* Risk & Return.

* Return & Risk based on Past - Data.

$$R_t = \left[\frac{P_t - P_{t-1} + Div_t}{P_{t-1}}\right] \times 100$$

* Expected Return

$$\overline{R} = \frac{\Sigma R_i}{n}$$

* Expected Risk

$$\sigma^2 = \frac{\Sigma (R_i - \overline{R})^2}{n-1} \qquad \sigma = \sqrt{\sigma^2}$$

* Risk & Return using Probabilities

Expected Return ($\overline{R}$) $= \Sigma P_i R_i$

Expected Risk (σ^2) $= \Sigma P_i (R_i - \overline{R})^2$

$$\sigma = \sqrt{\sigma^2}$$

1. Annual Return

Year	Annual Return $R_t = \left[\frac{P_t - P_{t-1} + Div}{P_{t-1}}\right] \times 100$	Return % R_i	$R_i - \bar{R}$	$(R_i - \bar{R})^2$
1988	$= \left(\frac{20.75 - 31.25 + 1.53}{31.25}\right) \times 100$	−28.7%	−80.74	6,518.95
1989	$= \left(\frac{30.88 - 20.75 + 1.53}{20.75}\right) \times 100$	56.2%	4.16	17.31
1990		123.45%	71.41	5,099.39
1991		52.24%	0.2	0.04
1992		57	4.96	24.60
		$\Sigma R_i = 260.19$		11,660.29

Expected Return $\bar{R} = \frac{\Sigma R_i}{n} = \frac{260.19}{5}$ $\boxed{= 52.04\%}$

Range of Returns = $\boxed{-1.96 \text{ to } 106.04}$

Expected Risk

$$\sigma^2 = \frac{\Sigma (R_i - \bar{R})^2}{n-1}$$

$$= \frac{11,660.29}{4}$$

$$\boxed{\sigma^2 = 2,915.07}$$

$$\sigma = \sqrt{2,915.07}$$

$$\boxed{\sigma = 54\%}$$

4.

ACC

Prob. (P_i)	Return (R_i)	$P_i R_i$	$R_i - \bar{R}$	$(R_i - \bar{R})^2$	$P_i (R_i - \bar{R})^2$
0.5	1.94	0.97	−0.463	0.214	0.107
0.4	2.74	1.096	0.337	0.114	0.046
0.1	3.37	0.337	0.967	0.934	0.094
		2.403			0.247

Expected Return $= \bar{R} = \Sigma P_i R_i$ 2.403 %.

$$\sigma^2 = \Sigma P_i (R_i - \bar{R})^2 = 0.247 \qquad \sigma \boxed{= 0.50\%}$$

Hero

P_i	R_i	$P_i R_i$	$R_i - \bar{R}$	$(R_i - \bar{R})^2$	$P_i (R_i - \bar{R})^2$
0.5	5.1	2.55	−32.68	1067.98	534
0.4	74.92	29.97	37.14	1379.38	551.75
0.1	52.59	5.26	14.81	219.34	21.93
		$\bar{R} = 37.78$			1107.68

$$\sigma^2 = \Sigma P_i (R_i - \bar{R})^2 = 1107.68 \qquad \sigma = \sqrt{1107.68} = 33.28\%$$

* Expected Return and Risk of a Portfolio (2-Assets)

* Expected Return $R_p = W_1 R_1 + W_2 R_2$

Weights Returns

* Expected Risk $\sigma_p^2 = W_1^2 \sigma_1^2 + W_2^2 \sigma_2^2 + 2 W_1 W_2 \sigma_1 \sigma_2 r_{12}$

OR

$$\sigma_p^2 = W_1^2 \sigma_1^2 + W_2^2 \sigma_2^2 + 2 W_1 W_2 \ COV_{12}$$

$$COV_{12} = \sigma_1 \times \sigma_2 \times r_{12}$$

$$\sigma_p = \sqrt{\sigma_p^2}$$

7.

	X	Y
R_i	12%	15%
σ_i (S.D.)	15%	20%
	$W_1 = 0.4$	$W_2 = 0.6$

$$R_p = W_1 R_1 + W_2 R_2 = (0.4 \times 12) + (0.6 \times 15) = 4.8 + 9 = \boxed{13.8\%}$$

* Calulating Portfolio Risk at different correlation co-efficient.

$$\sigma_p^2 = W_1^2 \sigma_1^2 + W_2^2 \sigma_2^2 + 2 W_1 W_2 \sigma_1 \sigma_2 r_{12}$$

$r_{12} = \pm 1$

$\sigma_p^2 = (0.4)^2 (15)^2 + (0.6)^2 (20)^2 + (2 \times 0.4 \times 0.6 \times 15 \times 20 \times 1)$

$= 36 + 144 + 144$

$\sigma_p^2 = 324$

$\sigma_p = \sqrt{324} = \boxed{18\%}$

$r_{12} = +0.5$

$\sigma_p^2 = (0.4)^2 (15)^2 + (0.6)^2 (20)^2 + (2 \times 0.4 \times 0.6 \times 15 \times 20 \times 0.5)$

$= 36 + 144 + 72$

$\sigma_p^2 = 252$

$\sigma_p = \sqrt{252} = \boxed{15.87\%}$

$r_{12} = 0$

$\sigma_p^2 = 36 + 144 + (2 \times 0.4 \times 0.6 \times 15 \times 20 \times 0)$

$= 36 + 144$

$= 186$

$\sigma_p = \sqrt{180} = \boxed{13.42\%}$

$r_{12} = -0.5$

$\sigma_p^2 = 36 + 144 + (2 \times 0.4 \times 0.6 \times 15 \times 20 \times -0.5)$

$= 36 + 144 - 72$

$= 108$

$\sigma_p = \sqrt{108} = \boxed{10.39\%}$

$r_{12} = -1$

$\sigma_p^2 = 36 + 144 - 144$

$= 36$

$\sigma_p = \sqrt{36}$

$\boxed{= 6\%}$

	X	Y
S.D	15%	20%
r_{12}	-1	
w_i =	0.7	0.3

$$\sigma_p^2 = (0.7)^2(15)^2 + (0.3)^2(20)^2 + (2 \times 0.7 \times 0.3 \times 15 \times 20 \times -1)$$

$$= 110.25 + 36 - 126$$

$$\sigma_p^2 = 20.25$$

$$\sigma_p = 4.5\% < 6\%$$

$$0.5 = \frac{50{,}000}{100000} = \frac{m}{n} \quad m \to \text{Invt. in Asset} \quad n \to \text{Total}$$

Invest 100% in X — 12%

Risk = 15%

Max = 15 + 12 = 27%

Min = 15 − 12 = 3%

Range = 3 — 27%

Invest 40% in X & 60% in Y

Return = 13.8%

Risk = 6%

Range = 7.8% — 19.8%

11.

P_i	R_x	R_y	P_iR_x	P_iR_y	$R_x - \bar{R}_x$	$P_i(R_x-\bar{R}_x)^2$	$R_y - \bar{R}_y$	$P_i(R_y-\bar{R}_y)^2$	$P_i(R_x-\bar{R}_x)(R_y-\bar{R}_y)$
0.1	20	14	2	1.4	19.1	36.48	13.8	19.04	26.36
0.4	-16	-20	-6.4	-8	-16.9	114.24	-20.2	163.22	136.55
0.2	14	18	2.8	3.6	13.1	34.32	17.8	63.37	46.64
0.1	9	12	0.9	1.2	8.1	6.56	11.8	13.92	9.56
0.2	8	10	1.6	2	7.1	10.08	9.8	19.21	13.92
			0.9	0.2		201.68		278.76	233.03

$\bar{R}_x = 0.9$ $\quad \bar{R}_y = 0.2$

$\sigma_x^2 = \Sigma P_i (R_x - \bar{R}_x)^2 = 201.68 = \sigma_x \sqrt{201.68} = 14.20$

$\sigma_y^2 = 278.76 \quad \sigma_y = \sqrt{278.76} = 16.70$

(1) $COV_{12} = \Sigma P_i (R_1 - \bar{R}_1)(R_2 - \bar{R}_2)$

$\boxed{= 233.03}$

$r_{12} = \dfrac{COV_{12}}{\sigma_1 \times \sigma_2} = \dfrac{233.03}{14.20 \times 16.70}$

$\boxed{= 0.98}$

(b) $R_p = (0.5 \times 0.9) + (0.5 \times 0.2) = \boxed{0.55\%}$

* Capital Asset Pricing Model (CAPM)

Return of a Portfolio

$$R_p = R_f + \beta (R_m - R_f)$$

Risk-free Rate

systematic Risk co-effiecient

Market Return

→ Market → Index (Sensex (BSE-30), Nifty (50), Bank Nifty etc.)

$\beta = 1$

Stock x has $\beta = 1.5$

If the Return as per CAPM < Required Return, Stock is Undervalued.

If the Return as per CAPM > Required Return, Stock is Overvalued.

13.

P_i	R_i XYZ	R_m Mkt.	P_iR_i	P_iR_m	$R_i-\bar{R}$	$P_i(R_i-\bar{R})^2$	$R_m-\bar{R}_m$	$P_i(R_m-\bar{R}_m)^2$	$P_i(R_i-\bar{R}_i)(R_m-\bar{R}_m)$
0.4	20	16	8	6.4	7.8	24.34	4.2	7.06	13.104
0.4	13	12	5.2	4.8	0.8	0.26	0.2	0.02	0.064
0.2	−5	3	−1	0.6	−17.2	59.17	−8.8	15.49	30.272
			12.2	11.8		83.77		22.57	43.440

$\bar{R} = \Sigma P_i R_i = 12.2\%$ $\quad R_f = 7\%$ (Given in Que)

$\bar{R}_m = \Sigma R_i R_m = 11.8\%$ (Required Return)

$\sigma_i^2 = \Sigma P_i (R_i - \bar{R}_i)^2 = 83.77 \quad \sigma_i = \sqrt{83.77} = 9.15\%$

$\sigma_m^2 = \Sigma P_i (R_m - \bar{R}_m)^2 = 22.57 \quad \sigma_m = \sqrt{22.57} = 4.75\%$

$COV_{(i,m)} = \Sigma P_i (R_i - \bar{R}_i)(R_m - \bar{R}_m) = 43.44$

$\beta = \frac{COV_{(i,m)}}{\sigma_m^2} = \frac{43.44}{22.57} = \boxed{1.93}$

Expected Return as per CAPM

$R_i = R_f + \beta (R_m - R_f)$

$= 7 + 1.93(11.8 - 7)$

$\boxed{= 16.26\%}$

As Expected Return as per CAPM (16.26%) > 12.2% (Required Return), the XYZ stock is overvalued, therefore investment is not wised.

14.

R_i	R_m	$R_i - \bar{R}_i$	$(R_i - \bar{R}_i)^2$	$(R_m - \bar{R}_m)$	$(R_m - \bar{R}_m)^2$	$(R_i - \bar{R}_i)(R_m - \bar{R}_m)$
18	15	9	81	9	81	81
9	7	0	0	1	1	0
20	16	11	121	10	100	110
-10	-13	-19	361	-19	361	361
5	4	-4	16	-2	4	8
12	7	3	9	1	1	3
54	36		588		548	563

$$\bar{R}_i = \frac{\Sigma R_i}{n} = \frac{54}{6} = 9\%$$

$$\bar{R} = \frac{\Sigma R_m}{n} = \frac{36}{6} = 6\%$$

$$\sigma_i^2 = \frac{(\Sigma R_i - \bar{R}_i)^2}{n-1} = \frac{588}{5} = 117.6$$

$$\sigma_i = \sqrt{117.6} \boxed{= 10.84\%}$$

$$\sigma_m^2 = \frac{\Sigma (R_m - \bar{R}_m)^2}{n-1} = \frac{548}{5} = 109.6$$

$$\sigma_m = \sqrt{109.6} \boxed{= 10.47\%}$$

14... Contd...

(i) $COV_{(i,m)} = \dfrac{\Sigma(R_i-\bar{R}_i)(R_m-\bar{R}_m)}{n-1}$

$= \dfrac{563}{5} \quad \boxed{= 112.6}$

$r_{(i,m)} = \dfrac{COV_{(i,m)}}{\sigma_i \times \sigma_m}$

$= \dfrac{112.6}{10.84 \times 10.47} \quad \boxed{= 0.99}$

ii) $\beta_i = \dfrac{COV_{(i,m)}}{\sigma_m^2} = \dfrac{112.6}{109.6}$

$\boxed{= 1.03}$

OR

$\beta = \dfrac{r_{(i,m)} \times \sigma_i}{\sigma_m}$

$= \dfrac{0.99 \times 10.84}{10.47} = \boxed{1.03}$

(iii) Total Risk of stock s = 10.84% (σ_i)

$\therefore$ Variance $= \sigma_i^2 = 117.6$

$\sigma_i^2 = S.R. + USR$

Systematic Risk $= \beta_i^2 \sigma_m^2$

$= (1.03)^2(10.47)^2 = \underset{SR}{\boxed{116.27}}$

17.

R_i	R_m	$R_i - \bar{R}_i$	$(R_i - \bar{R}_i)^2$	$(R_m - \bar{R}_m)$	$(R_m - \bar{R}_m)^2$	$(R_i - \bar{R}_i)(R_m - \bar{R}_m)$
29	−10	15.2	231.04	−14	256	−212.8
31	24	17.2	295.84	20	400	344
10	11	−3.8	14.44	7	49	−26.6
6	−8	−7.8	60.84	−12	144	93.6
(−7)	3	−20.8	432.64	−1	1	20.8
69	20		1034.8		790	219

$$\bar{R}_i = \frac{\Sigma R_i}{n} = \frac{69}{5} = 13.8$$

$$\bar{R}_m = \frac{\Sigma R_m}{n} = \frac{20}{5} = 4$$

$$\sigma_i^2 = \frac{\Sigma (R_i - \bar{R}_i)^2}{n-1} = \frac{1034.8}{4}$$

$$\sigma_i^2 = 258.7$$

$$\sigma_i = \boxed{16.08\%}$$

$$\sigma_m^2 = \frac{\Sigma (R_m - \bar{R}_m)^2}{n-1} = \frac{790}{4} = 197.5$$

$$\sigma_m = \boxed{14.05\%}$$

$\sigma_i^2 = 258.7$ $\sigma_m^2 = 197.5$ $COV_{(i,m)} = \frac{219}{4} = 54.75$

$\sigma_i = 16.08$ $\sigma_m = 14.05$ $\beta_i = \frac{COV_{(i,m)}}{\sigma_m^2} = \frac{54.75}{197.5} = \boxed{0.28}$

(d) Regression Line of Dependent Variable on Independent Variable

Regression Line of Y on X

$Y = \alpha + \beta X + e \leftarrow$ Residual Error

Alpha Beta

$\alpha = \bar{R}_i - \beta(\bar{R}_m)$

$= 13.8 - (0.28 \times 4)$

$\boxed{= 12.68}$

$Y = 12.68 + 0.28 X \leftarrow$ (Return of Xerox)

Return of S&P 500

Regression Equation $Y = 12.68 + 0.28X$

Return of xerox — Return of S&P 500 (Independent)

(d) Return of xerox = 17.7%

Market Return = 14%

Putting Values in Regression Eq. $Y = 12.68 + 0.28(14)$

$= 12.68 + 3.92$

Return of xerox in Yr. 6 $\boxed{= 16.6\%}$

b) Total Variance of Xerox $\sigma_i^2 = \underline{258.7}$

b)(ii) The proportion explained & not explained by Market.

→ Proportion of Total Risk which can be explained is calculated by $\underline{r^2}$ (Coeffient of Determination)

→ Proportion which can not be explained is $1 - r^2$

$$r = \frac{COV_{(i,m)}}{\sigma_m \times \sigma_i} = \frac{54.75}{16.08 \times 14.05} \boxed{= 0.25}$$

$r^2 = (0.25)^2 = 0.0625 \times 100 = 6.25\%$ Proption that is explained by S&P 500

$1 - r^2 = 0.9375 \times 100 = 93.75\%$ proportion not Explained.