Assignment – Chapter 9 – Derivatives Analysis and Valuation

Question 1

(a) The Forward Price shall be = $S_0 e^{n(r-y)}$

Where S_0 = Spot price n = period

r = risk free rate of interest y = dividend yield

Accordingly,

Forward Price = $2290\ e^{90/365(0.0416 - 0.0175)}$

$= 2290\ e^{0.005942}$

$= 2290(1.005960)$

$= 2303.65$

(b) Mr. X shall take long position in the Forward Contract on Index.

(c) Gain/loss on Long Position after 28 days

$= 2450 - 2290\ e^{(0.0416 - 0.0175)28/365}$

$= 2450 - 2290\ e^{0.001849}$

$= 2450 - 2290(1.001851)$

$= 2450 - 2294.24$

$= 155.76$

(d) Gain/loss on Long Position at maturity

$= S_n - S_0 e^{n(r-y)}$

$= 2470.00 - 2303.65$

$= 166.35$

Question 2

(i) Calculation of beta of Security A

Let beta of Security A is β_A

Security	Price of the Stock	No. of shares	Value	Weightage w_i	Beta B_i	Weighted Beta
A	612.65	3,000	18,37,950	0.113	β_A	0.113 β_A
B	334.20	5,000	16,71,000	0.102	1.15	0.117
C	454.45	6,000	27,26,700	0.167	0.40	0.067
D	775.10	10,000	77,51,000	0.475	0.95	0.451
E	781.05	3,000	23,43,150	0.143	0.85	0.122
			1,63,29,800			0.757 + 0.113 β_A

Since the Portfolio beta is 0.859, the beta of Security A shall be:

$0.757 + 0.113\ \beta_A = 0.859$

$\beta_A = 0.903$ or 0.90

(ii) Calculation of Theoretical Value of Future Contract

Cost of Capital = 10.5% p.a. Accordingly, the Continuously Compounded Rate of Interest ln (1.105) = 0.0998

For February 2023 contract, t = 58/365 = 0.1589

Further $F = Se^{rt}$

$F = ₹\ 6,500e^{(0.0998)(0.1589)}$

$F = ₹\ 6,500e^{0.015858}$

$F = ₹\ 6,500 X 1.01598 = ₹\ 6,603.87$

Alternatively, it can also be taken as follows:

$= ₹\ 6500\ e^{0.105 \times 58/365}$

$= ₹\ 6500\ e^{0.01668}$

$= ₹\ 6500 \times 1.01682 = ₹\ 6,609.33$

(iii) When total portfolio is to be hedged:

$$= \frac{\text{Value of Spot Position requiring hedging}}{\text{Value of Future Contract}} \times \text{Portfolio Beta}$$

$$= \frac{16329800}{6603.87 \times 200} \times 0.859 = 10.62 \text{ contracts say 11 contracts}$$

Or

$$= \frac{16329800}{6609.33 \times 200} \times 0.859 = 10.61 \text{ contracts say 11 contracts}$$

(iv) Revised Portfolio Beta if 4 Future contracts are sold to investor:

$$4 = (\beta_{P₹} - 0.859) \times \frac{16329800}{6603.87 \times 200}$$

$\beta_{P₹} = 1.18$

Or

$$4 = (\beta_{P₹} - 0.859) \times \frac{16329800}{6609.33 \times 200}$$

$\beta_{P₹} = 1.18$

Question 3

(i) Let N be the value of Nifty Future Contract then:

$$\frac{10000 \times 25 \times 1.50 - 5000 \times 40 \times 2}{N} = 25$$

N = - 1000

Since Mohan has bought Nifty Futures the above value shall be considered as positive i.e. value of per one Nifty Future is ₹ 1000.

Alternatively, it can also be computed as follows:

$$\frac{5000\times40\times2-10000\times25\times1.50}{N}=25$$

N = 1000

Accordingly, the value of Nifty Future is ₹ 1000.

(ii) Initial Cash Outlay

= 10000 x ₹ 25 + 1000 x ₹ 25 – 5000 x ₹ 40

= ₹ 2,50,000 + ₹ 25,000 - ₹ 2,00,000 = ₹ 75,000

(iii) Cash inflow at the closeout

₹ 75,000 - ₹ 16,625 = ₹ 58,375

(iv) Percentage Gain/ loss to Shares of A Ltd. at the time of closure

Let the amount realised from the sale of share of A Ltd. is A.

Accordingly, next day at the time of closing out the position will be as follows:

10000 x ₹ 25 (1 – 0.04) + 25 x ₹ 1000 x (1 – 0.025) - A = ₹ 58,375

A = ₹ 2,06,000

Thus, percentage of loss to shares of A Ltd. = $\frac{2,06,000-2,00,000}{2,00,000}$ = 0.03 i.e. 3%

Alternative presentation-

Percentage Gain / Loss to shares of A Ltd. at the time of closure:

Loss suffered by Mohan when he closes out his position at the closing price of the next day		₹ 16,625
Less:		
a. Loss suffered in purchase of shares of X Ltd. (10,000 x 25 x 0.04)	10,000	
b. Loss suffered in Nifty Futures (1,000 x 25 x 0.025)	625	₹ 10,625
Loss suffered in sale of shares of A Ltd.		₹ 6,000

Thus, percentage of loss to shares of A Ltd.= (6,000/2,00,000) x 100 = 0.03 i.e. 3%

Question 4

(i) Since Mr. H holds 100 equity shares, he should buy equal no. of Put option i.e. 100 put options in the same stock to hedge his position.

Total Premium amount to be paid = 50 x 100 Put = ₹ 5,000

(ii) Net Position after 2-months

					(₹)
Share price on exercise day	2,000	2,100	2,200	2,300	2,400
Option exercise	Yes	Yes	No	No	No
Inflow (strike price)	2,200	2,200	Nil	Nil	Nil
Inflow (in open market)	-	-	2,200	2,300	2,400
Less outflow (premium)	50	50	50	50	50
Position (per share)	2,150	2,150	2,150	2,250	2,350
Total Position	2,15,000	2,15,000	2,15,000	2,25,000	2,35,000

Thus, from above table it can be observed in any case the value of holding of Mr. H in V Ltd. shall not go below ₹ 2,150 per share.

Question 5

I. Option A

II. Option B

III. Option A

Question 6

Total premium paid on purchasing a call and put option

= (₹ 3 per share × 100) + (₹ 2 per share × 100).

= ₹ 300 + ₹ 200 = ₹ 500

(i) In this case, investor exercises neither the call option nor the put option as both will result in a loss for him.

Ending value = - ₹ 500 + zero gain = - ₹ 500

i.e. Net loss = ₹ 500

(ii) Since the price of the stock is below the exercise price of the call, the call will not be exercised. Only put is valuable and is exercised.

Total premium paid = ₹ 500

Ending value = – ₹ 500 + ₹ [(42 – 34) × 100] = – ₹ 500 + ₹ 800 = ₹ 300

i.e. Net gain = ₹ 300

(iii) In this situation, the put is worthless, since the price of the stock exceeds the put's exercise price. Only call option is valuable and is exercised.

Total premium paid = ₹ 500

Ending value = - 500 + [(46 – 45) × 100] = - 500 + 100 = - ₹ 400

i.e. Net Loss = ₹ 400

Question 7

(i) To compute perfect hedge we shall compute Hedge Ratio (Δ) as follows:

$$\Delta = \frac{C1-C2}{S1-S2} = \frac{100-0}{650-450} = \frac{100}{200} = 0.50$$

The investor should purchase 0.50 share for shortening every 1 call option

Or, the investor should purchase 1 share for shortening every 2 Call Option.

(ii) How the investor will be able to maintain his position if he purchase 0.50 share for 1 call option written.

(a) If price of share goes upto ₹ 650 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 650)	₹ 325
Loss on account of Short Position (₹ 650 – ₹ 550)	₹ 100
	₹ 225

(b) If price of share comes down to ₹ 450 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 450)	₹ 225

(iii) The Value of Option, say, P at the beginning of the period shall be computed as follows:

(₹ 250 – P) 1.05 = ₹ 225

₹ 262.50 – 1.05P = ₹ 225

₹ 37.5 = 1.05P

P = ₹ 35.71

(iv) Expected Return on the Option

Expected Option Value = (₹ 650 – ₹ 550) × 0.70 + ₹ 0 × 0.30 = ₹ 70

Expected Rate of Return = $\frac{70 - 35.71}{35.71} \times 100 = 96.02\%$

Question 8

Maximum decline in one month = $\frac{17025-15322.50}{17025} \times 100 = 10\%$

(a) Immediately to start with

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

= 2 (₹ 50,00,000 – ₹ 45,00,000) = ₹ 10,00,000

Mr. S may invest ₹ 10,00,000 in equity and balance in risk free securities.

(b) After 15 days

Value of equity = 10,00,000 x 16321.89 / 17025 =		₹ 9,58,701
Value of risk free investment		₹ 40,00,000
Total value of portfolio	=	₹ 49,58,701

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

= 2 (₹ 49,58,701 – ₹ 45,00,000) = ₹ 9,17,402

Revised Portfolio:

Equity	= ₹ 9,17,402
Risk free Securities = ₹ 49,58,701 – ₹ 9,17,402	= ₹ 40,41,299

(3) After another 15 days

Value of equity = 9,17,402 x 17512.14 / 16321.89	= ₹ 9,84,302
Value of risk free investment	= ₹ 40,41,299
Total value of portfolio	= ₹ 50,25,601

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

= 2 (₹ 50,25,601 – ₹ 45,00,000) = ₹ 10,51,202

Revised Portfolio:

Equity	= ₹ 10,51,202
Risk Free Securities = ₹ 50,25,601 – ₹ 10,51,202	= ₹ 39,74,399

Thus, Mr. S should off-load ₹ 66,900 of risk free securities and divert to Equity.