the course of action to be taken if in the coming month after a gap of 10 days Nifty happened:

(1) 10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.

(2) 10 days further from the above date if the NIFTY touches 5539.04.

Solution:

a. <u>Under buy & hold strategy</u>

$$\text{Max fall in NIFTY} = \frac{5,326 - 4,793.4}{5,326} = 10\%$$

Floor value = 3,00,000 - 10% = 2,70,000

Under this strategy investor invests an amount equal to floor value in Bonds i.e., 2,70,000 and the remaining ₹ 30,000 in equity.

Value of investment after 20 days:

Equity	$30,000 \times \frac{5539.04}{5326}$	31,200
Bonds		2,70,000

Total	3,01,200

b. Under CPPI

Immediately to start with:

Value of equity = (Portfolio Value – Floor Value) × multiplier

= (3,00,000 – 270,000) × 2 = 60,000

Value of debt = Total value of portfolio – value of equity

= 3,00,000 – 60,000 = 2,40,000

After 10 days:

Change in Nifty = $\frac{5122.96 - 5326}{5326}$ = 3.81%

Since change in nifty is less than 5%, portfolio will not be rebalanced.

After further 10 days:

Change in Nifty = $\frac{5539.04 - 5122.96}{5122.96}$ = 8.12%

Since change in nifty is more than 5%, portfolio will be rebalanced.

Value of portfolio on this date before rebalancing:

Equity = $60,000 \times \frac{5539.04}{5236}$ = 62,400

Value of debt = 2,40,000

Total Value of portfolio = 3,02,400

Ideal values as per policy

Equity = (3,02,400 – 2,70,000) × 2 = 64,800

Debt = 3,02,400 – 64,800 = 2,37,600

Indira should sell the risk-free security of Rs. 4,800 and invest the amount in equity.

c. Constant Ratio Plan

The ratio to be maintained is given as 60:40. Thus, Indira will invest ₹ 1,80,000 in equity and ₹ 120,000 in bonds.

After 10 days:

Change in Nifty = $\frac{5122.96 - 5326}{5326}$ = 3.81%

Since change in nifty is less than 5%, portfolio will not be rebalanced.

After further 10 days:

Change in Nifty = $\frac{5539.04 - 5122.96}{5122.96}$ = 8.12%

Since change in nifty is more than 5%, portfolio will be rebalanced.

Value of portfolio on this date before rebalancing:

Equity = $1,80,000 \times \frac{5539.04}{5326}$ = 1,87,200

Value of debt = 1,20,000

Total Value of portfolio = 3,07,200

Ideal values as per policy

Equity = 3,07,200 × 60% = 1,84,320

Debt = 3,02,400 – 1,84,320 = 1,22,880

Indira should sell the equity of Rs. 2,880 and invest the amount in bonds.

Nov 23 – RTP

No new question!

May 23 – Exam Paper

QUESTION 41:

M 23 | M 21

High Growth Ltd. (HGL) was having an excellent growth over a number of years. The Board of Directors is considering a proposal to reward its shareholders by buying back 20% shares at a premium. The premium is to be paid by raising a loan from the Bank. The interest on loan is to be serviced by internal accruals as supported by the financials of HGL. The company has a market capitalization of ₹ 15,000 crore and the current Earnings Per Share (EPS) is ₹ 600 with a Price Earnings Ratio (PER) of 25. The Board expects a post buy back Market Price per Share (MPS) of ₹ 10,000. The PER, post buy back, will remain the same. The loan can be availed at an interest rate of 16 % p.a.

Applicable corporate tax rate is 30 %.

You are required to calculate

a) The interest amount which can be paid for availing the bank loan.

b) The loan amount to be raised.

c) Buy back premium per share.

Solution:

a)

Pre BB Price	= 600 × 25	= ₹ 15000
Pre BB number of shares	$= \frac{15{,}000 \text{ Cr.}}{15{,}000}$	= 1 crore
Pre BB PAT	= 600 × 1 Cr. = 600 Crore	
Number of shares to be bought back	= 1 Cr. × 20%	= 0.2 Crore
Post BB number of shares	= 1 Cr. – 0.2 Cr. = 0.8 Crore	
Post BB MPS	= 10,000	
Post BB EPS	$= \frac{MPS}{PE} = \frac{10{,}000}{25} = 400$	
Post BB PAT	= 400 × 0.8 Cr. = 320 Cr.	
Pre BB PAT	= 600 Cr.	
Pre BB PBT	$= \frac{600 \text{ Cr.}}{(1 - 0.3)} = 857.14$ Cr.	

Since, there is no interest Pre BB

Therefore, Pre BB PBT = Pre BB EBIT

& also, Pre BB EBIT = Post BB EBIT = 857.14 Cr.

Now, Post BB PAT	= 320 Crore
Post BB PBT	$= \frac{320 \text{ Cr.}}{(1 - 0.3)} = 457.14$ Crore
Interest that can be paid post BB	= Post BB EBIT – Post BB PBT
	= 857.14 Cr. - 457.14 Cr.
	= 400 Cr.

b) Loan amount will be $= \frac{\text{Interest (₹)}}{\text{Interest (\%)}} = \frac{400 \text{ Cr.}}{0.16} = ₹ 2500 \text{ Crore.}$

c) Buy back price $= \frac{\text{Total Loan}}{\text{Shares BB}} = \frac{2500 \text{ Cr.}}{0.2 \text{ Cr.}}$

$= ₹ 12500$ per share

Premium per share = BB price – Post BB MPS

$= ₹ 12,500 - ₹ 10,000$

$= ₹ 2,500$

Or

$= \frac{2500}{10,000} = 25\%$

Self-note: In the 'C' part of the question, the institute has calculated the buyback premium by deducting post BB MPS (rather than pre BB MPS) from the BB Price.

QUESTION 42:

M 23 | N 20

Mr. Bull is a rational risk taker. He takes his position in a single stock for 4 days in a week. He does not take a position on Friday to avoid weekend effect and takes position only for four days in a week i.e. Monday to Thursday. He transfers the amount on Monday morning and withdraws the balance on Friday morning. He desires to make a maximum investment where Value At Risk (VAR) should not exceed the balance lying in his bank account. The position by his manager, as per standing instructions, is taken on the free balance lying in the bank account in the morning on each Monday.

On Monday morning (before opening of the capital market) he has transferred an amount of ₹ 11 Crore to his bank account. A fixed deposit also matured on this Monday. The maturity amount of ₹ 63,42,560 was also credited to his account by the bank in the morning of the Monday. However, Mr. Bull received the intimation of the same in the evening. The bank needs a minimum balance of ₹ 1,000 all the time. The value of Z score, at the required confidence level of 99% is 2.33

The other information with respect to stocks X & Y, which are under consideration for this week is as under:

X		Y	
Return	Probability	Return	Probability
6	0.10	4	0.10
7	0.25	6	0.20
8	0.30	8	0.40
9	0.25	10	0.20
10	0.10	12	0.10

You are required to recommend a single stock, where maximum investment can be made

Solution:

Maximum loss that Mr. can take = 11,00,00,000 + 63,42,560 – 1,000

= 11,63,41,560

Calculating SD of X & Y

P_X	X	$X \times P$	$P \times d_X^2$	P_Y	Y	$Y \times P$	$P \times d_Y^2$

0.10	6	0.60	0.40	0.10	4	0.40	1.60
0.25	7	1.75	0.25	0.20	6	1.20	0.80
0.30	8	2.40	-	0.40	8	3.20	-
0.25	9	2.25	0.25	0.20	10	2.00	0.80
0.10	10	1.00	0.40	0.10	12	1.20	1.60
		8.00	1.30			8.00	4.80

	X	Y
1 day Variance	1.3	4.8
4 days Variance	$1.3 \times 4 = 5.2$	$4.8 \times 4 = 19.2$
4 days SD	$\sqrt{5.2} = 2.28$	$\sqrt{19.2} = 4.38$
Maximum Loss (%) [SD × 2.33]	$2.28 \times 2.33 = 5.3124\%$	$4.38 \times 2.33 = 10.2054\%$
Maximum Investment (₹)	$\frac{11,63,41,560}{5.3124\%}$ = ₹ 219 Cr.	$\frac{11,63,41,560}{10.2054\%}$ = ₹ 114 Cr.

Recommendation: Maximum Investments can be made in Stock X of ₹ 219 Crores.

Self-note: There is an ambiguity in the question about the number of days for which returns are given in the table. Generally, the return data is assumed annual, therefore SD calculated using such data will also be SD for 365 days. In this question however, Institute has solved it assuming that given return data is for a day hence, the SD calculated using such data will also be daily and therefore, it is be converted to 4 days' SD.

QUESTION 43:

M 23

An investor is considering purchasing equity shares of Alpha Ltd., whose current Market price is ₹ 172.45. The company is proposing a dividend of ₹ 6 for the year ending 31st March, 2024. Alpha Ltd. is expected to grow @ 20 percent per annum for the next four years. Thereafter, the growth, over the next three years, will decline linearly by 100 basis points per annum. Thereafter, it will stabilize at a certain growth rate per annum infinitely. The required rate of return for the investor is 20%.

Dividend value is to be taken in 2 decimal points only.

You are required:

a. To calculate the stable growth rate of Alpha Ltd. after the end of 7 years.

b. To advise whether it is worth to purchase the share at this price if the investor has a stable target growth rate of 15% per annum.

Period	1	2	3	4	5	6	7
PVIF (20%, n)	0.8333	0.6944	0.5787	0.4823	0.4019	0.3349	0.2791

Solution:

a) Stable growth rate after the end of 7 years.

PV of dividends from years 1 to 7:

Year	Growth	Dividend / TV	PVF @ 20%	DCFs
1	20%	6	0.8333	5.00
2	20%	7.2	0.6944	5.00
3	20%	8.64	0.5787	5.00

4	20%	10.37	0.4823	5.00
5	19%	12.34	0.4019	4.96
6	18%	14.56	0.3349	4.88
7	17%	17.04	0.2791	4.76
				34.60

PV of terminal value $= \frac{17.04 \times (1+g)}{0.20 - g} \times 0.2791$

Now, P_0 = PV (Dividends) + PV (Terminal Value)

$172.45 = 34.6 + \frac{17.04 \times (1+g)}{0.20 - g} \times 0.2791$

$g = 16\%$

Thus, the stable growth rate after the end of the 7 years shall be 16%.

b) Since above calculated growth rate is more than target growth rate it is worth to purchase the share.

QUESTION 44:

M 23

IF an Indian firm has its subsidiary in Singapore and SF a Singapore firm has its subsidiary in India and face the following interest rates:

Company	IF	SF
INR Floating Rate	BPLR+ 0.5%	BPLR + 1.5%
SGD (fixed rate)	3%	3.50%

SF wishes to borrow Rupee loan at a floating rate and IF wishes to borrow SGD at a fixed rate. The amount of loan required by both the companies is same at the current exchange rate. A Bank arranges a swap and requires 50 basis points as its commission, which is to be shared equally, IF requires a minimum gain of 20 basis points and SF requires a minimum gain of 10 basis points for structuring the deal. The Bank is very keen to structure the deal, even if, it has to forego a part of its commission.

You are required to find out

a. Whether there are any advantages available to IF and SF?
b. Whether a swap can be arranged which may be beneficial to both the firms?
c. What rate of interest will they end up paying? Show detailed working

Solution:

a) Though firm IF has an advantage in both the markets but it has comparative more advantage in the INR floating-rate market. Firm SF has a comparative advantage in the SGD fixed interest rate market.

b) Firm IF wants to borrow in the SGD fixed interest rate market and firm SF wants to borrow in the INR floating-rate market. This gives rise to the swap opportunity and we make the borrow other way round.

Total interest cost under desired:	BPLR + 1.5 + 3 =	BPLR + 4.5%
Total interest cost under actual:	BPLR + 0.5 + 3.5 =	BPLR + 4%
Gross savings		0.5%
Commission		(0.2)%*
Net Savings		0.3%

Since, there is a net savings of 0.3%, therefore, a swap beneficial to both the firms can be arranged.

* Maximum commission = Gross savings – minimum gain of IF & SF
= 0.5% - 0.2% - 0.1%

= 0.2%

c) Calculating effective interest cost

Particulars	IF	SF
Interest Cost under desired position	3%	BPLR + 1.5%
(-) saving due to swap	(0.2)	(0.1)
Effective Interest under swap	2.8%	BPLR + 1.4%

QUESTION 45:

M 23

Mr. Potential has made investments in two mutual funds. The following information is available:

Mutual Fund	Smart	Growth
Jenson Alpha	1.10%	1.50%
Treynor's Ratio	0.0714	0.0775
Actual Return	8.5%	9.1%
Risk Premium	4%	

You are required to calculate:

a. Beta (β) for both the funds
b. Risk free Rate
c. Security Market Line

Solution:

Working Notes:

		Smart	Growth
a. Jenson Alpha		1.1%	1.5%
b. Actual Return		8.5%	9.1%
c. CAPM Expected Return	[b – a]	7.4%	7.6%
d. Market Risk Premium		4%	4%
e. Equation of CAPM	[i]	$7.4 = R_f + \beta_S \times 4$	$7.6 = R_f + \beta_G \times 4$
f. Treynor Ratio = $\frac{R_i - R_f}{\beta_i}$	[ii]	$7.14 = \frac{8.5 - R_f}{\beta_S}$	$7.75 = \frac{9.1 - R_f}{\beta_G}$

a) Solving Equation [i] & [ii] above, β_i:

Value of R_f as per eq. [ii]	$R_f = 8.5 - 7.14 \times \beta s$	$R_f = 9.1 - 7.75 \times \beta_G$
Putting above value in eq. [i]	$7.4 = R_f + \beta_S \times 4$ $7.4 = (8.5 - 7.14 \times \beta s) + \beta_S \times 4$ $\beta s = 0.35$	$7.6 = R_f + \beta_G \times 4$ $7.6 = (9.1 - 7.75 \times \beta_G) + \beta_G \times 4$ $\beta_G = 0.40$

b) Putting above value of β_i in eq. [i], R_f:

As per eq. [i]	$7.4 = R_f + \beta_S \times 4$ $7.4 = R_f + 0.35 \times 4$ $R_f = 6\%$	$7.6 = R_f + \beta_G \times 4$ $7.6 = R_f + 0.40 \times 4$ $R_f = 6\%$

c) Market Risk Premium = $R_f - R_m$

$4\% = 6\% - R_m$

$R_m = 10\%$

Equation of Security market Line: $E(R_i) = R_f + \beta_i \times (R_f - R_m)$

$E(R_i) = 6 + 4\beta_i$

Self-note: Risk premium given in the question is common for both the securities, therefore it has to assumed as market risk premium & not security risk premium.

QUESTION 46:

M 23

Big Ltd. (BL), a listed company, is enjoying a price earnings ratio g (PER) of 15 on an Earnings Per Share (EPS) of T 5. The Total number of outstanding shares are 2,00,000.

BL is proposing to acquire Small Pvt. Ltd. (SPL) an unlisted company by issuing shares in the ratio 4:5 i.e., for 5 shares of SPL 4 shares of BL will be issued. The outstanding shares of SPL are 50,000. SPL will be listed before the actual merger to discover its value. The EPS of the merged entity will be 5.5.

No other information is available for SPL. You are required to calculate:

a. Pre-merger EPS of SPL.
b. Expected Market Price per Share of SPL at the time of listing, if it expects a PER of 10 and,
c. Number of shares of BL to be issued to SPL if pre-merger EPS of BL is to be maintained.

Solution:

a) Pre-merger earnings of BL = $5 \times 2,00,000$
= 10,00,000

No. of shares to be issued to shareholder of SPL = $50,000 \times 4/5$
= 40,000

Post merger no. of shares of BL = 2,00,000 + 40,000
= 2,40,000

Post merger earnings of BL = $2,40,000 \times 5.5 = 13,20,000$

Less: Pre merger earnings of BL Ltd - 10,00,000

Premerger earnings of SPL = 3,20,000

Premerger EPS pf SPL = $\frac{3,20,000}{50,000}$ = ₹ 6.4 per share

b) Premerger MPS of SPL = 6.4×10 = ₹ 64

c) Exchange ratio to maintain EPS = $\frac{\text{EPS of SPL}}{\text{EPS of BL}}$ = 6.4:5

Number of shares to be issued to SPL = $50,000 \times 6.4/5$ = 64,000 shares

Self-note: While solving part (a) of the question, we have assumed that there is no synergy in earnings.

BoS Knowledge Portal's MCQs

FINANCIAL POLICY AND CORPORATE STRATEGY

1. ..... is the springboard for wealth creation.
   A. Investment in highly risky securities.
   B. Capital investment
   C. Foreign Exchange Risk Management
   D. None of the above

2. The primary objective of investors in a world of economic uncertainty is.....
   A. **to select investment and financial opportunities that will give them maximum expected returns at minimum risks.**
   B. to select investment and financial opportunities that will give them maximum expected returns at maximum risks.
   C. to select investment and financial opportunities that will give them minimum expected returns at maximum risks.
   D. None of the above

3. The Strategic financial management is ……
   A. Backward looking
   B. Report-focused discipline
   C. Forward-looking subject of financial management
   D. All of the above

RISK MANAGEMENT

1. Which type of risk is primarily faced by a company when it ventures into a new industry or geographical area with completely different laws and regulations?
   A. Operational Risk
   B. Compliance Risk
   C. Currency Risk
   D. Financial Risk

2. .....is associated with diffusion of economic crisis throughout a market, asset class or geographic region.
   A. Systematic Risk
   B. Unsystematic Risk
   C. Contagion **Risk**
   D. Credit Risk

3. Which of the following techniques can be used to manage counter party risk?
   A. Local sourcing of raw materials and labour.
   B. Evaluating countrys macro-economic conditions.
   C. Rapid action in the event of any likelihood of defaults.
   D. Entering into joint ventures.

4. Which type of risk occurs when a counter party fails to honour their obligations?
   A. Interest Rate Risk
   B. Currency Risk
   C. Credit Risk
   D. Political Risk

5. .....is associated with diffusion of economic crisis throughout a market, asset class or geographic region.
   A. Systematic Risk
   B. Unsystematic Risk
   C. Contagion Risk
   D. Credit Risk

6. One-year VaR [Value at risk] of a portfolio is Rs. 10 crores with a confidence level of 95%. This means.....
   A. There is a 5% probability that the loss will be Rs. 10 crores at the end of the year
   B. The loss will not exceed Rs. 9.5 crores during valuation anytime during the year
   C. The worst expected portfolio loss over one year will not exceed Rs. 10 crore with 95% confidence
   D. The investor can presume that there is a 95% chance of loss over one trading year will exceed Rs. 10 crore

ADVANCED CAPITAL BUDGETING DECISIONS

1. Sensitivity analysis is useful in decision making because:
   A. It shows the probabilities associated with each outcome.
   B. **It tells the user how much critical each input is for the Output value.**
   C. It allows to calculate the probable results under different scenarios.
   D. The results of Sensitivity Analysis are reliable.

2. When the risk is high, the cash flow under certainty equivalent coefficient is:
   A. Higher
   B. **Lower**
   C. No impact
   D. None of the above

3. The firm expects an NPV of Rs. 10,000 if the economy is exceptionally strong (30% probability), an NPV of Rs. 4,000 if the economy is normal (40% probability), and an NPV of Rs. 2,000 if the economy is exceptionally weak (30% probability). Expected Net present value is _____.
   A. **Rs. 5,200**
   B. Rs. 6,000
   C. Rs. 5,000
   D. Rs. 6,200

4. Expected cash flows are calculated as:
   A. Sum of likely cash flow of the project.
   B. **Sum of likely cash flow of project multiplied by probability of respective cash flows.**

C. Sum of likely cash flow of project divided by probability of cash flow.
D. none of these

5. Which of the following critical factor is generally overlooked by capital budgeting decision makers.
A. Quantitative factors
B. **Qualitative factors**
C. Time factor
D. Discounting factor

6. Scenario Analysis is considered under scenarios such as:
A. Worst Case Scenario
B. Base Case Scenario
C. Best Case Scenario
D. **All of the above**

7. Variance measures....
A. How far each number in the set is from the mean.
B. The mean of a given data set.
C. Return on Investment
D. Level of risk borne for every percent of expected return.

8. Certainty Equivalent approach is:
A. Guaranteed return from an investment after adjusting for certainty equivalent coefficient.
B. Return that is expected over the lifetime of a project.
C. Equivalent to Net Present Value.
D. An important component in Decision Tree Analysis.

SECURITY ANALYSIS

1. Which of the following technique is not used for economic analysis?
A. Barometer/Indicator Approach
B. Economic Model Building Approach
C. **Mixed Forecasting**
D. Economic Model Building Approach

2. As per the Dow Jones Theory the Secondary movement of stock prices last from.....
A. one year to three years.
B. three weeks to three months.
C. day to day.
D. None of these

3. An efficient capital market is one in which.....
A. Taxes are irrelevant.
B. Security prices reflect available information.
C. Securities always offer a positive rate of return to investors.

D. Security prices are guaranteed (by the SEBI) to be fair.

4. Which factor significantly influences the demand in consumer products industries?
   A. Interest rate
   B. Discount rate
   C. Inflation rate
   D. None of the above

5. Which of the following is a drawback of the Anticipatory Surveys technique used in economic analysis?
   A. Survey results guarantee that intentions surveyed would materialize.
   B. They are regarded as forecasts per se, as there can be a consensus approach by the investor for exercising his opinion.
   C. Both of (a) and (b)
   D. None of the above

6. Which of the following factor affects industry analysis?
   A. Product Lifecycle
   B. Government Attitude
   C. State of Competition in the Industry
   D. All of these

SECURITY VALUATION

1. The value a zero coupon with a maturity of three years and a maturity value of Rs 1,000 discounted at 7% is
   A. Rs. 816.30
   B. Rs. 901.94
   C. Rs. 966.18
   D. Rs. 1000

2. A debenture of Rs. 10000 carrying 15% coupon rate is quoted in the market at Rs.13500. The current yield on this debenture will be:
   A. 13.50%
   B. 15%
   C. 11.11%
   D. 10%

3. The annual interest of a bond divided by its face value is called the bond's.....
   A. Coupon Rate
   B. Face value
   C. Maturity
   D. Yield to maturity

4. Which of the following is not a money market instrument?
   A. Commercial paper
   B. Participatory certificates

C. Warrant
D. Treasury Bills

5. A Ltd. issued commercial paper worth ₹ 10 crores as per the following details:
Date of issue: 15th June, 2022
Maturity period: 73 days
No. of days in a year: 365 days
Interest rate: 15% p.a.
Intermediary charges: 0.1% of Net Receipts
The net amount received by the company on such issue of CP shall be approximately.....
A. ₹ 9,69,90,291
B. ₹ 9,70,87,379
C. ₹ 9,69,77,379
D. ₹ 9,69,00,000

6. The following information is related to two bonds same in other respects:

Price of Bond A	= Rs. 101
Price of Bond B	= Rs. 120
Coupon Rate of Bond A	=14%
Coupon Rate of Bond B	= 15%

If both the bonds are redeemable at a Premium of 10% after 2 years and the required yield on this category of Bonds is 16% then best avenue for investment shall be.....
A. Bond A
B. Bond B
C. Any of the two Bonds
D. Neither of the two Bonds

PORTFOLIO MANAGEMENT

1. Risk Premium is:
A. **Extra rate of return expected by the Investors as a reward for bearing extra risk.**
B. Equivalent to the rate of Government Securities.
C. Return provided to equity shareholders.
D. Risk free rate of return.

2. Arbitrage Pricing Theory was developed by.....
A. William Sharpe
B. Harry Markowitz
C. **Stephan Ross**
D. Black Scholes

3. What is the common hypothesis for Traditional and Modern Theories of Portfolio Management.
A. Both approaches use statistical methods.
B. Both approaches are based on judgement.
C. **Both approaches are based on hypothesis that a portfolio reduces risk by diversification.**

D. None of these.

4. According to the CAPM, the intercept of Security Market Line (SML) should be equal to.....
   A. **zero.**
   B. the expected risk premium on the market portfolio.
   C. the risk-free rate.
   D. the expected return on the market portfolio.

5. Calculation of Coefficient of Variance depends on:
   A. Standard Deviation
   B. Expected Return
   C. Expected cash flow
   D. **All of the above**

SECURITIZATION

1. The main objective of creating a Special Purpose Vehicle (SPV) in the securitization process is.....
   A. to acquire legal and beneficial interest in the assets.
   B. to issue securities to the investors.
   C. **to remove the asset from the balance sheet of the originator.**
   D. to write off the asset as bad debt from the balance sheet of the originator.

2. .....is the process of repackaging or rebundling of illiquid assets into marketable securities.
   A. Diversification
   B. **Securitization**
   C. Structured finance
   D. Tokenization

MUTUAL FUNDS

1. The lower the..... of the Index Fund, higher the accuracy the more predictable return is.
   A. Alpha
   B. Beta
   C. **Tracking Error**
   D. Exist Load

2. The major difference between open-ended and close-ended mutual fund schemes is that.....
   A. in Open Ended Schemes, investors can only make entry and exit during pre-specified intervals.
   B. Close-ended schemes allow investors to redeem their investments at any time.
   C. Open-ended schemes have a limited life, while close-ended schemes have an indefinite redemption period.
   D. **Open-ended schemes have an indefinite redemption period, while close-ended schemes have a limited life.**

3. Which of the following Business Parks has launched India's first Real Estate Investment Trust (ReIT)?

A. Galaxy Business Parks
B. DLF Cyber City
C. Patni Knowledge Parks
D. Embassy Office Parks

DERIVATIVES ANALYSIS AND VALUATION

1. ABC Masala Co. purchase jeera to make its products. The company is concerned that prices may rise prior to building inventory for festivals sales. Analysts project that price per quintal could vary from Rs. 52,000 to Rs. 70,000. A September futures contract can be obtained with a Rs. 65,000 purchase prices. What is ABC's risk in this situation?
   A. Coca prices will rise above Rs. 65,000 and Tingley will purchase its coca at a price of Rs. 65,000.
   B. **Coca prices will decline below Rs. 65,000 and Tingley will have to purchase coca at Rs. 65,000.**
   C. Coca prices will hit Rs. 65,000 and the contract was a waste of time.
   D. ABC Co. has no risk in this situation.

2. Which of the following is true regarding a forward contract?
   A. It is standardized.
   B. The contracting parties negotiate only on the price.
   C. The contracting parties negotiate only on quantity and quality.
   D. **Both parties negotiate on quality, quantity, place, and price.**

3. Which of the following position provides protection from a decrease in prices of a share?
   A. Buying of Future Contracts in the share.
   B. Buying Call Option in the share.
   C. **Selling of Future Contracts in the share.**
   D. Selling Put Option in the share.

4. What is the purpose of trading in futures?
   A. Only for speculation.
   B. Only for hedging.
   C. **Both for speculation and hedging.**
   D. Only for arbitraging.

5. The maximum possible loss for a covered call writer is…….
   A. Option premium.
   B. Current price of the underlying asset.
   C. Strike price.
   D. **Initial investment Net of Premium.**

6. The spot price of an investment is Rs. 3,000 and the risk-free rate for all maturities (with continuous compounding) is 10% p.a.. Suppose the asset provides an income of Rs. 200 at the end of the first year and at the end of the second year, then three-year forward price shall be ……..

($e^{0.10}$ = 1.1052, $e^{0.20}$ = 1.2214 and $e^{0.30}$= 1.3499)

A. Rs. 1,967
B. **Rs. 3,584**
C. Rs. 4,515
D. Rs. 4,050

7. As per Real Option in Capital Budgeting any commitment to disinvest upon the action of another party is called.
A. Long Call
B. Long Put
C. **Short Call**
D. Short Put

8. Which of the following is a traditional method for an Indian farmer to sell wheat?
A. Forward Contract
B. Future Contract
C. **Spot Market**
D. Capital Market

9. The spot price of an investment asset that provides no income is Rs. 3000 and the risk-free rate for all maturities (with yearly compounding) is 10%. The three- year forward price of same investment shall be.....
A. **Rs. 3,993**
B. Rs. 4,050
C. Rs. 4,020
D. Rs. 4,034

10. Which among the following derivative product is not traded in an exchange at all?
A. Futures
B. Options
C. **Forwards**
D. None of these

11. A short forward contract on share of A Ltd. that was negotiated some time ago will expire in 3 months and has a delivery price of Rs. 4,000. The current forward price for three-month forward contract is Rs. 4,200 and the 3-month risk-free interest rate (with monthly compounding) is 6%. The value of the same short forward contract will be.....
A. Rs. 200
B. -Rs. 200
C. Rs. 197.03
D. **-Rs. 197.03**

12. In a future contract the term Basis is.....
A. **The difference between the prevailing spot price and the futures price.**

B. The difference between the current market price and the strike price.
C. The difference between the long position and the short position.
D. The difference between the initial margin and the maintenance margin.

13. When an investor buys back the same amount of futures contracts that he sold earlier is called.....
A. **closing out the position.**
B. going long of the futures.
C. opening a new position.
D. None of these

14. Which amongst the following is not a Greek for Options Pricing
A. Delta
B. Gamma
C. Theta
D. **Kho**

15. A put option on a company's stock has an exercise price of Rs. 200. On the delivery date, the stock is trading at Rs. 240 per share. What should the investor who has paid Rs. 20 for the option do?
A. **Not exercise the option and lose Rs. 20.**
B. Not exercise the option and lose Rs. 60.
C. Exercise the option and gain Rs. 20.
D. Exercise the option and gain Rs. 40.

16. Mr. A a speculator shorts 1000 shares of X Ltd. when the share price was Rs. 50 and closes out the position after 3 months when the share price was Rs. 43. The company pays a dividend of Rs. 3 per share during the 3 months. The gain of Mr. A will be ….
A. Rs. 1,000
B. **Rs. 4,000**
C. Rs. 7,000
D. Rs. 3,000

FOREIGN EXCHANGE EXPOSURE & RISK MANAGEMENT

1. US dollar is quoted today as: spot $ 1 = Rs. 80 and six months forward $1 = Rs. 84. The annualized forward margin is.....
A. **10%**
B. 5%
C. 3%
D. 6%

2. .....Theory substantiates that the expected disparity between the exchange rate of two currencies is approximately equal to the difference between their countries' nominal interest rates.

A. Interest Rate Parity
B. Purchasing Power Parity
C. **International Fisher Effect (IFE)**
D. None of these

3. Suppose Hari approaches a forex dealer who loads INR 1.00 margin on the interbank rate for travel related remittances. If in the interbank market the USD is quoted at INR 85.46 - 85.50 then Mr. Hari
A. can buy travel card at INR 84.46.
B. can buy travel card at INR 84.50.
C. can buy travel card at INR 86.46.
D. **can buy travel card at INR 86.50.**

4. If USD/INR spot is trading at 83.2000 and one year Swap annualized premium is trading at 6.8% then what would be the net outright rate
A. 77.4500
B. 77.5524
C. 88.4500
D. **88.8576**

5. How does a deficit in current account affect the exchange rate of a country?
A. Appreciation of home currency
B. **Depreciation of home currency**
C. No impact on the exchange rate
D. It depends on the size of the deficit

6. How can expectations affect the exchange rate of a currency?
A. **Speculators can have a substantial impact on exchange rate through speculations.**
B. The current spot/forward rates are often used to develop forecasts.
C. A combination of forecasting techniques is used to develop forecasts.
D. Historical data is used to predict future values.

7. On October 10, 2022, the Spot exchange rate is INR / USD = INR 66.2525- INR 67.5945 and the two months swap points are 125 and 195. What would be the foreign exchange rate after 2 months?
A. INR / USD = INR 66.2620 – INR 67.6070
B. INR / USD = INR 66.2400 – INR 67.5750
C. INR / USD = INR 66.2330 – INR 67.5820
D. **INR / USD = INR 66.2650 – INR 67.6140**

8. US dollar is quoted today as: spot $ 1 = INR 80 and six months forward $1 = INR 83.
A. This means $ is at discount
B. This means future of rupee is uncertain
C. This means future of rupee is unclear

D. **This means $ is at premium**

9. T & L Ltd has submitted its bid along with bid bond guarantee of its bank for Green-house gas construction project in Australia with expected cash flows spread over next 3 years. Though its pricing is very competitive, it is not sure of securing it due to other factors. But if secured, it has a huge exchange risk in the invoicing currency viz.: AUD. It can opt for the following derivative product to protect itself.
   A. Forward contract
   B. Futures contract
   C. **Option contract**
   D. Swaps

10. An Indian exporter expecting a remittance of USD 5 Million, planning to hedge his position by option contracts should.....
   A. buy Call Option in USD.
   B. **buy Put Option in USD.**
   C. buy Call Option in INR.
   D. buy Put Option in INR.

11. Combination of two fixed floating currency swaps to fixed to fixed currency swap is called?
   A. Vanilla Swap
   B. **Circus Swap**
   C. Extendible Swap
   D. Roller-Coaster Swaps

12. A Trader sold 20 lots of USD/INR in an exchange (1 lot = $ 1000) via currency futures. He dealt at a future price of INR 78/$ for 3 months. Currently future price is trading at INR 82/$. The M2M (Mark to Market) of trader in the exchange shall be.....
   A. INR 4000
   B. INR 8000
   C. **INR 80000**
   D. INR 40000

INTERNATIONAL FINANCIAL MANAGEMENT

1. Which of the following factors are crucial in multinational capital budgeting?
   A. Cash flows from domestic projects.
   B. Profits remitted to the host country.
   C. **Effect of foreign exchange risk on the parent firm's cash flow.**
   D. Changes in rates of inflation in the parent country.

2. What is the difference between evaluating a project-based cash flows and parent firms cash flows?
   A. Evaluation based on parent firms cash flows requires competition with existing local firms.

B. Evaluation based on parent firms cash flows involves financial cash flows only.

C. Evaluation based on parent firms cash flows eliminates problems associated with fluctuating exchange rate changes.

D. **Evaluation based on parent firms cash flows involves operating and financial cash flows.**

INTEREST RATE RISK MANAGEMENT

1. Which of the following contract involves the notional principal for the purpose of exchange of liabilities.

A. Currency Swap

B. **Plain Vanilla Swap**

C. Forward Contract

D. None of these

2. The primary difference between an interest rate swap contract and a forward contract can be on account of.....

A. underlying

B. time of payment

C. daily marking to the market

D. **number of exchanges**

3. Suppose A Ltd. is entering into an interest rate swap with a notional principal of Rs. 10,00,00,000. At the beginning of the swap the initial amount of money the counterparties must exchange.....

A. **Rs. 0**

B. Rs. 5,000,000

C. The future value of Rs.10,00,00,000

D. Rs. 10,00,00,000 discounted

BUSINESS VALUATION

1. .....method involves valuation as per determination of the cost of group of assets and liabilities of equivalent company in the open market.

A. Net Asset Value

B. Net Realizable Value

C. **Replaceable Value**

D. None of the above

2. .....approach attempts to identify multi-industry companies that are undervalued and would have more value if separated from each other.

A. Economic Value Added Method

B. Market Value Added Method

C. **Chop-Shop Method**

D. None of the above

3. X Ltd. made a net profit of Rs. 50,00,000 and incurred expenses of Rs. 15,00,000. The number of issued Equity shares is 10,00,000. The company has a debt of Rs. 5,00,000. The market related details are as follows: Rf = 10% Market Rate of Return = 15% β = 1.2 The per share Earning Value of the company shall be.....

A. Rs. 31.25
B. Rs. 21.88
C. **Rs. 312.50**
D. Rs. 218.75

MERGERS, ACQUISITIONS & CORPORATE RESTRUCTURING

1. A merger that combines companies deal with the same product but in separate markets is called a.....

A. **Market extension merger.**
B. pure conglomerate merger.
C. vertical merger.
D. reverse merger.

2. Which type of merger happens when two companies that have buyer-seller relationship (or potential buyer-seller relationship) come together?

A. Horizontal Merger
B. **Vertical Merger**
C. Conglomerate Merger
D. Congeneric Merger

3. The general reason for a divestiture, such as a sell-off or spin-off may be.....

A. Synergy
B. Economics of scale
C. **Reverse synergy**
D. None of these

STARTUP FINANCE

1. The vendor financing in startup involves.....

A. borrowing funds from customer to lend funds to the company.
B. borrowing funds from customer to purchase products from the company.
C. lending funds to customer so that he can purchase products from different vendor.
D. **lending funds to customer so that he can purchase products from the company itself.**

2. In corporate restructuring when a company sells shares of the new company in market by making a public offer is called.

A. Sell off
B. Spin Off
C. Split up
D. **Equity Carve Outs**

3. Which among the following is not a method to approach a pitch presentation?
   A. Introduction of the team
   B. The market size of the product
   C. Explaining the approach to be followed to solve a problem
   D. **Method to be followed by the firm to bootstrap**

4. Which of the following can not be considered as a potential source of startup financing?
   A. Bank loans
   B. Personal financing
   C. Crowdfunding
   D. **Government grants**

Advanced Capital Budgeting Decisions & Other Amendments in May 24 & 25 Study Material

QUESTION 47:

SM | M 13 | PM

Skylark Airways is planning to acquire a light commercial aircraft for flying class clients at an investment of ₹ 50,00,000. The expected cash flow after tax for the next three years is as follows:

Year 1		Year 2		Year 3	
CFAT	Probability	CFAT	Probability	CFAT	Probability
14,00,000	0.1	15,00,000	0.1	18,00,000	0.2
18,00,000	0.2	20,00,000	0.3	25,00,000	0.5
25,00,000	0.4	32,00,000	0.4	35,00,000	0.2
40,00,000	0.3	45,00,000	0.2	48,00,000	0.1

The Company wishes to take into consideration all possible risk factors relating to airline operations. The company wants to know:

a. The expected NPV of this venture assuming independent probability distribution with 6 percent risk free rate of interest.

b. The possible deviation in the expected value.

c. How would standard deviation of the present value distribution help in Capital Budgeting decisions?

Solution:

a) $E(CF_1) = 14 \times 0.1 + 18 \times 0.2 + 25 \times 0.4 + 40 \times 0.3$
$= 27$ lacs

$E(CF_2) = 15 \times 0.1 + 20 \times 0.3 + 32 \times 0.4 + 45 \times 0.2$
$= 29.3$ lacs

$E(CF_3) = 18 \times 0.2 + 25 \times 0.5 + 35 \times 0.2 + 48 \times 0.1$
$= 27.9$ lacs

E(NPV):

Expected CFs	PVF @ 6%	Total PV
27.0	0.943	25.461
29.3	0.890	26.077
27.9	0.840	23.436
PV of E(CFs)		74.974
Less: Cash outflow		50.000
E(NPV)		24.974

b) Possible deviation in the expected value

SD of $E(CF_1)$:

X	P	$D_X = X - \bar{X}$	$P \times D_X^2$
14	0.1	-13	16.9
18	0.2	-9	16.2
25	0.4	-2	1.6
40	0.3	13	50.7

			85.4

$SD_1 = \sqrt{85.4} = 9.2412$ lacs

SD of $E(CF_2)$:

X	P	$D_X = X - \bar{X}$	$P \times D_X^2$
15	0.1	-14.3	20.45
20	0.3	-9.3	25.95
32	0.4	2.7	2.92
45	0.2	15.7	49.30
			98.60

$SD_2 = \sqrt{98.61} = 9.9303$ lacs

SD of $E(CF_3)$:

X	P	$D_X = X - \bar{X}$	$P \times D_X^2$
18	0.2	-9.9	19.60
25	0.5	-2.9	4.21
35	0.2	7.1	10.08
48	0.1	20.1	40.40
			74.29

$SD_2 = \sqrt{74.29} = 8.6192$ lacs

Standard deviation of E(NPV):

$$\sigma_{NPV} = \sqrt{\left(\frac{9.2412}{1.06^1}\right)^2 + \left(\frac{9.9303}{1.06^2}\right)^2 + \left(\frac{8.6192}{1.06^3}\right)^2}$$

= ₹ 14.3696 lacs

c) Standard deviation is a statistical measure of dispersion; it measures the deviation from a central number i.e. the mean.

In the context of capital budgeting decisions especially where we take up two or more projects giving somewhat similar mean cash flows, by calculating standard deviation in such cases, we can measure in each case the extent of variation. It can then be used to identify which of the projects is least risky in terms of variability of cash flows.

A project, which has a lower coefficient of variation will be preferred if sizes are heterogeneous.

Besides this, if we assume that probability distribution is approximately normal, we are able to calculate the probability of a capital budgeting project generating a net present value less than or more than a specified amount.

QUESTION 48:

SM | PM

Cyber Company is considering two mutually exclusive projects. Investment outlay of both the projects is ₹ 5,00,000 and each is expected to have a life of 5 years. Under three possible situations their annual cash flows and probabilities are as under

		Cash Flow (₹)	
Situation	Probabilities	Project A	Project B
Good	0.3	6,00,000	5,00,000
Normal	0.4	4,00,000	4,00,000

Worse	0.3	2,00,000	3,00,000

The cost of capital is 7 per cent, which project should be accepted? Explain with workings

Solution:

Project A

$E(CF_A)$ = 0.3 (6,00,000) + 0.4 (4,00,000) + 0.3 (2,00,000)
= 4,00,000

PV of $E(CF_A)$ = 4,00,000 × 4.100
= 16,40,000

$E(NPV_A)$ = 16,40,000 – 5,00,000 = 11,40,000

σ of $E(CF_A)$ = $\sqrt{0.3 \times (6,00,000 - 4,00,000)^2 + 0.4 \times (4,00,000 - 4,00,000)^2 + 0.3 \times (2,00,000 - 4,00,000)^2}$
= 1,54,919.33

Project B

$E(CF_B)$ = 0.3 (5,00,000) + 0.4 (4,00,000) + 0.3 (3,00,000)
= 4,00,000

PV of $E(CF_B)$ = 4,00,000 × 4.100
= 16,40,000

$E(NPV_B)$ = 16,40,000 – 5,00,000 = 11,40,000

σ of $E(CF_B)$ = $\sqrt{0.3 \times (5,00,000 - 4,00,000)^2 + 0.4 \times (4,00,000 - 4,00,000)^2 + 0.3 \times (3,00,000 - 4,00,000)^2}$
= 77,459.66

Recommendation: NPV in both projects being the same, the project should be decided on the basis of standard deviation and hence project 'B' should be accepted having lower standard deviation, means less risky.

QUESTION 49:

SM | PM

A company is considering Projects X and Y with following information:

Project	Expected NPV (₹)	Standard deviation
X	1,22,000	90,000
Y	2,25,000	1,20,000

a. Which project will you recommend based on the above data?
b. Explain whether your opinion will change, if you use coefficient of variation as a measure of risk.
c. Which measure is more appropriate in this situation and why?

Solution:

a) On the basis of standard deviation, Project X be chosen because it is less risky than Project Y and on the basis of return (i.e., NPV), Project Y should be chosen because it has higher return than project X.

b) $CV_x = \frac{SD}{ENPV} = \frac{90,000}{122,000} = 0.738$

$CV_y = \frac{120,000}{225,000} = 0.533$

On the basis of Co-efficient of Variation (C.V.) Project X appears to be riskier and hence Y should be accepted.

c) However, the NPV method in such conflicting situation is best because the NPV method is in compatibility of the objective of wealth maximisation in terms of time value

QUESTION 50:

SM | M 18 | PM

KLM Ltd. is considering taking up one of the two projects-Project-K and Project-So Both the projects having same life require equal investment of ₹ 80 lakhs each. Both are estimated to have almost the same yield. As the company is new to this type of business, the cash flow arising from the projects cannot be estimated with certainty. An attempt was therefore, made to use probability to analyse the pattern of cash flow from other projects during the first year of operations. This pattern is likely to continue during the life of these projects. The results of the analysis are as follows

Project K		Project S	
Cash Flow (in ₹)	Probability	Cash Flow (in ₹)	Probability
11	0.10	09	0.10
13	0.20	13	0.25
15	0.40	17	0.30
17	0.20	21	0.25
19	0.10	25	0.10

Required:

a. Calculate variance, standard deviation and co-efficient of variance for both the projects.

b. Which of the two projects is riskier?

Solution:

Project K

Expected Net Cash Flow = (0.10 x 11) + (0.20 x13) + (0.40 x 15) + (0.20 x 17) + (0.10 x 19)

= 15

σ^2 = $0.10(11 - 15)^2 + 0.20(13 - 15)^2 + 0.40(15 - 15)^2 + 0.20\ (17 - 15)^2 + 0.10(19 - 15)^2$

= 4.8

σ = $\sqrt{4.8}$ =2.19

Project S

Expected Net Cash Flow = (0.10 X 9) + (0.25 X 13) + (0.30 X 17) + (0.25 X 21) + (0.10 X 25)

= 17

σ^2 = $0.1\ (9 - 17)^2 + 0.25\ (13 - 17)^2 + 0.30\ (17 - 17)^2 + 0.25\ (21 - 17)^2 + 0.10\ (25 - 17)^2$

= 20.8

σ = $\sqrt{20.8}$ = 4.56

Calculation of Coefficient of Variation

Coefficient of Variation = $\frac{\text{Standard Deviation}}{\text{Mean}}$

Project K = $\frac{2.19}{15}$ = 0.146

Project S = $\frac{4.56}{17}$ = 0.268

Project S is riskier as it has higher Coefficient of Variation.

QUESTION 51:

SM | PM

Project X and Project Y are under the evaluation of XY Co. The estimated cash flows and their probabilities are as below:

Project X: Investment (year 0) ₹ 70 lakhs

Probability weights	0.30	0.40	0.30
Years	₹ lakhs	₹ lakhs	₹ lakhs
1	30	50	65
2	30	40	55
3	30	40	45

Project Y: Investment (year 0) ₹ 80 lakhs.

Probability weighted	Annual cash flows through life
	₹ lakhs
0.20	40
0.50	45
0.30	50

a. Which project is better based on NPV, criterion with a discount rate of 10%?

b. Compute the standard deviation of the present value distribution and analyse the inherent risk of the projects.

Solution:

a) NPV of Project X.: (in ₹ lacs)

Year	Expected CF	PVF	PV
1	(30 x 0.3) + (50 x 0.4) + (65 x 0.3) = 48.5	0.909	44.09
2	(30x 0.3) + (40 x0.4) + (55 x 0.3) = 41.5	0.826	34.28
3	(30 x 0.3) + (40 x 0.4) + (45 x0.3) = 38.5	0.751	28.91
	Total PV of E(CFs)		107.28
	Less: PV Outflows		-70
	Expected NPV		37.28

NPV of Project Y: (in ₹ lacs)

Year	Expected CF	PVAF	PV
1 - 3	(40 x 0.2) + (45 x 0.5) + (50 x 0.3) = 45.5	2.487	113.16
	Less: PV Outflows		-80
	Expected NPV		33.16

Project X is a better project as it has a higher NPV.

b) Calculation of Standard deviation as per Hiller's model:

Project X

SD of CFs of individual years:

Years 1 $= \sqrt{(30-48.5)^2\,0.30+(50-48.5)^2\,0.40+(65-48.5)^2\,0.30}$

= ₹ 13.61 lacs

Year 2 $= \sqrt{(30-41.5)^2 0.30+(40-41.5)^2 0.40+(55-41.5)^2 0.30}$

= ₹ 9.76 lacs

Year 3 $= \sqrt{(30-41.5)^2 0.30+(40-41.5)^2 0.40+(55-41.5)^2 0.30}$

= ₹ 5.94 lacs

Standard Deviation about the expected value

$= \sqrt{\left(\frac{13.61}{1.1^1}\right)^2+\left(\frac{9.76}{1.1^2}\right)^2+\left(\frac{5.94}{1.1^3}\right)^2}$

= ₹ 15.43 lacs

Project Y:

SD of CFs of individual years:

Year 1 – 3 $= \sqrt{(40-45.5)^2 0.20+(45-45.5)^2 0.50+(50-45.5)^2 0.30}$

= ₹ 3.50 lacs

Standard Deviation about the expected value

$= \sqrt{\left(\frac{3.5}{1.1^1}\right)^2+\left(\frac{3.5}{1.1^2}\right)^2+\left(\frac{3.5}{1.1^3}\right)^2}$

= ₹ 5.03 lacs

Analysis: Project Y is less risky as its Standard Deviation is less than Project X.

QUESTION 52:

SM | PM

Shivam Ltd. is considering two mutually exclusive projects A and B. Project A costs ₹ 36,000 and project B ₹ 30,000. You have been given below the net present value probability distribution for each project.

Project A		Project B	
NPV estimates (₹)	Probability	NPV estimates (₹)	Probability
15,000	0.2	15,000	0.1
12,000	0.3	12,000	0.4
6,000	0.3	6,000	0.4
3,000	0.2	3,000	0.1

a. Compute the expected net present values of projects A and B.
b. Compute the risk attached to each project i.e. standard deviation of each probability distribution.
c. Compute the profitability index of each project.
d. Which project do you recommend? State with reasons.

Solution:

a) Statement showing computation of expected net present value of Projects A and B:

Project A			Project B		
NPV	Probability	Expected Value	NPV	Probability	Expected

Estimate			Estimate		Value
15,000	0.2	3,000	15,000	0.1	1,500
12,000	0.3	3,600	12,000	0.4	4,800
6,000	0.3	1,800	6,000	0.4	2,400
3,000	0.2	600	3,000	0.1	300
	1.0	E(NPV) = 9,000		1.0	E(NPV) = 9,000

b) Computation of Standard deviation of each project

Project A

P	X	$D_X = (X - \bar{X})$	$P \times D_X^2$
0.2	15,000	6,000	72,00,000
0.3	12,000	3,000	27,00,000
0.3	6,000	- 3,000	27,00,000
0.2	3,000	- 6,000	72,00,000
		Variance =	1,98,00,000

Standard Deviation of Project A = $\sqrt{1,98,00,000}$ = ₹ 4,450

Project B

P	Y	$D_Y = (Y - \bar{Y})$	$P \times D_Y^2$
0.1	15,000	6,000	36,00,000
0.4	12,000	3,000	36,00,000
0.4	6,000	- 3,000	36,00,000
0.1	3,000	- 6,000	36,00,000
		Variance	1,44,00,000

Standard Deviation of Project B = $\sqrt{1,\ 44,00,000}$ = ₹ 3,795

c) Computation of profitability Index of each project

Profitability index = Discount cash inflow / Initial outlay

Project A $= \frac{9,000 + 36,000}{36,000}$ = 1.25 times

Project B $= \frac{9,000 + 36,000}{30,000}$ = 1.30 times

d) Measurement of risk is made by the possible variation of outcomes around the expected value and the decision will be taken in view of the variation in the expected value where two projects have the same expected value, the decision will be the project which has smaller variation in expected value. In the selection of one of the two projects A and B, Project B is preferable because the possible profit which may occur is subject to less variation (or dispersion). Much higher risk is lying with project A

QUESTION 53:

SM | PM

Following are the estimates of the net cash flows and probability of a new project of M/s X Ltd.

	Year	P = 0.3	P = 0.5	P = 0.2
Initial investment	0	4,00,000	4,00,000	4,00,000
Estimated net after tax cash inflows per year	1 to 5	1,00,000	1,10,000	1,20,000
Estimated salvage value (after tax)	5	20,000	50,000	60,000

Required rate of return from the project is 10%. Find:

a. The expected NPV of the project.
b. The best case and the worst case NPVs.
c. The probability of occurrence of the worst case if the cash flows are perfectly dependent overtime and independent overtime.
d. Standard deviation and coefficient of variation assuming that there are only three streams of cash flow, which are represented by each column of the table with the given probabilities.
e. Coefficient of variation of X Ltd. on its average project which is in the range of 0.95 to1.0. If the coefficient of variation of the project is found to be less risky than average,100 basis points are deducted from the Company's cost of Capital. Should the project be accepted by X Ltd?

Solution:

a) Expected cash flows:

Year	Net cash flows	PVF \ PVAF	DCF
0	4,00,000 x 1 = 4,00,000	1.000	-4,00,000
1 to 5	1,00,000 x 0.3 + 1,10,000 x 0.5 + 1,20,000 x 0.2 = 1,09,000	3.791	4,13,219
5	20,000 x 0.3 + 50,000 x 0.5 + 60,000 x 0.2 = 43,000	0.621	26,703
NPV			39,922

b) ENPV of the worst case

Annual CFS = 1,00,000 x 3.791 = ₹ 3,79,100
Salvage Value = 20,000 x 0.621 = ₹ 12,420
ENPV = - 4,00,000 + 3,79,100 + 12,420 = - ₹ 8,480

ENPV of the best case

Annual CFS = 1,20,000 x 3.791 = ₹ 4,54,920
Salvage Value = 60,000 x 0.621 = ₹ 37,260
ENPV = - 4,00,000 + 4,54,920 + 37,260 = ₹ 92,180

c) Dependent probability = 0.3
Independent probability = $(0.3)^5$ = 0.00243

d) The base case NPV = - 4,00,000 + (1,10,000 x 3.79) + (50,000 x 0.621)
= 48,060

E(NPV) = 0.30 x (- 8,480) + 0.5 x 48,060 + 92,180 x 0.20
= ₹ 39,922

SD of E(NPV) = $\sqrt{0.3 \times(-8{,}480 - 39{,}922)^2 + 0.5 \times(48{,}060-39{,}922)^2 + 0.2 \times(92{,}180-39{,}922)^2}$
= ₹ 35,807

CV of E(NPV) = 35,800/39,922
= 89.69%

e) Risk adjusted out of cost of capital of X Ltd. = 10% - 1% = 9%. NPV

Year	E(CF)	PV @ 9%	DCF
0	(-) 4,00,000	1.000	- 4,00,000
1 to 5	1,09,000	3.890	4,24,010
5	43,000	0.650	27,950
		ENPV =	51,960

Therefore, the project should be accepted

QUESTION 54:

SM | M 10 | PM

XY Ltd. has under its consideration a project with an initial investment of ₹ 1,00,000. Three probable cash inflow scenarios with their probabilities of occurrence have been estimated as below:

Annual cash inflow (₹)	20,000	30,000	40,000
Probability	0.1	0.7	0.2

The project life is 5 years and the desired rate of return is 20%. The estimated terminal values for the project assets under the three probability alternatives, respectively, are ₹ 0, 20,000 and 30,000.

You are required to:

a. Find the probable NPV;

b. Find the worst-case NPV and the best-case NPV; and

c. State the probability occurrence of the worst case, if the cash flows are perfectly positively correlated over time.

Solution:

The expected cash flows of the project are as follows:

Year	P = 0.1	P = 0.7	P = 0.2	Total (₹)
0	-10,000	-70,000	-20,000	-1,00,000
1 - 5	2,000	21,000	8,000	31,000
5	0	14,000	6,000	20,000

a) NPV based on expected cash flows would be as follows:

$$= -1{,}00{,}000 + \frac{31{,}000}{(1+0.20)^1} + \frac{31{,}000}{(1+0.20)^2} + \frac{31{,}000}{(1+0.20)^3} + \frac{31{,}000}{(1+0.20)^4} + \frac{31{,}000}{(1+0.20)^5}$$

= ₹ 746.52

b) For the worst case, the cash flows from the cash flow column farthest on the left are used to calculate NPV

$$= -1{,}00{,}000 + \frac{40{,}000}{(1+0.20)^1} + \frac{40{,}000}{(1+0.20)^2} + \frac{40{,}000}{(1+0.20)^3} + \frac{40{,}000}{(1+0.20)^4} + \frac{40{,}000}{(1+0.20)^5} + \frac{30000}{(1+0.20)^5}$$

= ₹ 31,680.81

c) If the cash flows are perfectly dependent, then the low cash flow in the first year will mean a low cash flow in every year. Thus, the possibility of the worst case occurring is the probability of getting ₹ 20,000 net cash flow in year 1 is 10%.

QUESTION 55:

SM | PM

XYZ Ltd. is considering a project for which the following estimates are available:

	₹
Initial Cost of the project	10,00,000
Sales price/unit	60
Cost/unit	40
Sales volumes	
Year 1	20000 units
Year 2	30000 units
Year 3	30000 units

Discount rate is 10% p.a.

You are required to measure the sensitivity of the project in relation to each of the following parameters:

(a) Sales Price/unit

(b) Unit cost

(c) Sales volume

(d) Initial outlay and

(e) Project lifetime

Taxation may be ignored.

Solution:

Calculation of Base NPV

$$NPV = -10,00,000 + \frac{20,000 \times (60 - 40)}{1.1} + \frac{30,000 \times (60 - 40)}{1.1^2} + \frac{30,000 \times (60 - 40)}{1.1^3}$$

= ₹ 3,10,293/-.

Measurement of sensitivity is as follows:

a) Sales Price:

Let the sale price/Unit be S so that the project would break even with 0 NPV.

$$0 = -10,00,000 + \frac{20,000x(S-40)}{1.1} + \frac{30,000x(S-40)}{1.21} + \frac{30,000x(S-40)}{1.331}$$

S = ₹ 55.26

Decrease in Sales price to make NPV zero = (60-55.26)/60 = 7.9%

Alternative Solution:

If sale Price decreased by say 10%, then NPV (at Sale Price of ₹ 60 – ₹ 6 = ₹ 54)

$$NPV = -10,00,000 + \frac{20,000x14}{(1.1)^1} + \frac{30,000x14}{(1.1)^2} + \frac{30,000x14}{(1.1)^3}$$

= - 82,796

$$\text{NPV decrease (\%)} = \frac{3,10,293-(-82,796)}{10,293} \times 100 = 126.68\%$$

(b) Unit Cost:

Let the cost price/Unit be C so that the project would break even with 0 NPV.

$$0 = -10,00,000 + \frac{20,000 \times (60 - C)}{1.1} + \frac{30,000 \times (60 - C)}{1.21} + \frac{30,000 \times (60 - C)}{1.331}$$

C = ₹ 44.74

Increase in Cost price to make NPV zero = $\left(\frac{44.74 - 40}{40} x100\right)$ = 11.85%

Alternative Solution:

If unit cost increased by say 10%. The new NPV will be as follows:

NPV = -10,00,000 + $\frac{20,000X16}{(1.1)^1} + \frac{30,000x16}{(1.1)^2} + \frac{30,000x16}{(1.1)^3}$

= ₹ 48,234

NPV decrease (%) = $\frac{3,\ 10,293-(\ 48,234)}{3,\ 10,293}$ x 100 = 84.46%

c) Sales volume:

Let the Sales volume of 1st year be V. Therefore 2nd and 3rd year be 1.5V so that the project would break even with 0 NPV.

0 = - 10,00,000 + $\frac{V \times (60 - 40)}{1.1} + \frac{1.5V \times (60 - 40)}{1.21} + \frac{1.5V \times (60 - 40)}{1.331}$

V = 15263.76 units

Decrease in Sales price to make NPV zero = (15,263.76 – 20,000)/20,000 = 23.68%

Alternative Solution:

If sale volume decreased by say 10%. The new NPV will be as follows:

NPV = -10,00,000 + $\frac{18000x20}{(1.1)^1} + \frac{27000x20}{(1.1)^2} + \frac{27000x20}{(1.1)^3}$

= 1,79,263

NPV decrease (%) = $\frac{3,\ 10,293-179,263}{3,\ 10,293}$ x 100 = 42.22%

d) Initial Outlay

Initial Outlay to the project would break even with 0 NPV.

0 = - Initial OF + $\frac{20,000 \times (60 - 40)}{1.1} + \frac{30,000 \times (60 - 40)}{1.1^2} + \frac{30,000 \times (60 - 40)}{1.1^3}$

Initial OF = ₹ 13,10,293

Increase in Initial OF to make NPV zero = 3,10,293/10,00,000 = 31.03%.

Alternative Solution:

If initial outlay increased by say 10%. The new NPV will be as follows:

NPV = -11,00,000 + $\frac{20000x20}{(1.1)^1} + \frac{30000x20}{(1.1)^2} + \frac{30000x20}{(1.1)^3}$

= 2,10,293

NPV decrease (%) = $\frac{3,10,293-2,10,293}{3,10,293}$ x 100 = 32.22%

e) Project lifetime

Present value of CFS for 1st two years.

NPV = -10,00,000 + $\frac{20,000 \times 20}{1.1} + \frac{30,000 \times 20}{1.21}$

= - 1,40,496

To make the NPV Zero, the project needs to run for some part of the third year such that the present value of CFs of is ₹ 1,40,496.

It can be computed as follows:

PV of CFs of year 3 $= \frac{30,000 \times 20}{1.331}$

= 4,50,789

Part of year 3, the project needs to run $= \frac{1,40,496}{4,50,789}$

= 0.312 years

Total project life to make NPV zero = 2.312 years

The requisite percentage fall is $= \frac{(2.312 - 3)}{3}$ 100 = - 22.93%

QUESTION 56:

SM | PM | M 17

Years	Cost of Plant	Recurring Cost	Savings
0	10,000		
1		4,000	12,000
2		5,000	14,000

The cost of capital is 9%. Measure the sensitivity of the project to changes in the levels of plant value, running cost and savings (considering each factor at a time) such that the NPV becomes zero. The P.V. factor at 9% are as under:

Year	Factor
0	1
1	0.917
2	0.842

Which factor is the most sensitive to affect the acceptability of the project?

Solution:

NPV = -10,000 + (12,000 – 4,000) x 0.917 + (14,000 – 5,000) x 0.842

= 4914

Sensitivity Analysis

a) To make NPV zero, increase of Plant Value by ₹ 4,914

$= \frac{4,914}{10,000}$ x 100 = 49.14%

b) To make NPV Zero, Running Cost should be:

Let's assume 1st year's cost to be X

Therefore, 2nd year's cost will be 5,000/4,000 * X = 1.25X

0 = -10,000 + (12,000 – X) x 0.917 + (14,000 – 1.25X) x 0.842

X = 6495.05

Increase in cost (%) $= \frac{6495.05 - 4,000}{4,000}$ x 100

= 62.38%

c) To make NPV Zero, Savings should be:

Let's assume 1st year's savings to be X

Therefore, 2nd year's cost will be 14,000/12,000 * X = 1.1667X

0 = -10,000 + (X – 4,000) x 0.917 + (1.667X – 5,000) x 0.842

X = 9412.64

Increase in cost (%) $= \frac{9412.64 - 12,000}{12,000} \times 100$

= 21.56%

Hence, savings factor is the most sensitive to affect the acceptability of the project as in comparison of other two factors a slight % change in this fact shall more affect the NPV than others.

Alternative Solution:

Sensitivity Analysis

a. If the initial project cost is varied adversely by say 10%*.

NPV (Revised) = (₹ 4,914 – ₹1,000) = 3,914

Change in NPV $= \frac{4,914-3914}{4,914} = 20.35\%$

b. If Annual Running Cost is varied by say 10%*.

NPV (Revised) = ₹ 4,914 – ₹ 400 X 0.917 – ₹ 500 X 0.843

= ₹ 4,126

Change in NPV = $\frac{4,914-4126}{4,914} = 16.04\%$

c. If Saving is varied by say 10%*.

NPV (Revised) = ₹ 4,914 – ₹ 1,200 X 0.917 – ₹ 1,400 X 0.843

= ₹ 2,634

Change in NPV $= \frac{4,914-4126}{4,914} = 46.40\%$

Hence, Savings is the most sensitive factor to affect the acceptability of the project.

Self-note: Any percentage of variation other than 10% can also be assumed.

QUESTION 57:

SM | N 13 | PM

The Easygoing Company Limited is considering a new project with initial investment, for a product Survival". It is estimated that IRR of the project is 16% having an estimated life of 5 years.

Financial Manager has studied that project with sensitivity analysis and informed that annual fixed cost sensitivity is 7.8416%, whereas cost of capital (discount rate) sensitivity is 60%.

Other information available are:

Profit Volume Ratio (P/V) is 70%,

Variable cost ₹ 60/- per unit

Annual Cash Flow ₹ 57,500/-

Ignore Depreciation on initial investment and impact of taxation.

Calculate

a. Initial Investment of the Project
b. Net Present Value of the Project
c. Annual Fixed Cost
d. Estimated annual unit of sales

e. Break Even Units

Cumulative Discounting Factor for 5 years

8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%
3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127

Solution:

a) Initial Investment

IRR = 16% (Given)

At IRR, NPV shall be zero, therefore

Initial Cost of Investment = PVAF (16%,5) x Cash Flow (Annual)

= 3.274 x ₹ 57,500

= ₹ 1,88,255

b) Net Present Value (NPV)

Let Cost of Capital be X, then $\frac{16-X}{X} = 60\%$

$X = 10\%$

Thus, NPV of the project

= Annual Cash Flow x PVAF (10%, 5) – Initial Investment

= ₹ 57,500 x 3.791 – ₹ 1,88,255

= ₹ 29,727.50

c) Annual Fixed Cost

Let change in the Fixed Cost which makes NPV zero is X. Then,

₹ 29,727.50 – 3.791X = 0

Thus X = ₹ 7,841.60

Let original Fixed Cost be Y

then, Y × 7.8416% = ₹ 7,841.60

Y = ₹ 1,00,000

Thus, Fixed Cost is equal to ₹ 1,00,000

d) Estimated Annual Units of Sales

Selling Price per unit = $\frac{60}{100\% - 70\%}$ = ₹ 200

$\frac{\text{Annual Cash Flow} + \text{Fixed Cost}}{\text{P/V Ratio}}$ = Sales Value

$\frac{57,500 + 1,00,000}{0.70}$ =2,25,000

Sales in Units = $\frac{2,25,000}{200}$ =1,125 units

e) Break Even Units = $\frac{\text{Fixed Cost}}{\text{Contribution Per Unit}}$

= $\frac{1,00,000}{140}$ = 714.285 units

QUESTION 58:

SM | PM

Unnat Ltd. is considering investing ₹ 50,00,000 in a new machine. The expected life of machine is five years and has no scrap value. It is expected that 2,00,000 units will be produced and sold each year at a selling price of ₹ 30.00 per unit. It is expected that the variable costs to be ₹ 16.50 per unit and
fixed costs to be ₹ 10,00,000 per year. The cost of capital of Unnat Ltd. is 12% and acceptable level of risk is 20%.
You are required to measure the sensitivity of the project's net present value to a change in
the following project variables:

(a) sale price;
(b) sales volume;
(c) variable cost;
(d) On further investigation it is found that there is a significant chance that the expected sales volume of 2,00,000 units per year will not be achieved. The sales manager of Unnat Ltd. suggests that sales volumes could depend on expected economic states which could be assigned the following probabilities:

State of Economy	Annual Sales (in Units)	Prob.
Poor	1,75000	0.30
Normal	2,00,000	0.60
Good	2,25,000	0.10

Calculate expected net present value of the project and give your decision whether company should accept the project or not.

Solution:

Calculation of NPV

= - ₹ 50,00,000 + [2,00,000 (₹ 30 – ₹ 16.50) – ₹ 10,00,000] PVIAF (12%,5)
= - ₹ 50,00,000 + [2,00,000 (₹ 13.50) – ₹ 10,00,000] 3.605
= ₹ 11,28,500

Measurement of Sensitivity Analysis

a) Sales Price:

Let the sale price/Unit be S so that the project would break even with 0 NPV.
₹ 50,00,000 = [2,00,000 (S – ₹ 16.50) – ₹ 10,00,000] PVAF (12%,5)
₹ 50,00,000 = [2,00,000 x S – ₹ 33,00,000 – ₹ 10,00,000] 3.605
S = ₹ 28.43
which represents a fall of (30 - 28.43)/30 = 5.23%

b) Sales volume:

Let V be the sale volume so that the project would break even with 0 NPV.
₹ 50,00,000 = [V (₹ 30 – ₹ 16.50) – ₹ 10,00,000] PVAF (12%,5)
₹ 50,00,000 = [V (₹ 13.50) – ₹ 10,00,000] 3.605
V = 1,76,812 which represents a fall of (2,00,000 - 1,76,812)/2,00,000 = 11.59%

c) Variable Cost:

Let the variable cost be V so that the project would break even with 0 NPV.
∴ ₹ 50,00,000 = [2,00,000(₹ 30 – V) – ₹ 10,00,000] PVAF(12%,5)
₹ 50,00,000 = [₹ 60,00,000 – 2,00,000 V – ₹ 10,00,000] 3.605
V = ₹ 18.07 which represents a fall of (18.07 – 16.50)/16.50 = 9.51%

d) Expected Net Present Value

Expected Unit = (1,75,000 X 0.30) + (2,00,000 X 0.60) + (2,25,000 X 0.10) =1,95,000
E(NPV) = [1,95,000 X ₹ 13.50 – ₹ 10,00,000] 3.605 – ₹ 50,00,000 = ₹ 8,85,163

NPV in worst cases:

[1,75,000 X ₹ 13.50 – ₹ 10,00,000] 3.605 – ₹ 50,00,000 = - ₹ 88,188

Thus, there are 30% chances that the rise will be a negative NPV and 70% chances of positive NPV. Since acceptable level of risk of Unnat Ltd. is 20% and there are 30% chances of negative NPV hence project should not be accepted.

QUESTION 59:

SM | PM

The Textile Manufacturing Company Ltd. is considering one of two mutually exclusive proposals, Projects M and N, which require cash outlays of ₹ 8,50,000 and ₹ 8,25,000 respectively. The certainty-equivalent (C.E) approach is used in incorporating risk in capital budgeting decisions. The current yield on government bonds is 6% and this is used as the risk free rate. The expected net cash flows and their certainty equivalents are as follows:

Project M			Project N	
Year-end	Cash Flow ₹	C.E.	Cash Flow ₹	C.E.
1	4,50,000	0.8	4,50,000	0.9
2	5,00,000	0.7	4,50,000	0.8
3	5,00,000	0.5	5,00,000	0.7

Present value factors of ₹ 1 discounted at 6% at the end of year 1, 2 and 3 are 0.943, 0.890 and 0.840 respectively.

Required:

a. Which project should be accepted?

b. If risk adjusted discount rate method is used, which project would be appraised with a higher rate and why?

Solution:

a) Statement Showing the Net Present Value of Project M

Year	CFs (₹) (a)	C.E. (b)	Adjusted CFs (₹) (c) = (a) x (b)	PVF at 6% (d)	DCFs (₹) (e) = (c) x (d)
1	4,50,000	0.8	3,60,000	0.943	3,39,480
2	5,00,000	0.7	3,50,000	0.89	3,11,500
3	5,00,000	0.5	2,50,000	0.84	2,10,000
	Total				8,60,980
Less:	Initial Investments				8,50,000
	NPV				10,980

Statement Showing the Net Present Value of Project N

Year	CFs (₹) (a)	C.E. (b)	Adjusted CFs (₹) (c) = (a) x (b)	PVF at 6% (d)	DCFs (₹) (e) = (c) x (d)
1	4,50,000	0.9	4,05,000	0.943	3,81,915
2	4,50,000	0.8	3,60,000	0.890	3,20,400
3	5,00,000	0.7	3,50,000	0.840	2,94,000
	Total				9,96,315
Less:	Initial Investments				8,25,000
	NPV				1,71,315

Decision: Since the net present value of Project N is higher, so the project N should be accepted.

b) Certainty - Equivalent (C.E.) Co-efficient of Project M (2.0) is lower than Project N (2.4). This means Project M is riskier than Project N as "higher the riskiness of a cash f low, the lower will be the CE factor". If risk adjusted discount rate (RADR) method is used, Project M would be analysed with a higher rate.
RADR is based on the premise that riskiness of a proposal may be taken care of, by adjusting the discount rate. The cash flows from a more risky proposal should be discounted at a relatively higher discount rate as compared to other proposals whose cash flows are less risky. Any investor is basically risk averse. However, he may be ready to take risk provided he is rewarded for undertaking risk by higher returns. So, more risky the investment is, the greater would be the expected return. The expected return is expressed in terms of discount rate which is also the minimum required rate of return generated by a proposal if it is to be accepted. Therefore, there is a positive correlation between risk of a proposal and the discount rate.

QUESTION 60:

SM | PM

Determine the risk adjusted net present value of the following projects:

	X	Y	Z
Net cash outlays (₹)	2,10,000	1,20,000	1,00,000
Project life	5 years	5 years	5 years
Annual Cash inflow (₹)	70,000	42,000	30,000
Coefficient of variation	1.2	0.8	0.4

The Company selects the risk-adjusted rate of discount on the basis of the coefficient of variation:

Coefficient ofVariation	Risk-Adjusted Rate of Return	PVF of 1 to 5 years At riskadjusted rate of discount
0.0	10%	3.791
0.4	12%	3.605
0.8	14%	3.433
1.2	16%	3.274
1.6	18%	3.127
2.0	22%	2.864
More than 2.0	25%	2.689

Solution:

Statement showing the determination of the risk adjusted net present value

Projects	Net cash outlays	Coeff of variation	Risk adjusted rate	Annual cash inflow	PV factor 1-5 years	Discounted cash inflow	Net present value
a	b	c	d	e	f	g = e x f	g - b
X	2,10,000	1.20	16%	70,000	3.274	2,29,180	19,180
Y	1,20,000	0.80	14%	42,000	3.433	1,44,186	24,186
Z	1,00,000	0.40	12%	30,000	3.605	1,08,150	8,150

QUESTION 61:

SM | PM | M 16

New Projects Ltd. is evaluating 3 projects, P-I, P-II, P-III. Following information is available in respect of these projects:

	P-I	P-II	P-III
Cost	₹ 15,00,000	₹ 11,00,000	₹ 19,00,000

Inflows-Year 1	6,00,000	6,00,000	4,00,000
Year 2	6,00,000	4,00,000	6,00,000
Year 3	6,00,000	5,00,000	8,00,000
Year 4	6,00,000	2,00,000	12,00,000
Risk Index	1.80	1.00	0.60

Minimum required rate of return of the firm is 15% and applicable tax rate is 40%. The risk-free interest rate is 10%.
Required:

a. Find out the risk-adjusted discount rate (RADR) for these projects.

b. Which project is the best?

Solution:

a) The risk free rate of interest and risk factor for each of the projects are given. The risk adjusted discount rate (RADR) for different projects can be found on the basis of CAPM as follows:

= Rf + (ko - Rf) Risk Factor

For P-I = 0.10 + (0.15 – 0.10) 1.80 = 19%

For P-II = 0.10 + (0.15 – 0.10) 1.00 = 15 %

For P-III = 0.10 + (0.15 – 0.10) 0.60 = 13 %

b) The three projects can now be evaluated at 19%, 15% and 13% discount rate as follows:

Project P-I

	Annual Inflows	₹ 6,00,000
	PVAF (19 %, 4)	2.639
	PV of Inflows	₹ 15,83,400
Less:	Cost of Investment	₹ 15,00,000
	Net Present Value	₹ 83,400

Project P-II

Year	Cash Inflow (₹)	PVF @ 15%	PV (₹)
1	6,00,000	0.870	5,22,000
2	4,00,000	0.756	3,02,400
3	5,00,000	0.658	3,29,000
4	2,00,000	0.572	1,14,400
Total Present Value of Inflows			12,67,800
Less: Cost of Investment			11,00,000
Net Present Value			**1,67,800**

Project P-III

Year	Cash Inflow (₹)	PVF @ 13%	PV (₹)
1	4,00,000	0.885	3,54,000
2	6,00,000	0.783	4,69,800
3	8,00,000	0.693	5,54,400
4	12,00,000	0.613	7,35,600
Total Present Value of Inflows			21,13,800
Less: Cost of Investment			19,00,000
Net Present Value			**2,13,800**

Project P-III has highest NPV. So, it should be accepted by the firm

QUESTION 62:

SM | N 10 | PM |N 16

A firm has projected the following cash flows from a project under evaluation:

Year	₹ lakhs
0	(70)
1	30
2	40
3	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%.
The expected annual rate of inflation is 5%.
Show how the viability of the project is to be evaluated.

Solution:

Nominal rate = (1 + 0.1) x (1 + 0.1) – 1 = 0.155 i.e., 15.5%

Year	Nominal cash flows	PVF @ 15.50%	PV of cash flows
1	30	0.866	25.98
2	40	0.749	29.96
3	30	0.649	19.47
	Total Present Value of Inflows		75.41
Less:	Cash out flow		70
	NPV		5.41

Advise: With positive NPV, the project is financially viable.

QUESTION 63:

N 20 | N 19 | SM | PM

KLM Ltd. requires ₹ 15,00,000 for a new project.
Useful life of project is 3 years.
Salvage value - NIL.
Depreciation is ₹ 5,00,000 p.a.
Given below are projected revenues and costs (excluding depreciation) ignoring inflation:

Year	1	2	3
Revenues in ₹	10,00,000	13,00,000	14,00,000
Costs in ₹	5,00,000	6,00,000	6,50,000

Applicable tax rate is 35%. Assume cost of capital to be 14% (after tax). The inflation rates for revenues and costs are as under:

Year	Revenues %	Costs %
1	9	10
2	8	9
3	6	7

PVF at 14%, for 3 years =0.877, 0.769 and 0.675
Show amount to the nearest rupee in calculations.
You are required to calculate net present value of the project.

Solution:

a. Inflation adjusted Revenues

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	10,00,000	10,00,000(1.09) = 10,90,000
2	13,00,000	13,00,000(1.09) (1.08) = 15,30,360
3	14,00,000	14,00,000(1.09) (1.08)(1.06) = 17,46,965

b. Inflation adjusted Costs

Year	Costs (₹)	Costs (Inflation Adjusted) (₹)
1	5,00,000	5,00,000(1.10) = 5,50,000
2	6,00,000	6,00,000(1.10)(1.09) = 7,19,400
3	6,50,000	6,50,000(1.10)(1.09)(1.07) = 8,33,905

c. Tax Benefit on Depreciation = ₹ 5,00,000 x 0.35 = ₹ 1,75,000

d. Calculation of DCF:

Particulars		Year1	Year2	Year3
	Revenue	10,90,000	15,30,360	17,46,965
Less:	Cost	5,50,000	7,19,400	8,33,905
Less:	Depreciation	5,00,000	5,00,000	5,00,000
	PBT	40,000	3,10,960	4,13,060
Less:	Tax	14,000	1,08,836	1,44,571
	PAT	26,000	2,02,124	2,68,489
Add:	Depreciation	5,00,000	5,00,000	5,00,000
	CFAT	5,26,000	7,02,124	7,68,489
X	PVF	0.877	0.769	0.675
	DCF	4,61,302	5,39,933	5,18,730

NPV = – 15,00,000 + 4,61,302 + 5,39,933 + 5,18,730
= ₹ 19,965

QUESTION 64:

SM | PM

A firm has an investment proposal, requiring an outlay of ₹ 80,000. The investment proposal is expected to have two years economic life with no salvage value. In year 1, there is a 0.4 probability that cash inflow after tax will be ₹ 50,000 and 0.6 probability that cash inflow after tax will be ₹ 60,000. The probability assigned to cash inflow after tax for the year 2 is as follows:

The cash inflow year 1	₹ 50,000		₹ 60,000	
The cash inflow year 2	Probability		Probability	
	₹ 24,000	0.2	₹ 40,000	0.4
	₹ 32,000	0.3	₹ 50,000	0.5
	₹ 44,000	0.5	₹ 60,000	0.1

The firm uses a 10% discount rate for this type of investment. Required:

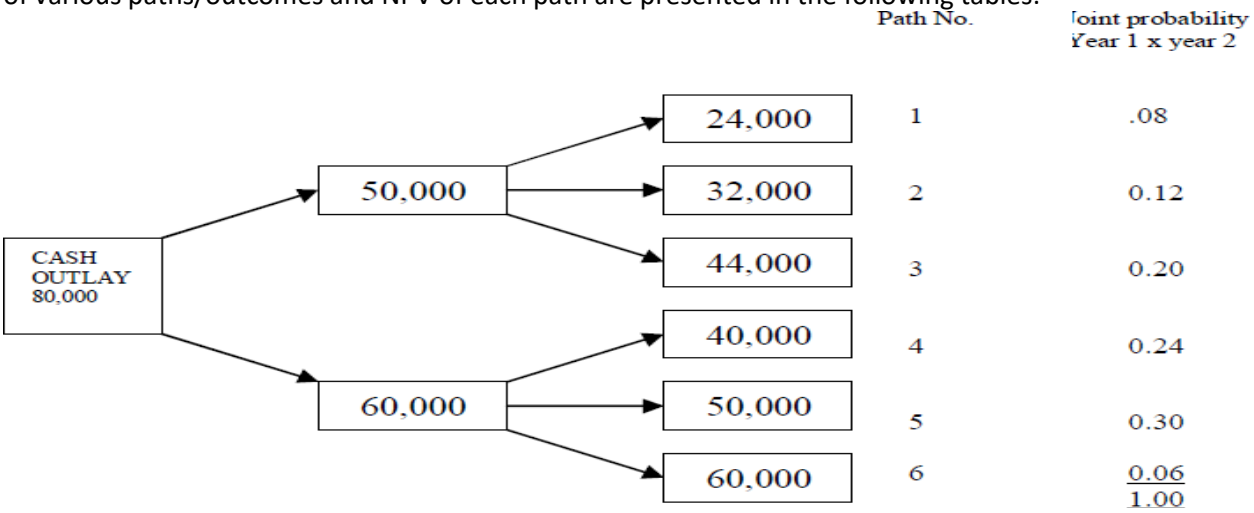
a. Construct a decision tree for the proposed investment project and calculate the expected net present value (NPV).

b. What net present value will the project yield, if worst outcome is realized? What is the probability of occurrence of this NPV?

c. What will be the best outcome and the probability of that occurrence?
d. Will the project be accepted?
(Note: 10% discount factor 1 year 0.909; 2 year 0.826)

Solution:

a) The decision tree diagram is presented in the chart, identifying various paths and outcomes, and the computation of various paths/outcomes and NPV of each path are presented in the following tables:



The Net Present Value (NPV) of each path at 10% discount rate is given below:

Path	PV (Year 1 CFs) (₹)	PV (Year 2 CFs) (₹)	PV (CF IFs)	Cash OF	NPV
1	50,000 x 0.909 = 45,450	24,000 x 0.826 = 19,824	65,274	80,000	- 14,726
2	45,450	32,000 x 0.826 = 26,432	71,882	80,000	- 8,118
3	45,450	44,000 x 0.826 = 36,344	81,794	80,000	1,794
4	60,000 x 0.909 = 54,540	40,000 x 0.826 = 33,040	87,580	80,000	7,580
5	54,540	50,000 x 0.826 = 41,300	95,840	80,000	15,840
6	54,540	60,000 x 0.826 = 49,560	1,04,100	80,000	24,100

Statement showing Expected Net Present Value

z	NPV (₹)	Joint Probability	Expected NPV
1	- 14,726	0.08	- 1,178.08
2	- 8,118	0.12	- 974.16
3	1,794	0.20	358.80
4	7,580	0.24	1,819.20
5	15,840	0.30	4,752.00
6	24,100	0.06	1,446.00
			6,223.76

b) If the worst outcome is realized the project will yield NPV of – ₹ 14,726. The probability of occurrence of this NPV is 8%

c) The best outcome will be path 6 when the NPV is at ₹ 24,100. The probability of occurrence of this NPV is 6%.

d) The project should be accepted because the expected NPV is positive at ₹ 6,223.76 based on joint probability.

QUESTION 65:

SM | M 11 | PM

Jumble Consultancy Group has determined relative utilities of cash flows of two forthcoming projects of its client company as follows:

Cash Flow in ₹	-15000	-10000	-4000	0	15000	10000	5000	1000
Utilities	-100	-60	-3	0	40	30	20	10

The distribution of cash flows of project A and Project B are as follows:

Project A					
Cash Flow (₹)	-15000	- 10000	15000	10000	5000
Probability	0.10	0.20	0.40	0.20	0.10
Project B					
Cash Flow (₹)	- 10000	-4000	15000	5000	10000
Probability	0.10	0.15	0.40	0.25	0.10

Which project should be selected and why?

Solution:

Evaluation of project utilizes of Project A

Cash flow(in ₹)	Project B		
	Probability	Utility	Utility value
-15,000	0.10	-100	-10
-10,000	0.20	-60	-12
15,000	0.40	40	16
10,000	0.20	30	6
5,000	0.10	20	2
			2

Evaluation of project utilizes of Project B

Cash flow(in ₹)	Project B		
	Probability	Utility	Utility value
-10,000	0.10	-60	-6
-4,000	0.15	-3	-0.45
15,000	0.40	40	16
5,000	0.25	20	5
10,000	0.10	30	3
			17.55

Project B should be selected as its expected utility is more.

QUESTION 66:

SM | PM

A & Co. is contemplating whether to replace an existing machine or to spend money on overhauling it. A & Co. currently pays no taxes. The replacement machine costs ₹ 90,000 now and requires maintenance of ₹ 10,000 at the end of every

year for eight years. At the end of 8 years, it would have a salvage value of ₹ 20,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value fall each year as follows:

Year	Maintenance (₹)	Salvage (₹)
Present	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

The opportunity cost of capital for A & Co. is 15%.

Required:

When should the company replace the machine?

(Notes: Present value of an annuity of Re. 1 per period for 8 years at interest rate of 15% : 4.4873; present value of Re. 1 to be received after 8 years at interest rate of 15% : 0.3269).

Solution:

A & Co: Equivalent Annual Cost of (EAC) of new machine

		₹
	Cost of new machine now	90,000
Add:	PV of annual repairs @ ₹ 10,000 per annum for 8 years (₹ 10,000 x 4.4873)	44,873
Less:	PV of salvage value at the end of 8 years(₹20,000x0.3269)	6,538
	PV of Net CFs related to new machine	1,28,335
÷	$PVAF_{(15\%,8years)}$	4.4873
	Equivalent annual cost (EAC) of buying & operating the machine	28,600

PV of cost of replacing the old machine in each of 4 years with new machine

Scenario	Year	Cashflow	PVF at 15%	PV
Replace immediately	0	(40,000)	1	(40,000)
	1 to 4	28,600	2.855	81,652
				41,652
Replace after 1 year	1	10,000 – 25,000 = -15,000	0.870	- 13,044
	2 to 4	28,600	1.985	56,783
				43,739
Replace after 2 years	1	10,000	0.870	8,696
	2	20,000 – 15,000 = 5,000	0.756	3,780
	3 and 4	28,600	1.229	35,157
				47,633
Replace after 3 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	3	30,000 – 10,000 = 20,000	0.658	13,150
	4	28,600	0.572	16,352
				53,321

Replace after 4 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	3	30,000	0.658	19,725
	4	40,000	0.572	22,870
				66,414

Advice: The company should replace the old machine immediately because the PV of cost of replacing the old machine with new machine is least.

QUESTION 67:

SM | N 08 | PM

A company has an old machine having book value zero – which can be sold for ₹ 50,000. The company is thinking to choose one from following two alternatives:

a. To incur additional cost of ₹ 10,00,000 to upgrade the old existing machine.

b. To replace old machine with a new machine costing ₹ 20,00,000 plus installation cost ₹ 50,000.

Both above proposals envisage useful life to be five years with salvage value to be nil. The expected after tax profits for the above three alternatives are as under :

Year	Old existing Machine (₹)	Upgraded Machine (₹)	New Machine(₹)
1	5,00,000	5,50,000	6,00,000
2	5,40,000	5,90,000	6,40,000
3	5,80,000	6,10,000	6,90,000
4	6,20,000	6,50,000	7,40,000
5	6,60,000	7,00,000	8,00,000

The tax rate is 40 per cent.

The company follows straight line method of depreciation. Assume cost of capital to be 15 percent.

P.V.F. of 15%, 5 = 0.870, 0.756, 0.658, 0.572 and 0.497. You are required to advise the company as to which alternative is to be adopted.

Solution:

Upgrading Decision:

Incremental initial cash outflow: Upgradation Cost = 10,00,000

Incremental cash inflow:

Year	Existing Machine	Upgraded Machine			Incremental CFAT	PVF	DCF
	(a) EAT/CFAT	(b) EAT	(c) Dep	(d) CFAT			
1	5,00,000	5,50,000	2,00,000	7,50,000	2,50,000	0.87	2,17,500
2	5,40,000	5,90,000	2,00,000	7,90,000	2,50,000	0.756	1,89,000
3	5,80,000	6,10,000	2,00,000	8,10,000	2,30,000	0.658	1,51,340
4	6,20,000	6,50,000	2,00,000	8,50,000	2,30,000	0.572	1,31,560
5	6,60,000	7,00,000	2,00,000	9,00,000	2,40,000	0.497	1,19,280
Total P.V. of incremental CFAT							8,08,680

Less: Incremental Cash Outflows	-10,00,000
Incremental NPV	-1,91,320

Conclusion: Machine should not be upgraded.

Replacement Decision:

Incremental initial cash outflow:

	Cost	20,00,000
Add:	Installation cost	50,000
	Total Cost	20,50,000
Less:	Disposal of old machine (₹ 50,000 – 40% tax)	- 30,000
	Initial Incremental Cash Outflow	20,20,000

Incremental cash inflow:

Working Note:

c Depreciation – in case machine is upgraded
₹ 10,00,000 ÷ 5 = ₹ 2,00,000

d Depreciation – in case new machine is installed
₹ 20,50,000 ÷ 5 = ₹ 4,10,000

e Old existing machine – Book Value is zero. So, no depreciation.

Year	Existing Machine	Replaced Machine			Incremental CFAT	PVF	DCF
	(a) EAT/CFAT	(b) EAT	(c) Dep	(d) CFAT			
1	5,00,000	6,00,000	4,10,000	10,10,000	5,10,000	0.87	4,43,700
2	5,40,000	6,40,000	4,10,000	10,50,000	5,10,000	0.756	3,85,560
3	5,80,000	6,90,000	4,10,000	11,00,000	5,20,000	0.658	3,42,160
4	6,20,000	7,40,000	4,10,000	11,50,000	5,30,000	0.572	3,03,160
5	6,60,000	8,00,000	4,10,000	12,10,000	5,50,000	0.497	2,73,350
Total P.V. of Incremental CFAT							17,47,930
Less: Incremental Cash Outflows							-20,20,000
Incremental NPV							-2,72,070

Conclusion: Machine should not be replaced.

QUESTION 68:

SM

Company X is forced to choose between two machines A and B. The two machines are designed differently but have identical capacity and do exactly the same job. Machine A costs₹ 1,50,000 and will last for 3 years. It costs ₹ 40,000 per year to run. Machine B is an 'economy' model costing only ₹ 1,00,000, but will last only for 2 years, and costs ₹ 60,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10 per cent. Which machine company X should buy?

Solution:

Statement showing the evaluation of two machines

Machines		A	B
Purchase cost (₹):	(a)	1,50,000	1,00,000
Life of machines (years)		3	2
Running cost of machine per year (₹):	(b)	40,000	60,000
PVAF for 3 years @ 10% | PVAF for 2 years @ 10%	(c)	2.486	1.735
Present value of running cost of machines (₹): (d = b x c)		99,440	1,04,100
Cash outflow of machines (₹):	(f = d + e)	2,49,440	2,04,100
Equivalent present value of annual cash outflow	(f / c)	1,00,338	1,17,637

QUESTION 69:

SM | PM

Company Y is operating an elderly machine that is expected to produce a net cash inflow of ₹40,000 in the coming year and ₹ 40,000 next year. Current salvage value is₹ 80,000 and next year's value is ₹ 70,000. The machine can be replaced now with a new machine, which costs ₹ 1,50,000, but is much more efficient and will provide a cash inflow of₹ 80,000 a year for 3 years. Company Y wants to know whether it should replace the equipment now or wait a year with the clear understanding that the new machine is the best of the available alternatives and that it in turn be replaced at the optimal point. Ignore tax. Take opportunity cost of capital as 10 per cent. Advise with reasons.

Solution:

Statement showing present value of cash inflow of new machine when it replaces elderly machine now

	PV of Cash Inflow of 3 years (80,000 x 2.487)	₹ 1,98,960
Less:	Purchase Cost of New Machine	₹ 1,50,000
	NPV of New Machine	₹ 48,960

Since NPV of New Machine is positive, it should be purchased.

Timing Decision:

Replace Now

Current Realizable Value	₹ 80,000
NPV of New Machine	₹ 48,960
Total PV of Net CFs of 3 years	₹ 1,28,960

Replace after 1 Year

Cash Inflow for Year 1	₹ 40000
Realisable Value of Old Machine	₹ 70000
NPV of New Machine	₹48,960
Total NPV after 1 Year	₹ 1,58,960
Total PV of Net CFs of 4 years (158880/1.1)	₹ 1,44,509

Advise: Since Total NPV is higher in case of Replacement after one year Machine should be replaced after 1 year.

Self-note: Ambiguity is that if you replace after a year, the total inflow and outflow of four years are being considered, which is not comparable with 'replacing now' which has CFs of only three years.

QUESTION 70:

M 24 | SM | M 12 | PM

A machine used on a production line must be replaced at least every four years. Costs incurred to run the machine according to its age are:

Age of the Machine (years)					
	0	1	2	3	4
Purchase price (in ₹)	60,000				
Maintenance (in ₹)		16,000	18,000	20,000	20,000
Repair (in ₹)		0	4,000	8,000	16,000
Scrap Value (in ₹)		32,000	24,000	16,000	8,000

Future replacement will be with identical machine with same cost. Revenue is unaffected by the age of the machine. Ignoring inflation and tax, determine the optimum replacement cycle. PV factors of the cost of capital of 15% for the respective four years are 0.8696, 0.7561, 0.6575 and 0.5718.

Solution:

One Year Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow	PVF @ 15%	DCF
0	-60,000			-60,000	1.0000	- 60,000.00
1		-16,000	32,000	16,000	0.8696	13,913.60
PV of Cashflows of 1 year						- 46,086.40
÷ PVAF (15%, 1 year)						0.8696
EAC						-52,997.24

Two Years Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow	PVF @ 15%	DCF
0	-60,000			-60,000	1	-60,000.00
1		-16,000		-16,000	0.8696	-13,913.60
2		-22,000	24,000	2,000	0.7561	1,512.20
PV of Cashflows of 2 years						-72,401.40
÷ PVAF (15%, 2 years)						1.6257
EAC						-44,535.52

Three Years Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow	PVF @ 15%	DCF
0	-60,000			-60,000	1	-60,000.00
1		-16,000		-16,000	0.8696	-13,913.60
2		-22,000		-22,000	0.7561	-16,634.20
3		-28,000	16,000	-12,000	0.6575	-7,890.00
PV of Cashflows of 3 years						-98,437.80
÷ PVAF (15%, 3 years)						2.2832
EAC						-43,113.96

Four Years Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow	PVF @ 15%	DCF
0	-60,000			-60,000	1	-60,000.00
1		-16,000		-16,000	0.8696	-13,913.60
2		-22,000		-22,000	0.7561	-16,634.20
3		-28,000		-28,000	0.6575	-18,410.00
4		-36,000	8,000	-28,000	0.5718	-16,010.40
PV of Cashflows of 4 years						-1,24,968.20
÷ PVAF (15%, 4 years)						2.855
EAC						-43,771.70

Since EAC is least in case of replacement cycle of 3 years hence machine should be replaced after every three years.

QUESTION 71:

SM | PM

Trouble Free Solutions (TFS) is an authorized service center of a reputed domestic air conditioner manufacturing company. All complaints/service related matters of Air conditioner are attended by this service center. The service center employs a large number of mechanics, each of whom is provided with a motor bike to attend the complaints. Each mechanic travels approximately 40000 kms per annuam. TFS decides to continue its present policy of always buying a new bike for its mechanics but wonders whether the present policy of replacing the bike every three year is optimal or not. It is of believe that as new models are entering into market on yearly basis, it wishes to consider whether a replacement of either one year or two years would be better option than present three year period. The fleet of bike is due for replacement shortly in near future.

The purchase price of latest model bike is ₹ 55,000. Resale value of used bike at current in market is as follows:

1 Year old	35,000
2 Year old	21,000
3 Year old	9,000

Running and Maintenance expenses (excluding depreciation) are as follows:

Year	Road Taxes Insurance etc.(₹)	Petrol Repair Maintenance etc.(₹)
1	3,000	30,000
2	3,000	35,000
3	3,000	43,000

Using opportunity cost of capital as 10% you are required to determine optimal replacement period of bike.

Solution:

In this question the effect of increasing running cost and decreasing resale value have to be weighted up to against the purchase cost of bike. For this purpose, we shall compute Equivalent Annual Cost (EAC) of replacement in different years shall be computed and compared.

Year	RoadTaxes(₹)	Petroletc. (₹)	Total (₹)	PVF @10%	PV (₹)	Cumulative PV (₹)	PV of Resale Price (₹)	Net Outflow (₹)
1	3,000	30,000	33,000	0.909	29,997	29,997	31,815	(1,818)
2	3,000	35,000	38,000	0.826	31,388	61,385	17,346	44,039

3	3,000	43,000	46,000	0.751	34,546	95,931	6,759	89,172

Computation of EACs

Year	Purchase Price of Bike (₹)	Net Out flow(₹)	Total Outflow (₹)	PVAF @ 10%	EAC (₹)
1	55,000	(1,818)	53,182	0.909	58,506
2	55,000	44,039	99,039	1.735	57,083
3	55,000	89,172	1,44,172	2.486	57,993

Thus, from above table it is clear that EAC is least in case of 2 years, hence bike should be replaced every two years.

QUESTION 72:

SM

A Company named Roby's cube decided to replace the existing Computer system of their organisation. Original cost of old system was ₹25,000 and it was installed 5 years ago. Current market value of old system is ₹5,000. Depreciation of the old system was charged with life of 10 years with Estimated Salvage value as Nil. Depreciation of the new system will be charged with life over 5 years. Present cost of the new system is ₹50,000. Estimated Salvage value of the new system is ₹1,000. Estimated cost savings with new system is ₹5,000 per year. Increase in sales with new system is assumed at 10% per year based on original total sales of ₹100000. Company follows straight line method of depreciation. Cost of capital of the company is 10% whereas tax rate is 30 %. Should the existing machine is replaced?

Solution:

a. Book Value of Old Machine: = 25,000 – 25,000/10 × 5
= ₹ 12,500

Tax savings on Capital Loss from sale: = [5,000 – 12,500] × 0.30
= ₹ 2,250

Initial Net cash outflow = 50,000 – [2,250 + 5,000]
= ₹ 42,750

b. Incremental annual cash inflow:

	Incremental Sales	1,00,000 × 10%	10,000
Add:	Savings in Cost		5,000
Less:	Incremental Depreciation	49,000/5 – 25,000/10	- 7,300
	Incremental PBT		7,700
Less:	Tax @ 30%		- 2,310
	Incremental PAT		5,390
Add:	Incremental Depreciation		7,300
	Incremental CFAT		12,690

c. Incremental Salvage Value = 1,000 – 0 = 1,000

d. Incremental Net present value:

Years		CFs	PVF / PVAF	DCF
1	Initial OF	- 42,750	1.000	- 42,750
1 - 5	Annual IFs	12,690	3.791	48,108
5	Terminal Cash IF	1,000	0.621	621
NPV				5,979

Decision: Since Incremental NPV is positive we should accept the proposal to replace the machine.

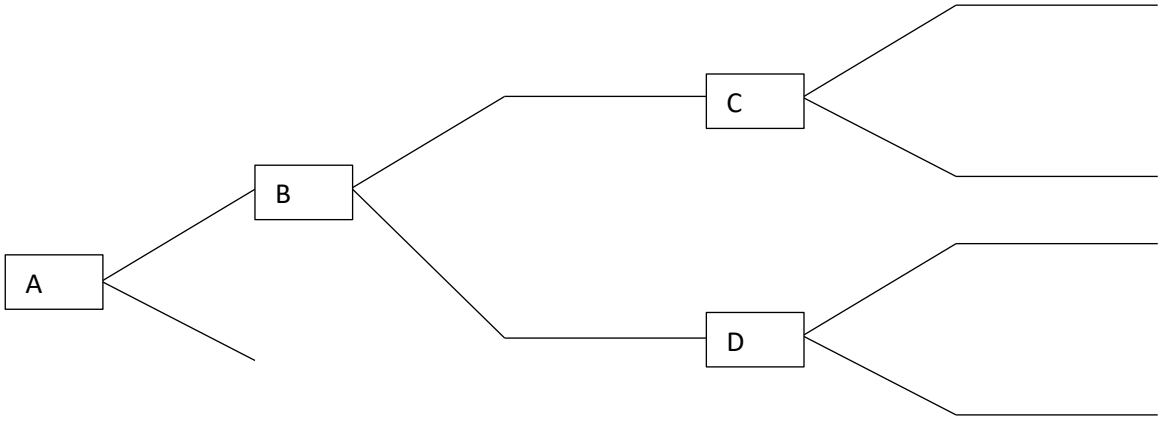
QUESTION 73:

SM

L & R Limited wishes to develop new virus-cleaner software. The cost of the pilot project would be ₹ 2,40,000. Presently, the chances of the product being successfully launched on a commercial scale is rated at 50%. In case it does succeed. L&R can invest a sum of ₹ 20 lacs to market the product. Such an effort can generate perpetually, an annual net after tax cash income of ₹ 4 lacs.

Even if the commercial launch fails, they can make an investment of a smaller amount of ₹ 12 lacs with the hope of gaining perpetually a sum of ₹ 1 lac. Evaluate the proposal, adopting decision tree approach. The discount rate is 10%.

Solution:



Evaluation

At Decision Point C: The choice is between investing ₹ 20 lacs for a perpetual benefit of ₹ 4 lacs and not to invest. The preferred choice is to invest, since the capitalized value of benefit of ₹ 4 lacs (at 10%) adjusted for the investment of ₹ 20 lacs, yields a net benefit of ₹ 20 lacs.

At Decision Point D: The choice is between investing ₹ 12 lacs, for a similar perpetual benefit of ₹ 1 lac. and not to invest. Here the invested amount is greater than capitalized value of benefit at ₹ 10 lacs. There is a negative benefit of ₹ 2 lacs. Therefore, it would not be prudent to invest.

At Outcome Point B: Evaluation of EMV is as under (₹ in lacs).

Outcome	Amount	Prob	Result
Success	20	0.5	10
Failure	0	0.5	0
Net Result			10

EMV at B is, therefore, ₹10 lacs.

At A: Decision is to be taken based on preferences between two alternatives. The first is to test, by investing ₹ 2,40,000 and reap a benefit of ₹ 10 lacs. The second is not to test, and thereby losing
the opportunity of a possible gain.

The preferred choice is, therefore, investing a sum of ₹ 2,40,000 and undertaking the test.

QUESTION 74:

SM

XYZ Ltd. is considering a project "A" with an initial outlay of ₹ 14,00,000 and the possible three cash inflow attached with the project as follows: (₹'000)

	Year 1	Year 2	Year 3
Worst case	450	400	700
Most likely	550	450	800
Best case	650	500	900

Assuming the cost of capital as 9%, determine whether project should be accepted or not.

Solution:

Year	PVF @9%	Worst Case		Most likely		Best case	
		Cash Flow '000	PV '000	Cash Flow '000	PV '000	Cash Flow '000	PV '000
0	1	(1400)	(1400)	(1400)	(1400)	(1400)	(1400)
1	0.917	450	412.65	550	504.35	650	596.05
2	0.842	400	336.80	450	378.90	500	421.00
3	0.772	700	540.40	800	617.60	900	694.80
NPV			-110.15		100.85		311.85

Now suppose that CEO of XYZ Ltd. is bit confident about the estimates in the first two years, but not sure about the third year's high cash inflow. He is interested in knowing what will happen to traditional NPV if 3rd year turn out the bad contrary to his optimism.

The NPV in such case will be as follows:

$$= -₹1400000 + \frac{550000}{(1+0.09)} + \frac{450000}{(1+0.09)^2} + \frac{700000}{(1+0.09)^3}$$

= ₹ 23871

Thus, CEO's concern is well founded that, as a worst case in the third year alone yield a marginally positive NPV.

QUESTION 75:

N 24 | M 17 | PM | SM

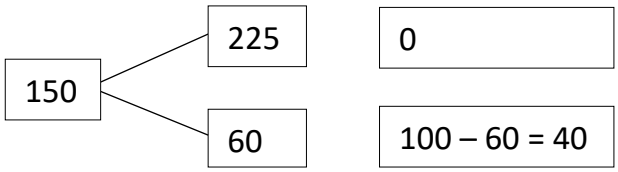
A firm is considering a proposal to set up a cement manufacturing plant with an initial investment of ₹ 150 crore. The firm has the option to abandon the project after one year by selling it to a competitor for ₹ 100 crore. If the market conditions are unfavorable and the demand is low, the project's value will decline by 60%. However, if the market conditions turn out to be favorable and the demand for cement is high, the value of the project at the end of year 1 will increase by 50%.

Given that the risk free rate of interest as 8%, what will be the value of the abandonment option and the value of the project with abandonment (Put) option?

Solution:

Decision Tree showing payoff:

Year 0 Year 1 Pay off



calculate probability of high demand (P) using risk neutral method:

150 = [225 × p + 60 × (1-p)]/1.08

p = 61.82%

1 – p = 38.18%

The value of abandonment option will be as follows:

Present value of expected pay off = [0 × p + 40 × (1-p)]/1.08

= [0 × 61.82% + 40 × 38.18%]/1.08

= ₹ 14.1389Cr.

The Value of project with abandonment option = [225 × 61.82% + 100 × 38.18%)]/1.08

= 164.2019

QUESTION 76:

SM

ABC Ltd. is a pharmaceutical company possessing a patent of a drug called 'Aidrex', a medicine for aids patient. Being an approach drug ABC Ltd. holds the right of production of drugs and its marketing. The period of patent is 15 years after which any other pharmaceutical company produce the drug with same formula. It is estimated that company shall require to incur $ 12.5 million for development and market of the drug. As per a survey conducted the expected present value of cashflows from the sale of drug during the period of 15 years shall be $ 16.7 million. Cash flow from the previous similar type of drug have exhibited a variance of 26.8% of the present value of cashflows. The current yield on Treasury Bonds of similar duration (15 years) is 7.8%.

Determine the value of the patent.

Given

ln(1.336) = 0.2897

$e^{1.0005}$ = 0.3677 and $e^{-1.17}$ = 0.3104 and N(2.389) = 0.9916 and N(2.188) = 0.9857

Solution:

ICAI Solution:

To value the patent, we shall use Black Scholes Model for option pricing as follows:

S (Spot Price) = The Present Value of Cashflows = $16.7 million

E (Exercise Price) = Cost of Development Formula = $ 12.5 million

σ^2(Variance of Cash flow) = 26.8% i.e. 0.27

R (Risk Free Rate of Return) = 7.8%

D (Expected cost of Delays) = $\frac{1}{15}$ = 0.0667 i.e. 6.67%

Value call option

$$d_1 = \frac{\ln\left(\frac{S}{E}\right) + \left(\frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$= \frac{\ln\left(\frac{16.7}{12.5}\right) + \left[0.078 - 0.0667 + \left(\frac{0.2681}{2}\right)\right]15}{\sqrt{0.268}\ \sqrt{15}}$$

$= 1.2315$

$N(d_1) = 0.8910$

$d_2 = d_1 - \sigma\sqrt{t}$

$= 1.2315 - 2.005$

$= -0.7735$

$N(d_2) = 0.2196$

Value of Patent

$C = S \times e^{-df} \times N(d_1) - E \times e^{-rt} N(d_2)$

$= 16.7 \times e^{-0.0667 \times 15} \times 0.8910 - 12.5 \times e^{-0.078 \times 15} \times 0.2196$

$= 16.7 \times 0.3677 \times 0.8910 - 12.5 \times 0.3104 \times 0.2196$

$= 4.619$

Thus, the value of patents is $ 4.619 million

Logical Solution:

To value the patent, we shall use Black Scholes Model for option pricing as follows:

S (Spot Price) = The Present Value of Cashflows = $16.7 million

E (Exercise Price) = Cost of Development Formula = $ 12.5 million

σ^2(Variance of Cash flow) = 26.8% i.e. 0.27

R (Risk Free Rate of Return) = 7.8%

D (Expected cost of Delays) = $\frac{1}{15}$ = 0.0667 i.e. 6.67%

Value call option

$$d_1 = \frac{\ln\left(\frac{S}{E}\right) + \left(\frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$= \frac{\ln\left(\frac{16.7}{12.5}\right) + \left[0.078 - 0.0667 + \left(\frac{0.002681}{2}\right)\right]15}{\sqrt{0.00268}\ \sqrt{15}}$$

$= 2.389$

$N(d_1) = 0.9916$

$d_2 = d_1 - \sigma\sqrt{t}$

$= 2.389 - 0.2001$

$= 2.188$

$N(d_2)$ = 0.9857

Value of Patent

$$C = \frac{S}{e^{yt}} \times N(d_1) - \frac{E}{e^{rt}} \times N(d_2)$$

$$= \frac{16.7}{e^{0.0667 \times 15}} \times 0.9916 - \frac{12.5}{e^{0.078 \times 15}} \times 0.9857$$

= 16.7 x 0.3677 x 0.9916 – 12.5 x 0.3104 x 0.9857

= 2.2645

Thus, the value of patents is $ 2.2645 million

QUESTION 77:

SM

Suppose MIS Ltd. is considering installation of solar electricity generating plant for light the staff quarters. The plant shall cost ₹ 2.50 crore and shall lead to saving in electricity expenses at the current tariff by ₹ 21 lakh per year forever. However, with change in Government in state, the rate of electricity is subject to change. Accordingly, the saving in electricity can be of ₹ 12 lakh or ₹ 35 lakh per year and forever.
Assuming WACC of MIS Ltd. is 10% and risk-free rate of rate of return is 8%.
Decide whether MIS Ltd. should accept the project or wait and see.

Solution:

Here we shall evaluate NPV in two possible situations:

(1) As on Today

At cost of Capital of 10%, the PV of saving forever = $\frac{21 \text{ lakhs}}{0.10}$ = ₹ 2.1 crore

NPV = ₹ 2.1 crore - ₹ 2.5 crore = - ₹ 0.4 crore

Since NPV is negative, it does not worth to accept the project.

(2) After one Year

After one year these are two possible situations, either rate of electricity decreases or increase.

(a) If price of electricity increases

At cost of Capital of 10%, the PV of saving forever = $\frac{35 \text{ lakh}}{0.10}$ = ₹ 3.50 crore

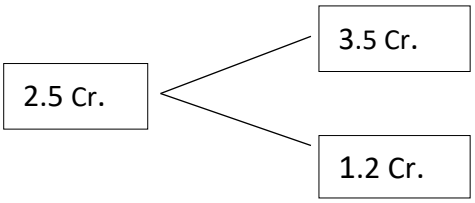
The position of the NPV at year 1 will be = ₹ 3.50 crore - ₹ 2.50 crore
= ₹ 1 crore

(b) If the price of electricity decreases

At cost of Capital of 10%, the PV of saving forever = $\frac{12 \text{ lakh}}{0.10}$ = ₹ 1.20 crore

The position of the NPV at year 1 will be = ₹ 1.20 crore - ₹ 2.5 crore
= - ₹ 1.3 crore

Diagrammatically it can be shown below



calculate probability of high demand (P) using risk neutral method:

2.5 = [3.5 × p + 1.2 × (1-p)]/1.08

p = 65.22%

1 – p = 34.78%

Hence, PV of expected NPV Today = [₹ 1 crore × .6522 + (- ₹ 1.30 crore) × 0.3478]/1.08

= ₹ 0.1852 Cr.

Thus, it shall be advisable to wait and see as NPV may turn out to be positive after one year.

Additional Practice Questions

Practice Question 1

RTP M 15

TMC is a venture capital financier. It received a proposal for financing requiring an investment of ₹45 crore which returns ₹600 crore after 6 years if succeeds. However, it may be possible that the project may fail at any time during the six years. The following table provide the estimates of probabilities of the failure of the projects.

Year	1	2	3	4	5	6
Probability of failure	0.28	0.25	0.22	0.18	0.18	0.10

In the above table the probability that the project fails in the second year is given that it has survived throughout year 1. Similarly, for year 2 and so forth.

TMC is considering an equity investment in the project. The beta of this type of project is 7. The market return and risk-free rate of return are 8% and 6% respectively. You are required to compute the expected NPV of the venture capital project and advice the TMC.

Solution:

Probability of project success

$= (1 - 0.28) \times (1 - 0.25) \times (1 - 0.22) \times (1 - 0.18) \times (1 - 0.18) \times (1 - 0.10)$

$= 0.255$

Probability of project will fail $= 1 - 0.255 = 0.745$

Cost of equity using CAPM, Ke $= Rf + \beta (Rm - Rf)$

$= 6\% + 7 \times (8\% - 6\%) = 20\%$

Net present value of the project:

Expected Cash Inflow: (600 Cr. × 0.255 + 0 × 0.745)	153 Cr.
× PVF (20%, 6 years)	0.335
PV of Expected Inflows	51.255 Cr.
Less: PV of Initial Outflow	45 Cr.
NPV	6.255 Cr.

Since expected NPV of the project is positive it should be accepted.

Practice Question 2

M 21

M/s. SKPD Ltd. employs certainty-equivalent approach in the evaluation of risky investments. The finance department of the company has developed the following information regarding a new project:

Year	Expected CFAT (₹)	Certainty equivalent quotient
0 (Initial Outlays)	300,000	1.0
1	140,000	0.8
2	130,000	0.7
3	120,000	0.6
4	115,000	0.4
5	80,000	0.3

Following is the other information:

a. The firm's cost of equity capital is 18%;

b. Cost of debt is 9%,

c. Present risk-free rate of interest in the Market on the treasury bonds is 6%, which will rise by 200 basis points from 4th year onwards.

Year (t)	1	2	3	4	5
PVIF (6%, t)	0.943	0.890	0.840	0.792	0.747
PVIF (8%, t)	0.926	0.857	0.794	0.735	0.681

You are required to:

a. To find out the viability of the project; and

b. To advise on the popularity of this method.

Solution:

a. Statement Showing the Net Present Value of Project

Year end	CFs (a)	C.E. (b)	Adjusted CFs (c) = (a x b)	Applicable PVIF (d)	Present Value ₹ (e) = (c x d)
1	1,40,000	0.8	112,000	0.943	1,05,616
2	1,30,000	0.7	91,000	0.890	80,990
3	1,20,000	0.6	72,000	0.840	60,480
4	1,15,000	0.4	46,000	0.735	33,810
5	80,000	0.3	24,000	0.681	16,344
Total PV of Cash Flows					2,97,240
Less: Initial Investment					3,00,000
Net Present Value					- 2,760

Decision: Since the net present value of the Project is negative, it should not be accepted.

b. In Certainty Equivalent approach we incorporate risk to adjust the cash flows of a proposal so as to reflect the risk element and also adjust future cash flows rather than discount rates. But the procedure for reducing the forecasts of cash flows is implicit and likely to be inconsistent from one investment to another. Therefore, it is not popular.

Practice Question 3

Old SM

Determine NPV of the project with the following information:

Initial Outlay of project	₹ 40,000
Annual revenues (Without inflation)	₹ 30,000
Annual costs excluding depreciation (Without inflation)	₹ 10,000
Useful life	4 years
Salvage value	Nil
Tax Rate	50%
Cost of Capital (Including inflation premium of 10%)	12%

Solution:

Annual Cash Flow of project is

= (₹ 30,000 – ₹ 10,000) (1 - 0.50) + ₹ 10,000 x 0.50 = ₹ 15,000

It would be inconsistent to discount these real cash flows at 12% (nominal rate of return).

There are two alternatives:

NPV using (i) approach: restate the cash flow in nominal term and discount at 12%

Nominal Cash Flow = (1 + Inflation Rate) Real Cash Flows

Year	Real Cash Flows	Nominal Cash flows
1	15000	15,000 × 1.10 = 16,500
2	15,000	15,000 × $(1.10)^2$ = 18,150
3	15,000	15,000 × $(1.10.)^3$ = 19,965
4	15,000	15,000 × $(1.10)^4$ = 21,962

NPV using nominal discounting rate 12%

$$= \frac{16,500}{(1.12)} + \frac{18,150}{(1.12)^2} + \frac{19,965}{(1.12)^3} + \frac{21,962}{(1.12)^4} = 40,000$$

= ₹ 17,369 (Approx)

NPV using (ii) approach: Restate the discount rate in real terms and use this to discount the real cash flows

$$\text{Real Discount Rate} = \frac{1 + \text{Nominal Discount Rate}}{1 + \text{Inflation Rate}} - 1$$

$$= \frac{1+0.12}{1+0.10} - 1 = 0.0182 \text{ i.e. } 1.8\%.$$

Accordingly, NPV of the project

$$= \frac{15,000}{(1.0182)} + \frac{15,000}{(1.0182)^2} + \frac{15,000}{(1.0182)^3} + \frac{15,000}{(1.0182)^4} - 40,000$$

= ₹ 57,367 – ₹ 40,000 = ₹17,367(Approx)

Practice Question 4

N 21

XYZ Ltd. is considering to replace the existing computer system of their organization. Original cost of the system was ₹ 2,50,000 and it was installed 5 years ago. Current market value of the old system is ₹ 50,000. The life of the old system is 10 years. Present cost of the new system is ₹ 5,00,000 with estimated Salvage by value of ₹ 10,000/-.

The life of the new system is 5 years.

Estimated cost savings with the new computer system is ₹ 50,000 per year. Increase in sales with new system is assumed to be 10% per year based on original total sales of ₹ 10,00,000.

XYZ Ltd. follows straight-line method of depreciation. Cost of capital of the company is 12% whereas applicable income tax rate is 30%.

You are required to advise XYZ Lt. on acceptance of the replacement proposal.

Given PVIF(12%, 5) = 0.567; PVIFA (12%, 5) = 3.605.

Solution:

Working Notes:

a. Initial Outlay

Cost of new System	₹ 5,00,000
Less: Salvage value of existing system	₹ 50,000
Less: Tax Saving on STCL [1,25,000 -50,000]0.30	₹ 22,500

	₹ 4,27,500

b. Depreciation on New System

Cost of New System Less: S	₹5,00,000
	₹10,000
	₹4,90,000
Tenure	5years
Depreciation per year	₹98,000

c. Increase in Profit

Cost Saving	₹50,000
Increase in sales each year Total increase in	₹1,00,000
Profit	₹1,50,000

d. Calculation of Annual Cash flow

Increase in Profit	₹ 1,50,000
Less: Increased Dep. (₹ 98,000 – ₹ 25,000)	₹73,000
	₹ 77,000
Tax @ 30%	₹ 23,100
	₹ 53,900
Add: Depreciation	₹ 73,000
Annual Cash flow	₹ 1,26,900

NPV of Replacement Decision

PV of Cash Flows (Annual) 1,26,900 × 3.605	₹ 4,57,474.50
PV of Salvage Value of New System 0.567x ₹ 10,000	₹5,670.00
	₹ 4,63,144.50
Less: Initial Outlay	₹ 4,27,500.00
	₹ 35,644.50

Since NPV is positive the computer system should be replaced.

Practice Question 5

PM

You own an unused gold mine that will cost ₹ 10,00,000 to reopen. If you open the mine, you expect to be able to extract 1,000 ounces of Gold a year for each of three years. After that the deposit will be exhausted. The Gold price is currently ₹ 5,000 an ounce, and each year the price is equally likely to rise or fall by ₹ 500 from its level at the start of year. The extraction cost is ₹4,600 an ounce and the discount rate is 10 per cent.

Required:

(a) Should you open the mine now or delay one year in the hope of a rise in the gold price?

(b) What difference would it make to your decision if you could costlessly (but irreversibly) shut down the mine at any stage? Show the value of abandonment option.

Solution:

(a) (i) Assume we open the mine now at t = 0. Taking into account the distribution of possible future price of gold over the next three years, we have

$$\text{NPV} = -\text{Rs.}10,00,000 + \frac{1,000 \times \left[\left(0.5 \times 5,500 + 0.5 \times 4,500\right) - 4,600\right]}{1.10} +$$

$$= \frac{1000 \text{ x } [(0.5)^2 \text{ } (6,000 + 5,000 + 5,000 + 4,000) - 4,600]}{(1.10)^2} +$$

$$\frac{1,000 \text{ x } [(0.5)^3 \text{ } (6,500 + 5,500 + 5,500 + 4,500 + 4,500 + 5,500 + 4,500 + 3,500) - 4,600]}{(1.10)^3}$$

= - ₹ 5,260

Because the NPV is negative, we should not open the mine at t = 0. It does not make sense to open the mine at any price less than or equal to ₹ 5,000 per ounce.

(ii) Assume that we delay one year until t = 1, and open the mine if the price is ₹ 5,500.

At that point:

$$\text{NPV} = (-) \text{ ₹ } 10,00,000 + \frac{1000 \left[(0.5 \times 6000 + 0.5 \times 5000) - 4600\right]}{1.10} +$$

$$\frac{1000 \left[((0.5)^2 \times (6500 + 5500 + 5500 + 4500)) - 4600\right]}{(1.10)^2} +$$

$$\frac{1000 \text{ x } [(0.5)^3 \text{ } (7000 + 6000 + 6000 + 5000 + 5000 + 6000 + 5000 + 4000) - 4600]}{(1.10)^3}$$

= ₹ 12,38,167

If the price at t1 reaches ₹ 5,500, then expected price for all future periods is ₹ 5,500.

NPV at t0 = 12,38,167/1.10 = ₹ 11,25,606

If the price rises to ₹ 5,500 at t = 1, we should open the mine at that time. The expected NPV of this strategy is:

(0.50 x 11,25,606) + (0.50 x 0) = ₹ 5,62,803

As already stated, mine should not be opened if the price is less than or equal to ₹ 5,000 per ounce.

If the price at t1 reaches ₹ 4,500, then expected price for all future periods is ₹ 4,500. In that situation we should not open the mine.

(b) Suppose we open the mine at t = 0, when the price is ₹ 5,000. At t = 2, there is a 0.25 probability that the price will be ₹ 4,000. Then since the price at t = 3 cannot rise above the extraction cost, the mine should be closed. If we open the mine at t = 0, when the price was ₹5,000 with the closing option the NPV will be:

$$\text{NPV} = -\text{Rs.}10,00,000 + \sum_{t-1}^{2} \frac{(5,000 - 4,600)1,000}{(1.10)^t}$$

$$\frac{0.125 \times [1,900 + 900 + 900 + 900 - 100 - 100) \times 1,000]}{(1.10)^3}$$

= ₹ 1,07,438

Therefore, the NPV with the abandonment option (i.e. savings) is ₹ 1,07,438. The value of the abandonment option is:
0.125 x 1,000 x (100+1100) / (1.10)3 = ₹ 1,12,697

The NPV of strategy (2), that to open the mine at t = 1, when price rises to ₹ 5,500 per ounce, even without abandonment option, is higher than option 1. Therefore, the strategy (2) is preferable.

Under strategy 2, the mine should be closed if the price reaches ₹ 4,500 at t = 3, because the expected profit is (₹ 4,500 – 4,600) x1,000 = – ₹ 1,00,000.

The value of the abandonment option is: 0.125 x (1,00,000) / $(1.10)^4$ = ₹ 8,538

Note: Students may also assume that the price of the gold remains at ₹ 5,000 to solve the

Practice Question 6

A company is considering bidding for the exclusive rights to undertake a project, which will initially cost ₹35 lakh. The company has forecast the following end of year cash flows for the four-year project.

Year	1	2	3	4
Cash flow (₹ in lakhs)	20	15	10	5

The relevant cost of capital for this project is 11% and the risk-free rate is 4.5%. The likely volatility (standard deviation) of the cash flows is estimated to be 50%.

Solution:

NPV without any option to delay the decision

Year	0	1	2	3	4
Cash flow (₹ in lakhs)	-35	20	15	10	5
PVIF @ 11%	1	0.9	0.81	0.73	0.66
PV of cash flows (₹ in lakhs)	-35	18	12.2	7.3	3.3

So, NPV = ₹ 5.8 lakh.
Supposing the company does not have to make the decision right now but can wait for two years before it needs to make the decision.
NPV with the option to delay the decision for two years.

Year	3	4	5	6
Cash flow (₹ in lakhs)	20	15	10	5
PVIF @ 11%	0.73	0.66	0.59	0.54
PV of cash flows (₹ in lakhs)	14.6	9.9	5.9	2.7

Total PV = 14.6 + 9.9 + 5.9 + 2.7 = ₹ 33.1 lakh

Variables to be used in the BSOP model
Asset value (P_a) = $14.6m + $9.9m + $5.9m + $2.7m = $33.1m
Exercise price (P_e) = $35m
Exercise date (t) = 2 years
Risk free rate (r) = 4.5%
Volatility (s) = 50%

Using Black Scholes Option Pricing formula, we can calculate:
d_1 = 0.40; d_2= -0.31; $N(d_1)$ = 0.6554 and $N(d_2)$ = 0.3783

Therefore, C $= S_1 N(d_1) - Ke^{-rt} N(d_2)$
$= 33.1 \times 0.6554 - 35 \times e^{-0.045 \times 2} \times 0.3783$
= ₹9.6 lakh

Based on the facts that the company can delay its decision by two years and a high volatility, it can bid as much as₹9.6 lakh instead of ₹5.8 lakh for the exclusive rights to undertake the project. The increase in value reflects the time before the decision has to be made and the volatility of the cash flows.

Practice Question 7

X Ltd. is evaluating an investment proposal which has uncertainty associated with all three major factors: the initial investment or original cost, the useful life and the annual cash flows. The probability distribution of the three variables are as follows:

Original cost		Useful life		Annual cash flows	
Value (₹ lakh)	Probability	Value (years)	Probability	Value (₹ Lakh)	Probability
9.00	0.10	7.00	0.20	2.00	0.20
7.00	0.60	6.00	0.40	2.50	0.40
6.00	0.30	5.00	0.40	1.50	0.10
				1.00	0.30

The firm's cost of capital is 15% and the risk-free rate of return is 12%. Suppose the finance manager feels that these two values are likely to remain unchanged during the life of the project.
Conduct simulation trials and determine the NPV. Advice on the acceptability of the project. The random numbers are:
The random numbers are:

Original Cost	52	37	82	69	98	96	33	50	88	90
Useful Life	6	63	57	2	94	52	69	33	32	30
Annual Cashflow	50	28	68	36	90	62	27	50	18	36

Solution:

Calculation of cumulative Probability

Original cost			Useful life			Annual cash flows		
Value (₹ lakh)	Prob.	Cumulative Prob.	Value (years)	Prob.	Cumulative Prob.	Value (₹ lakh)	Prob.	Cumulative Prob.
9.00	0.10	0.10	7.00	0.20	0.20	2.00	0.20	0.20
7.00	0.60	0.70	6.00	0.40	0.60	2.50	0.40	0.60
6.00	0.30	1.00	5.00	0.40	1.00	1.50	0.10	0.70
						1.00	0.30	1.00

Calculation of random number intervals

Original cost			Useful life			Annual cash flows		
Value (₹ lakh)	Cumulative Prob.	Random No.	Value (years)	Cumulative Prob.	Random No.	Value (₹ lakh)	Cumulative Prob.	Random No.
9.00	0.10	0-9	7.00	0.20	0-19	2.00	0.20	0-19
7.00	0.70	10-69	6.00	0.60	20-59	2.50	0.60	20-59
6.00	1.00	70-99	5.00	1.00	60-99	1.50	0.70	60-69
						1.00	1.00	70-99

Simulation Trials

Run	Original cost ₹		Useful life (Years)		Annual Cashflow ₹		NPV
	Random No.	Value	Random No.	Value	Random No.	Value	₹
1	52	7	6	7	50	2.5	4.41
2	37	7	63	5	28	2.5	2.01
3	82	6	57	6	68	1.5	0.17
4	69	7	2	7	36	2.5	4.41
5	98	6	94	5	90	1.0	-2.4
6	96	6	52	6	62	1.5	0.17
7	33	7	69	5	27	2.5	2.01
8	50	7	33	6	50	2.5	3.28
9	88	6	32	6	18	2.0	2.22
10	90	6	30	6	36	2.5	4.28
Expected NPV							20.56

As the NPV is positive, the firm may accept the investment proposal.

Practice Question 8

Particulars	Profit if there is strong demand	Profit/(loss) in case of weak demand
Option A	4,000	(1,000)
Option B	1,500	500
Probability of demand	0.3	0.7

a. What would be the decision based on expected values? If no information about demands were available?
b. What is the value of perfect information about demand?

Solution:

a. If there were no information to help with the decision, the project with the higher EV of profit would be selected.

Probability	Project A		Project B	
	Profit	EV	Profit	EV
0.3	4,000	1,200	1,500	450
0.7	(1,000)	(700)	500	350
1.0		500		800

Analysis: Project B would be selected. This is clearly the better option if demand turns out to be weak. However, if demand were to turn out to be strong, Project A would be more profitable. There is a 30% chance that this could happen.

b. Perfect information will indicate for certain whether demand will be weak or strong. If demand is forecasted 'weak' Project B would be selected. If demand is forecasted as 'strong', Project A would be selected, and perfect information would improve the profit from ₹1,500, which would have been earned by selecting B to₹4,000.

Forecast demand	Probability	Project chosen	Profit	EV of profit
Weak	0.7	B	500	350
Strong	0.3	A	4,000	1,200
EV of profit with perfect information				1,550

The Value of Perfect Information derives from the 0.3 probability that if demand is going to be strong, the information would reveal this fact, and the decision is changed from 'choose B' to 'choose A' thereby earning₹2,500 more profit. The EV of the Value of Perfect Information is therefore 0.3 × ₹2,500 = ₹750. Another way of making this same calculation is as follows:

EV of profit without Perfect Information (i.e., choose B all the time)	₹ 800
EV of profit with Perfect Information	₹ 1,550
Value of Perfect Information	₹ 750

Analysis: Provide that the information does not cost more than ₹ 750 to collect, it would be worth having.

Practice Question 9

A manager is trying to decide which of the three mutually exclusive projects to undertake. Each of the projects could lead to varying net profits which are classified as outcomes I, II and III. The manager has constructed the following pay-off table or matrix (a conditional profit table).

Net profit if outcome turns out to be:

Project	I	II	III
A ₹	50,000	65,000	80,000
B ₹	70,000	60 ,000	75,000
C ₹	90,000	80,000	55,000
Probability	0.2	0.6	0.2

Which project should be undertaken?

Solution:

If the project with the highest EV of profit were chosen, this would be project C.

Outcome	Probability	Project A EV	Project B EV	Project C EV
I	0.2	10,000	14,000	18,000
II	0.6	39,000	36,000	48,000
III	0.2	16,000	15,000	11,000
	1.0	65,000	65,000	77,000

However, if the maximum criterion were applied, the assessment would be as follows:

Project Selected	The worst outcome that could happen	Profit ₹
A	I	50,000
B	II	60,000
C	III	55,000

Analysis: By choosing B, we are 'guaranteed' a profit of at least ₹ 60,000, which is more than we would get from project A or C if the worst outcome were to occur for them. The decision would therefore be to choose project B.

Practice Question 10

A manager is trying to decide which of the three mutually exclusive projects to undertake. Each of the projects could lead to varying net profits which are classified as outcomes I, II and III. The manager has constructed the following pay-off table or matrix (a conditional profit table).

Net profit if outcome turns out to be:

Outcomes		Project		
(Net profit)	Probability	A	B	C
I (Worst)	0.2	50,000	70,000	90,000
II (Most likely)	0.5	85,000	75,000	1,00,000

III (Best)	0.3	1,30,000	1,40,000	1,10,000

Which project should be undertaken? Which project is profitable, if minimax regret rule is applicable?

Solution:

If the project with the highest EV of profit were chosen, this would be project C. ₹

Outcome	Probability	Project A EV	Project B EV	Project C EV
I (Worst)	0.2	10,000	14,000	18,000
II (Most likely)	0.5	42,500	37,500	50,000
III (Best)	0.3	39,000	42,000	33,000
	1.0	91,500	93,500	1,01,000

A table of regrets can be compiled, as follows, showing the amount of profit that might be foregone for each project, depending on whether the outcome is I, II or III.

	Project		
Outcome	A	B	C
Worst	[90,000 – 50,000] = 40,000	[90,000 – 70,000] = 20,000	[90,000 – 90,000] = 0
Most likely	[1,00,000 - 85,000] = 15,000	[1,00,000 - 75,000] =25,000	[1,00,000 – 1,00,000] = 0
Best	[1,40,000 - 1,30,000] =10,000	[1,40,000 – 1,40,000] = 0	[1,40,000-1,10,000] =30,000

Analysis: The maximum regret is 40,000 with project A, 25,000 with B and 30,000 with C. The lowest of these three maximum regrets is 25,000 with B, and so project B would be selected if the minimax regret rule is used.
Note: The minimax regret rule aims to minimize the regret from making the wrong decision. Regret is the opportunity lost through making the wrong decision.