Part-1

* Total, Systematic & Unsystematic Risk of a Portfolio :-

Portfolio → 70% $\beta = 1.2$ $\beta_P = 1.2 \times 0.7 + 1.8 \times 0.3$
→ 30% $\beta = 1.8$ $= 1.38$

β_P = weighted average

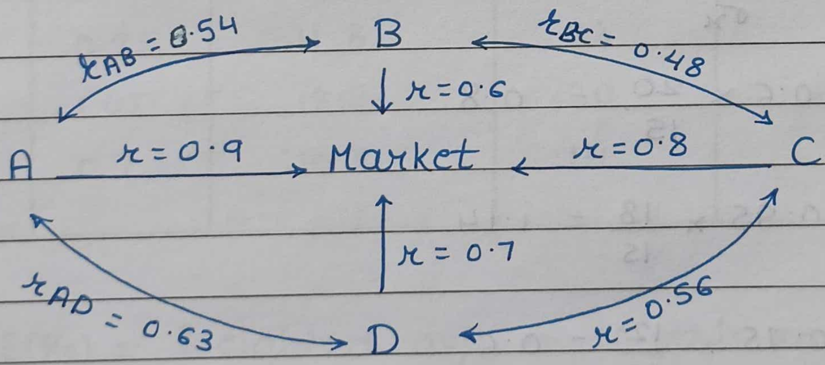
$\sigma_m = 20\%$

$\therefore$ SR $= \sigma_m^2 \beta^2 = (1.38)^2 (20)^2 = 761.76$

SR of portfolio $= \beta^2 \sigma_m^2$ (same formula as stock)

r of stock A with mkt = 0.8
r of stock B with mkt = 0.6
r of stock A with B = $0.8 \times 0.6 = 0.48$

$r_{AB} = r_{A.mkt} \times r_{B.mkt}$



$r_{AC} = 0.72$
$r_{BD} = 0.42$

$\text{Cov}(A, B) = \beta_A \cdot \beta_B \cdot \sigma_m^2$ → Sharpe

$r_{A\,Mkt} \dfrac{\sigma_A}{\sigma_m} \times r_{B\cdot mkt} \dfrac{\sigma_B}{\sigma_m} \times \sigma_m^2$

$= r_{AM} \cdot r_{BM} \cdot \sigma_A \cdot \sigma_B$

$= r_{AB} \cdot \sigma_A \cdot \sigma_B$ → MPT (Markowitz)

$$\sigma_p = \sqrt{(W_A \sigma_A)^2 + (W_B \sigma_B)^2 + 2 \cdot W_A \cdot W_B \cdot \underbrace{COV(A,B)}}$$

MPT	CAPM
(Markowitz)	(sharpe)
$r_{AB} \cdot \sigma_A \cdot \sigma_B$	$\beta_A \cdot \beta_B \cdot \sigma_m^2$

$COV(e_A, e_B) = 0$

↳ Covariance b/w error terms is 'zero'.

UR of the portfolio

$TR_p - SR_p$

$\sigma_p^2 - \beta^2 \sigma_m^2$

$\sigma_{e_p}^2 = (W_A \sigma_{eA})^2 + (W_B \sigma_{eB})^2 + 0$

Q.39	pg
CW. 57	

(i) sensitivitiy means Beta :-

$$\beta = r \frac{\sigma_y}{\sigma_x}$$

Stock A : $\beta_A = 0.6 \times \frac{20}{15} = 0.8$

Stock B : $\beta_B = 0.95 \times \frac{18}{15} = 1.14$

Stock C : $\beta_C = 0.75 \times \frac{12}{15} = 0.6$

(ii) Covariance among various stocks :-

$COV(A,B) = \beta_A \cdot \beta_B \cdot \sigma_m^2 = 0.8 \times 1.14 \times 15^2 = 205.20$

$COV(A,C) = \beta_A \cdot \beta_C \cdot \sigma_m^2 = 0.8 \times 0.6 \times 15^2 = 108$

$COV(B,C) = \beta_B \cdot \beta_C \cdot \sigma_m^2 = 1.14 \times 0.6 \times 15^2 = 153.90$

(iii) $\sigma_p^2 = W_A^2 \sigma_A^2 + W_B^2 \sigma_B^2 + W_C^2 \sigma_C^2 + 2 W_A W_B \, COV(A,B)$

$+ 2 W_A W_C \, COV(A,C) + 2 W_B W_C \, COV(B,C)$

$\sigma_p^2 = (1/3 \times 20)^2 + (1/3 \times 18)^2 + (1/3 \times 12)^2 + 2(1/3)(1/3)(205.20)$
$+ 2(1/3)(1/3)(108) + 2(1/3)(1/3)(153.90)$

$\sigma_p^2 = 200.24$

$\therefore \sigma_p = 14.15\%$

(iv) $\beta_P = \dfrac{0.8 + 1.14 + 0.6}{3} = 0.8467$

(v) $TR = \sigma_p^2 = 200.24$

$SR = \beta_p^2 \sigma_m^2 = (0.8467)^2 \times (15)^2 = 161.30$

$UR = TR - SR = 200.24 - 161.30 = 38.94$

Q.40	pg
CW.58	

(i)

Security	β	Re = 8+4β	E(R)	overvalued / undervalued
O	1.7	14.8	32	undervalued
P	1.4	13.6	30	undervalued
Q	1.1	12.4	25	undervalued
R	0.95	11.8	22	undervalued
S	1.05	12.2	20	undervalued
T	0.7	10.8	14	undervalued

(ii) (a) $E(R_P)$ = Weighted avg → in this case simple avg

$= \dfrac{32 + 30 + 25 + 22 + 20 + 14}{6}$

$= 23.83\%$

(b) Expected Return of leveraged portfolio

Imp

$= 1.4 \times 23.83 - 0.4 \times 12$

$= 28.56$

(iii) Assume a portfolio is constructed using equal portions of 6 stocks listed above -

(a) what is the TR of such portfolio?

(b) what would be the risk, if this portfolio was increased by 40% through borrowed funds with cost of borrowing 12%.

→ (a) $\beta p = \frac{1.7 + 1.4 + 1.1 + 0.95 + 1.05 + 0.7}{6} = 1.15$

SR of portfolio = $\beta_p^2 \sigma_m^2 = (1.15)^2 (20)^2 = 529$

Security	$TR = \sigma_y^2$	$SR = \beta^2 \sigma_m^2$	$UR = \sigma_e^2 = TR - SR$
O	2500	$(1.7)^2 (20)^2 = 1156$	1344
P	1225	$(1.4)^2 (20)^2 = 784$	441
Q	1600	$(1.1)^2 (20)^2 = 484$	1116
R	576	$(0.95)^2 (20)^2 = 361$	215
S	784	$(1.05)^2 (20)^2 = 441$	343
T	324	$(0.7)^2 (20)^2 = 196$	128
			3587

$UR = \sigma_e^2 = \sum_{i=1}^{n} w_i^2 \sigma_{e_i}^2 = \left(\frac{1}{6}\right)^2 \times 3587 = \frac{3587}{36} = 99.64$

∴ TR of portfolio = SR + UR = 529 + 99.64 = 628.64

$\sigma_p^2 = 628.64$

$\sigma_p = 25.07\%$

(b) Risk of leveraged portfolio = $1.4 \times 25.07 = 35.10\%$

$(1.4 \times 25.07 - 0.4 \times 0)$

self practice: HW. Q.21] pg.37

Part-2

Q.41	Pg
CW.58	

Step 1: Calⁿ of SR of portfolio

βp = weighted avg

$= 1.6 \times 0.25 + 1.15 \times 0.3 + 1.4 \times 0.25 + 1 \times 0.2$

$= 1.295$

SR of portfolio = $\beta^2 \sigma_m^2 = (1.295 \times 18)^2 = 543.26$

Step 2: UR of portfolio :-

Security	w	σ_e	$w^2 \sigma_e^2$
L	0.25	7	3.0625
M	0.30	11	10.8900
N	0.25	3	0.5625
K	0.20	9	3.2400
			17.7550 = UR_P

Step 3: TR = SR + UR
= 543.26 + 17.755
= 562.115

Q.42	Pg
CW. 59	

(i) $\sigma_p^2 = (w_D \sigma_D)^2 + (w_E \sigma_E)^2 + (w_F \sigma_F)^2 + 2 w_D w_E \, Cov(D,E) + 2 w_D w_F \, Cov(D,F) + 2 w_E w_F \, Cov(E,F)$

$= (0.2 \times 150)^2 + (0.5 \times 250)^2 + (0.3 \times 1000)^2 + 2 \times 0.2 \times 0.5 \times 300 + 2 \times 0.2 \times 0.3 \times 200 + 2 \times 0.5 \times 0.3 \times 400$

$= 362.5$ (as per markowitz)

(ii) $\sigma_p^2 = (w_D \sigma_D)^2 + (w_E \sigma_E)^2 + (w_F \sigma_F)^2 + 2 w_D w_E \beta_D \beta_E \sigma_m^2 + 2 w_D w_F \beta_D \beta_F \sigma_m^2 + 2 w_E w_F \beta_E \beta_F \sigma_m^2$

$= (0.2 \times 150)^2 + (0.5 \times 250)^2 + (0.3 \times 1000)^2 + 2 \times 0.2 \times 0.5 \times 0.4 \times 0.5 \times 10^2 + 2 \times 0.2 \times 0.3 \times 0.4 \times 0.1 \times 10^2 + 2 \times 0.5 \times 0.3 \times 0.5 \times 0.1 \times 10^2$

$= 184.28$

Alternatively, we can calculate $Cov(D,E) = \beta_D \beta_E \sigma_m^2$ & other 2 first then put in formula .... less confusion.

(This sum is highly repetitive)

Part-3

Q.43	Pg
CW. 59	

(i) S.D. of expected returns on A & B -
(i.e. we have to calculate TR)

Stock A : SR = $\beta_A^2 \sigma_m^2 = (0.8)^2 (25)^2 = 400$

UR = $\sigma_e^2 = (35)^2 = 1225$

$\therefore$ TR = S.D. of A = $\sqrt{SR + UR}$

$= \sqrt{1625}$

$= 40.31\%$

Always remember → TR = SR + UR
isme TR hamesha variance k terms me nikalta h.....

Stock B : SR = $\beta_B^2 \sigma_m^2 = (1.2)^2 (25)^2 = 900$

UR = $45^2 = 2025$

$\therefore$ TR = S.D. of B = $\sqrt{SR + UR} = \sqrt{2925} = 54.08\%$

(ii) Expected Return of portfolio = weighted avg

$= (0.25 \times 14) + (0.40 \times 18) + (0.35 \times 6)$

$= 12.80\%$

S.D. of portfolio -

$\beta_P = 0.25 \times 0.8 + 0.4 \times 1.2 + 0.35 \times 0 = 0.68$

SR = $\beta_P^2 \sigma_m^2 = (0.68 \times 25)^2 = 289$

UR = $(0.25 \times 35)^2 + (0.40 \times 45)^2 + (0.35 \times 0)^2 = 400.56$

TR = SR + UR = 689.56

$\therefore$ S.D. of portfolio = $\sqrt{689.56} = 26.26\%$

Self Note :- Alternatively - (Not preferred in exam)

$\sigma_P = \sqrt{(0.25 \times 40.31)^2 + (0.4 \times 54.08)^2 + (0.35 \times 0)^2 + 2 \times 0.25 \times 0.4 \times COV(A,B)}$

$= 26.26$

$(COV(A,B)) = \beta_A \beta_B \sigma_m^2 = 0.8 \times 1.2 \times 25^2 = 600$

Q.44	pg
cw. 59	

Company X :

$SR = \beta_x^2 \sigma_m^2 = (0.71) \times 2.25 = 1.134$

$UR = TR - SR = 6.30 - 1.134 = 5.166$

Company Y:

$SR = \beta_y^2 \sigma_m^2 = (0.685)^2 \times 2.25 = 1.056$

$UR = TR - SR = 5.86 - 1.056 = 4.804$

Portfolio risk of equally weighted portfolio -

$SR = \beta_p^2 \sigma_m^2$

$= [(0.5 \times 0.71) + (0.5 \times 0.685)]^2 \times 2.25$

$= 1.0946$

$UR = [(0.5)^2 \times 5.166] + [(0.5)^2 \times 4.804] = 2.493$

$TR = SR + UR = 3.5876$

Self Practice : HW. Q.19] pg. 36 IMP (likh k solve krna plz)

HW. Q.20] pg. 37

HW. Extra Q.] HW. soln. pg. 130