Q1

1. (a): What is the expected return and risk (standard deviation) of the portfolio.

Period	R_{HUL}	R_m	$R_H - \bar{R}_H$	$R_m - \bar{R}_m$	$(R_m - \bar{R}_m)^2$	$(R_H - \bar{R}_H)(R_m - \bar{R}_m)$
1	14	10	6	5	25	30
2	8	5	0	0	0	0
3	(6)	−2	−14	−7	49	98
4	4	−1	−4	−6	36	24
5	10	5	+2	0	0	0
6	11	8	3	3	9	9
7	15	10	7	5	25	35

$\Sigma R_H = 56 \quad \Sigma R_m = 35 \quad \Sigma(R_m - \bar{R}_m)^2 = 144, \ \Sigma(R_H - \bar{R}_H)(R_m - \bar{R}_m) = 196$

$R_H = 8, \quad \bar{R}_m = 5 \quad \sigma_M^2 = 144/6 = 24 \quad Cov(H, M) = 196/6 = 32.7$

β of HUL, $\beta_H = 32.7/24 = \underline{1.36}$.

(b). Calculation of expected returns, standard deviations and covariances.

$E(DLF) = 0.3 \times 5 + 0.4 \times 18 + 0.3 \times 30 = 17.7$

$E(REL) = 0.3 \times 15 + 0.4 \times 8 + 0.3 \times 12 = 11.3$

$E(HUL) = 0.3 \times (-10) + 0.4 \times 16 + 0.3 \times 24 = 10.6$

$E(NSE) = 0.3 \times -2 + 0.4 \times 17 + 0.3 \times 26 = 14$

$\sigma_{DLF} = [0.3(5-17.7)^2 + 0.4(18-17.7)^2 + 0.3(30-17.7)^2]^{1/2}$

$= [48.4 + 0.1 + 45.4]^{1/2} = 9.7$

Similarly

$\sigma_{REL} = 2.94$

$\sigma_{HUL} = 13.89$

$\sigma_{NSE} = 11.1$

Calculation of Covariances between the stocks

State of the economy	Prob.	$[R_D - \bar{R}_D]$	$[R_{RI} - \bar{R}_{RI}]$	$[R_{HL} - \bar{R}_{HL}]$	$2 \times 3 \times 4$	$2 \times 4 \times 5$	$2 \times 3 \times 5$
(1)	(2)	(3)	(4)	(5)			
Recession	0.3	−12.7	3.7	−20.6	−14.1	−22.9	78.5
Normal	0.4	0.3	−3.3	5.4	−0.1	−7.1	0.6
Boom	0.3	12.3	0.7	13.4	2.6	2.8	49.4

$\sigma_{DLF, REL} = -11.6 \quad \sigma_{REL, HL} = -27.2 \quad \sigma_{DLF, HUL} = 128.5$

Expected return and standard deviation of the portfolio

$E(P) = (0.4 \times 17.7) + (0.4 \times 11.3) + (0.2 \times 10.6) = 13.7$

$$\sigma_p = \left[W_D^2 \sigma_D^2 + W_R^2 \sigma_R^2 + W_H^2 \sigma_H^2 + 2 W_D W_R \sigma_{D,R} + 2 W_R W_H \sigma_{RH} + 2 W_D W_H \sigma_{D,H} \right]^{1/2}$$

$$= \left[15.1 + 1.4 + 7.7 \times 3.7 \times -4.4 + 20.6 \right]^{1/2}$$

$$= \boxed{6.1}$$

(3) Determining the underpricing and overpricing under CAPM.

$\beta_D = 1.7,\ \beta_R = 0.8,\ \beta_H = 1.36,\ E(R_{M_{NSE}}) = 14,\ R_f = 7\%.$

$SML = 7 + (14 - 7) \times \beta$

$= 7 + 7 \times \beta$

Required return on DLF $= 7 + (7 \times 1.7) = 18.9\%$

" " " REL $= 7 + 7 \times 0.8 = 12.6\%$

" " " HUL $= 7 + 7 \times 1.36 = 16.5\%$

As the expected return of 17.7% on DLF is slightly less than the required return of 18.9%, its expected return can be expected to go up to the fair return indicated by CAPM and for this to happen its market price should come down. So it is slightly overvalued.

For Releance, as the expected return is again slightly less than the required return of 12.6%, its expected return can be expected to go up and for this to happen its market price should come down. So it is also slightly overvalued.

In the case of HUL, the expected return is 10.6% against the required return of 16.5%. So it is considerably overvalued.

Q.2 2. Standard deviation of portfolio return is

$$\sigma_p = [w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + w_3^2\sigma_3^2 + w_4^2\sigma_4^2 + 2w_1w_2\rho_{12}\sigma_1\sigma_2 + 2w_1w_3\rho_{13}\sigma_1\sigma_3 + 2w_1w_4\rho_{14}\sigma_1\sigma_4 + 2w_2w_3\rho_{23}\sigma_2\sigma_3 + 2w_2w_4\rho_{24}\sigma_2\sigma_4 + 2w_3w_4\rho_{34}\sigma_3\sigma_4]^{1/2}$$

$$= [0.3^2 * 5^2 + 0.2 \times 6^2 + 0.2^2 \times 12^2 + 0.3^2 \times 8^2 + 2 \times 0.3 \times 0.2 \times 0.2 \times 5 \times 6 + 2 \times 0.3 \times 0.2 \times 0.615 \times 12 + 2 \times 0.3 \times 0.3 \times 0.3 \times 5 \times 8 + 2 \times 0.2 \times 0.2 \times 0.4 \times 6 \times 12 + 2 \times 0.2 \times 0.3 \times 0.6 \times 6 \times 8 + 2 \times 0.2 \times 0.3 \times 0.5 \times 12 \times 8]^{1/2}$$

$$= \underline{5.82\%}$$

Q4 (4). $R_m = 16\%$, $\beta_A = 1.6$

$R_A = 22\%$, $g = 12\%$, $P_0 = Rs.260$

$P_0 = D_1/r-g$

$Rs.260 = D_1/(0.22-.12)$

so $D_1 = Rs.26$ and $D_0 = \frac{D_1}{1+g} = \frac{26}{1.12} = Rs.23.12$

$R_A = R_f + (R_M - R_f)\beta A$

$0.22 = R_f + 1.6(0.16 - R_f)$

$0.6 R_f = 0.036$

$R_f = 6\%$ or 0.06

	Original	Revised
R_f	6%	11%
$R_M - R_f$	10%	5%
g	12%	10%
β_A	1.6	1.1

R_A (Revised) $= 11\% + (1.1)5\% = 16.5\%$

Price per share of stock A, gives the above changes is

$$\frac{23.12(1.10)}{0.165 - 0.10} = \underline{Rs.\ 392.78}$$

(3) Q3 (a) $$\frac{8+10-6-1+9}{5} = 4\%$$

(b) $$\frac{10+6-9+4+11}{5} = 4.4\%$$

(c) $$\frac{9+6+3+5+8}{5} = 6.2\%$$

(d) $$\frac{10+8+13+7+12}{5} = 10.0\%$$

(a) Return on portfolio consisting of stock A = 4%

(b) Return on portfolio consisting of stock A and B in equal proportions

$$= 0.5(4) + 0.5(4.4) = \underline{4.2\%}$$

(c) Return on portfolio consisting of stocks A, B and C in equal proportions

$= \frac{1}{3}(4) + \frac{1}{3}(4.4) + \frac{1}{3}(6.2)$

$= 4.87\%$.

(d). Return on portfolio consisting of A, B, C and D in equal proportions

$= 0.25(4) + (0.25)4.4 + 0.25(6.2) + 0.25(10)$

$= 6.15\%$.

Q5. (5):- The required rate of return on stock P is

$R_p = R_F + \beta_P(R_m - R_F)$

$= 0.07 + 0.8(0.13 - 0.07)$

$= 0.118$

Intrinsic value of share $= \frac{D_1}{(r-g)} = D_0(1+g)/(r-g)$

Given D_0 = Rs. 1.00, $g = 0.05$, $r = 0.118$

Intrinsic value per share of stock P

$= \frac{1.00(1.05)}{0.118 - 0.05}$ = Rs. 15.44.

Q6 6. Required rate of return on stock A is

$R_X = R_F + \beta_X(R_M - R_F)$

$= 0.08 + 1.2(0.16 - 0.08)$

$= 0.176$

Intrinsic value of share $= \frac{D_1}{(r-g)} = D_0(1+g)/(r-g)$

Given $D_0 = 3.$ $g = 0.10$, $r = 0.176$

Intrinsic value per share of stock X

$= \frac{3.00(1.10)}{0.176 - 0.10} = Rs.\ 43.42$

Q7 7. $P_0 = D_1/(r-g) = D_0(1+g)/r-g$

~~D_0 = Rs. 3, g~~

$D_0 =$ Rs. 3, $g = -0.10$, $P_0 = 25$ Rs.

$25 = 3.00(1 - 0.10)/(r - (-0.10))$

$= 2.7/(r + 0.10)$

$r + 0.10 = 2.7/25 = 0.108$

$r = 0.108 - 0.10 = 0.008$ or 0.8%

⑩ Questions 8&9, Solve by yourself

Q:10 Using the two factor APT model, the expected return for the Invest fund named UBS (~~IRA~~) equals:-

$E(R_{IF}) = 0.05 + 1.5(0.03) + 2(0.0125) = 0.12 = 12\%$.

By allocating 50% portfolios A and B, we can obtain a portfolio (D) with β equal to the portfolio C β (1.50)

β of Port. D $= 0.50(1) + 0.50(2) = 1.50$

While the βs of portfolios D and C are identical, the expected returns are different

expected return for portfolio D $= 0.50(0.10) + 0.50(0.20) = 15\%$.

Therefore we created a portfolio D that has the same risk as portfolio C ($\beta = 1.50$) but has a higher expected return than portfolio C (15% Vs 13%)

By purchasing portfolio D and short selling portfolio C, we expect to earn a 2% return (15% − 13%) = 2%.

This portfolio is called arbitrage portfolio