CA-Final AFM Test 4
Topics Covered: Portfolio Management
Max Marks: 40 Time: 1 Hour

Question 1(10 Marks):

Following are the details of a portfolio consisting of three shares:

Share	Portfolio weight	Beta	Expected return in %	Total variance
D	0.20	0.40	14	0.015
E	0.50	0.50	15	0.025
F	0.30	1.10	21	0.100

Standard Deviation of Market Portfolio Returns = 10% You are given the following additional data:

Covariance (D, E) = 0.030

Covariance (D, F) = 0.020

Covariance (E, F) = 0.040

Calculate the Portfolio variance considering:

(i) Correlation between each pair of securities.

(ii) Co-movement between securities due to change in the market index.

Question 2(8 Marks): M is interested to construct a Portfolio of Securities A and B. He has collected the following information:

	A	B
Expected Return (ER)	19%	23%
Risk (%)	14%	18%

M has 4 Portfolio options of A and B as follows:

(i) 50% of funds in each A and B

(ii) 75% of funds in A and 25% in B

(iii) 25% of funds in A and 75% in B

(iv) 60% of funds in A and 40% in B

Co-efficient of correlation (r) between A and B is 0.16. You are required to calculate:

(i) Expected Return under different Portfolio Options.

(ii) Risk Factor associated with these Portfolio Options.

(iii) Which Portfolio is best from the point of view of Risk?

(iv) Which Portfolio is best from the point of view of Return?

Question 3(8 Marks): Equity of ABC Ltd. (ABCL) is ` 500 Crores, its debt, is worth ` 290 Crores. Printer Division segments value is attributable to 64%, which has an Asset Beta (βp) of 1.55, balance value is applied on Spares and Consumables Division, which has an Asset Beta (β sc) of 1.40 ABCL Debt beta (βD) is 0.28.

You are required to calculate:

(i) Equity Beta (βE),

(ii) Ascertain Equity Beta (βE), if ABC Ltd. decides to change its Debt Equity position by raising further debt and buying back of equity to have its Debt to Equity Ratio at 1.50.

Assume that the present Debt Beta (βD1) is 0.45 and any further funds raised by way of Debt will have a Beta (βD2) of 0.50.

(iii)Whether the new Equity Beta (βE) justifies increase in the value of equity on account of leverage?

Question 4(6 Marks): Ankit has a fund of ` 10 lacs which he wants to invest in share market with rebalancing target after every 15 days to start with for a period of one month from now. The present

NIFTY is 19679. The minimum NIFTY within a month can at most be 18104.68. He wants to know as to how he should rebalance his portfolio under the following situations, according to the theory of Constant Proportion Portfolio Insurance Policy, using "2" as the multiplier:
(i) Immediately to start with.
(ii) 15 days later-being the 1st day of rebalancing if NIFTY falls to 19088.63.
15 days further from the above date if the NIFTY touches 20997.493.
Note: Assume that the value of his equity component will change in tandem with that of the NIFTY.

Question 5(8 Marks): The returns and market portfolio for a period of four years are as under:

Year	**% Return of Stock**	**% Return on Market**
1	10	8
2	12	10
3	9	9
4	3	-1

For stock B, you are required to determine:
(a) characteristic line; and
(b) The Systematic and Unsystematic Risk

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Covariance (D, E) = 0.030

Covariance (D, F) = 0.020

Covariance (E, F) = 0.040

Calculate the Portfolio variance considering:

(i) Correlation between each pair of securities.

(ii) Co-movement between securities due to change in the market index.

Answer:

(i) We can compute the Portfolio variance on the basis of Correlation between each pair of securities as follows:

$= (w_A \times w_A \times \sigma^2_A) + (w_A \times w_B \times Cov_{AB}) + (w_A \times w_C \times Cov_{AC}) + (w_B \times w_A \times Cov_{AB}) + (w_B \times w_B \times \sigma^2_B) +$

$(w_B \times w_C \times Cov_{BC}) + (w_C \times w_A \times Cov_{CA}) + (w_C \times w_B \times Cov_{CB}) + (w_C \times w_C \times \sigma^2_C)$

= (0.20 x 0.20 x 0.015) + (0.20 x 0.50 x 0.030) + (0.20 x 0.30 x 0.020) + (0.20 x 0.50 x 0.030) + (0.50 x 0.50 x 0.025) + (0.50 x 0.30 x 0.040) + (0.30 x 0.20 x 0.020) + (0.30 x 0.50 x 0.040) + (0.30 x 0.30 x 0.10)

= 0.0006 + 0.0030 + 0.0012 + 0.0030 + 0.00625 + 0.0060 + 0.0012 + 0.0060 + 0.0090

= 0.0363

(ii) To compute the Portfolio variance considering the Co-movement between securities due to change in the market index first we shall compute the Beta of the portfolio is as follows:

0.20 x 0.40 + 0.50 x 0.50 + 0.30 x 1.10 = 0.66

Then we shall compute the Residual Variance by separating the Systematic Risk from total risk as follows:

Systematic Risk of each security shall be computed as follows:

$\beta^2_A \times \sigma^2_M = (0.40)^2(0.01) = 0.0016$

$\beta^2_B \times \sigma^2_M = (0.50)^2(0.01) = 0.0025$

$\beta^2_C \times \sigma^2_M = (1.10)^2(0.01) = 0.0121$

The Residual Variance of each security

A 0.015 - 0.0016 = 0.0134

B 0.025 - 0.0025 = 0.0225

C 0.100 - 0.0121 = 0.0879

Then Portfolio variance shall be computed using Sharpe Index Model as follows: Systematic Variance of Portfolio = $(0.10)^2 \times (0.66)^2 = 0.004356$

Unsystematic Variance of Portfolio = $0.0134 \times (0.20)^2 + 0.0225 \times (0.50)^2 + 0.0879 \times (0.30)^2$

$= 0.014072$

Total Variance = 0.004356 + 0.014072 = 0.018428

Question 2(8 Marks): M is interested to construct a Portfolio of Securities A and B. He has collected the following information:

	A	B
Expected Return (ER)	19%	23%
Risk ( )	14%	18%

M has 4 Portfolio options of A and B as follows:
(i) 50% of funds in each A and B
(ii) 75% of funds in A and 25% in B
(iii) 25% of funds in A and 75% in B
(iv) 60% of funds in A and 40% in B
Co-efficient of correlation (r) between A and B is 0.16. You are required to calculate:
(i) Expected Return under different Portfolio Options.
(ii) Risk Factor associated with these Portfolio Options.
(iii) Which Portfolio is best from the point of view of Risk?
(iv) Which Portfolio is best from the point of view of Return?
Answer:

Two asset portfolio

$\sigma^2_p = w^2_1\sigma^2_1 + w^2_2\sigma^2_2 + 2\, w_1w_2\sigma_1\sigma_2\rho_{12}$ Or

$\sigma_p = \sqrt{w_1\sigma_1 + w_2\sigma_2 + 2\, w_1w_2\sigma_1\sigma_2\rho_{12}}$ Substituting

the respective values we get,

(i) 50% of funds in each of A and B

$Ep = 0.50 \times 19\% + 0.50 \times 23\% = 21\%$

$\sigma^2_p = (0.50)^2(14\%)^2 + (0.50)^2(18\%)^2 + 2(0.50)(0.50)(0.16)(14\%)(18\%)$

$\sigma^2_p = 49 + 81 + 20.16 = 150.16$

$\sigma_p = 12.25\%$

(ii) 75% in A and 25% in B

$Ep = 0.75 \times 19\% + 0.25 \times 23\% = 20\%$

$\sigma^2_p = (0.75)^2(14\%)^2 + (0.25)^2(18\%)^2 + 2(0.75)(0.25)(0.16)(14\%)(18\%)$

$\sigma^2_p = 110.25 + 20.25 + 15.12 = 145.62$

$\sigma_p = 12.07\%$

(iii) 25% in A and 75% in B

$Ep = 0.25 \times 19\% + 0.75 \times 23\% = 22\%$

$\sigma^2_p = (0.25)^2(14\%)^2 + (0.75)^2(18\%)^2 + 2(0.25)(0.75)(0.16)(14\%)(18\%)$

$\sigma^2_p = 12.25 + 182.25 + 15.12 = 209.62$

$\sigma_p = 14.48\%$

(iv) 60% in A and 40% in B

$Ep = 0.60 \times 19\% + 0.40 \times 23\% = 20.6\%$

$\sigma^2_p = (0.60)^2(14\%)^2 + (0.40)^2(18\%)^2 + 2(0.60)(0.40)(0.16)(14\%)(18\%)$

σ^2_p = 70.56 + 51.84 + 19.35 = 141.75

σ_p= 11.91%

Portfolio	(i)	(ii)	(iii)	(iv)
Return	21	20	22	20.6
σ	12.25	12.07	14.48	11.91

In the terms of return, we see that portfolio (iii) is the best portfolio. In terms of risk we see that portfolio (iv) is the best portfolio.

Question 3(8 Marks): Equity of ABC Ltd. (ABCL) is Rs 500 Crores, its debt, is worth Rs 290 Crores. Printer Division segments value is attributable to 64%, which has an Asset Beta (βp) of 1.55, balance value is applied on Spares and Consumables Division, which has an Asset Beta (β sc) of 1.40 ABCL Debt beta (βD) is 0.28.

You are required to calculate:

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Assume that the present Debt Beta (βD1) is 0.45 and any further funds raised by way of Debt will have a Beta (βD2) of 0.50.

(iii)Whether the new Equity Beta (βE) justifies increase in the value of equity on account of leverage?

Answer:

1. *Equity Beta*

To calculate Equity Beta first we shall calculate Weighted Average of Asset Beta asfollows:

= 1.55 x 0.64 + 1.40 x 0.36

= 0.992 + 0.504 = 1.496

Now we shall compute Equity Beta using the following formula:

B asset = Be*We + Bd*Wd

1.496 = Be*500/790 + 0.28*290/790

Be = 2.20

(ii) Equity Beta on change in Capital Structure

Amount of Debt to be raised:

Particulars	**Value (in Rs Crore)**
Total Value of Firm (Equity Rs 500 crore + Debt Rs 290 crore)	790
Desired Debt Equity Ratio	1.50 : 1.00
Desired Debt Level = $\frac{Total\ Value\ x\ Debt\ Ratio}{Debt\ Ratio+Equity\ Ratio}$	474
Less: Value of Existing Debt	(290)
Value of Debt to be Raised	184

Equity after Repurchase = Total value of Firm - Desired Debt Value

= Rs 790 Crore - Rs 474 Crore

= Rs 316 Crore

Weighted Average Beta of ABCL:

Source of Finance	Investment (in Rs Crore)	Weight	Beta of the Division	Weighted Beta
Equity	316	0.4	$\beta_{(E=X)}$	0.4x
Debt - 1	290	0.367	0.45	0.165
Debt - 2	184	0.233	0.50	0.117
	790	**Weighted Average Beta**		**0.282 + (0.4x)**

$\beta_{ABCL} = 0.282 + 0.4x$

$1.496 = 0.282 + 0.4x$

$0.4x = 1.496 - 0.282$

$X = 1.214/0.4 = 3.035$

$\beta_{\text{New Equity}} = 3.035$

Yes, it justifies the increase as it leads to increase in the Value of Equity due toincrease in Beta.

Question 4(6 Marks): Ankit has a fund of Rs 10 lacs which he wants to invest in share market with rebalancing target after every 15 days to start with for a period of one month from now. The present NIFTY is 19679. The minimum NIFTY within a month can at most be 18104.68. He wants to know as to how he should rebalance his portfolio under the following situations, according to the theory of Constant Proportion Portfolio Insurance Policy, using "2" as the multiplier:
(i) Immediately to start with.
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(iii) 15 days further from the above date if the NIFTY touches 20997.493.
Note: Assume that the value of his equity component will change in tandem with that of the NIFTY.

Answer:Maximum decline in one month = $\frac{19679 - 18104.68}{19679} \times 100 = 8\%$

(1) Immediately to start with

Investment in equity = Multiplier x (Portfolio value – Floor value)

= 2 (10,00,000 – 9,20,000) = Rs 1,60,000

Ankit may invest Rs 1,60,000 in equity and balance in risk free securities.

(2) After 15 days

Value of equity = 1,60,000 x 19088.63 / 19679	=	Rs 1,55,200
Value of risk free investment	=	Rs 8,40,000
Total value of portfolio	=	Rs 9,95,200

Investment in equity = Multiplier x (Portfolio value – Floor value)

= 2 (9,95,200 – 9,20,000) = Rs 1,50,400

Revised Portfolio:

Equity = Rs 1,50,400

	Risk free Securities = Rs 9,95,200 – Rs 1,50,400	=	Rs 8,44,800
(3)	After another 15 days		
	Value of equity = 1,50,400 x 20997.493 / 19088.63	=	Rs 1,65,440
	Value of risk free investment	=	Rs 8,44,800
	Total value of portfolio	=	Rs 10,10,240
	Investment in equity = Multiplier x (Portfolio value – Floor value)		
	= 2 (10,10,240 – 9,20,000)	=	Rs 1,80,480
	Revised Portfolio:		
	Equity	=	Rs 1,80,480
	Risk Free Securities = Rs 10,10,240 – Rs 1,80,480	=	Rs 8,29,760

Ankit should off-load Rs 15,040 of risk free securities and divert to Equity.

Question 5(8 Marks): The returns and market portfolio for a period of four years are as under:

Year	% Return of Stock	% Return on Market
1	10	8
2	12	10
3	9	9
4	3	-1

For stock B, you are required to determine:
(a) characteristic line; and
(b) The Systematic and Unsystematic Risk
Answer:
Characteristic line is given by
$\alpha i + \beta i\ Rm$
$\beta i = (\sum xy - n\bar{x}\bar{y}) / (\sum x^2 - n(\bar{x})^2)$
$\alpha i = \bar{y} - \beta\bar{x}$

Return on B(Y)	Return on Market (X)	XY	X^2	$(x - \bar{x})$	$(x - \bar{x})^2$	$(y - \bar{y})$	$(y - \bar{y})^2$
10	8	80	64	1.50	2.25	1.50	2.25
12	10	120	100	3.50	12.25	3.50	12.25
9	9	81	81	2.50	6.25	0.50	0.25
3	-1	-3	1	-7.50	56.25	-5.50	30.25
34	26	278	246		77.00		45.00

$= \bar{y} = 34 / 4 = 8.50$
$= \bar{x} = 26 / 4 = 6.50$
$\beta = (\sum xy - n\bar{x}\bar{y}) / (\sum x^2 - n(\bar{x})^2) = (278 - 4(6.50)(8.50)) / (246 - 4(6.50)^2) = 57 / 77 = 0.74$
$\alpha = \bar{y} - \beta\bar{x} = 8.50 - 7.74(6.50) = 3.69$
Hence the characteristic line is $3.69 + 0.74\ (R_m)$
Total risk of market $= \sigma^2_m = \sum(x - \bar{x})^2 / n = 77 / 4 = 19.25\%$
Total Risk of stock = 45 / 4 = 11.25%
Systematic Risk $= \beta^2_i\ \sigma^2_m = (0.74)^2 \times 19.25 = 10.54(\%)$

Unsystematic Risk is = Total Risk – Systematic Risk
= 11.25 – 10.54 = 0.71(%)