

Upper Limit =  $\mu_r + \sigma t$  (t depends on two factors)

Degree of Freedom df =  $n_1 + n_2 - 1$   
=  $11 + 8 - 1 = 18$

Level of significant (%)

**5%**

Upper Limit =  $10.26 + 2.06 \times 2.101$   
= 14.588

Lower Limit =  $10.26 - 2.06 \times 2.101$   
= 5.932



Since actual run (8) is in the range, hence market is weak form of efficient market.

**10%**

Upper Limit =  $10.26 + 2.06 \times 1.734$   
= 13.832

Lower Limit =  $10.26 - 2.06 \times 1.734$   
= 6.688

Since actual run (8) is in the range, hence market is weak form of efficient market.

**Question – 52**

Mr. X is of the opinion that market has recently shown the Weak Form of Market Efficiency. In order to test the validity of his impression he has collected the following data relating to the movement of the SENSEX for the last 20 days.

Days	Open	High	Low	Close
1	33470.94	33513.79	33438.03	33453.99
2	33453.64	33478.11	33427.82	33434.83
3	33414.06	33440.29	33397.65	33431.93
4	33434.94	33446.18	33377.78	33383.41
5	33372.92	33380.27	33352.12	33370.93
6	33375.85	33389.49	33331.42	33340.75
7	33340.89	33340.89	33310.95	33330.98
8	33326.84	33340.91	33306.17	33335.08
9	33307.16	33328.22	33296.43	33301.97
10	33298.64	33318.60	33254.28	33259.03
11	33260.04	33228.85	33241.66	33251.53
12	33255.92	33289.46	33249.46	33285.89
13	33288.86	33535.67	33255.98	33329.28
14	33335.00	33346.21	33276.72	33284.17
15	33293.83	33310.86	33278.54	33298.78
16	33300.02	33337.79	33300.02	33325.38
17	33323.36	33356.34	33322.44	33329.95
18	33322.81	33345.98	33317.44	33319.67
19	33317.51	33321.18	33294.19	33302.32
20	33290.86	33324.96	33279.62	33319.61

You are required:

To test the **Weak Form of Market Efficiency** using Auto-Correlation test, taking time lag of 10 days.

**(Exam January - 2018)**

**Solution:**

Days	x	(x - $\bar{x}$ )	(x - $\bar{x}$ ) <sup>2</sup>	y	(y - $\bar{y}$ )	(y - $\bar{y}$ ) <sup>2</sup>	(x - $\bar{x}$ )(y - $\bar{y}$ )
1	-19.16	2.50	6.25	34.36	26.80	718.24	67
2	-2.90	18.76	351.94	43.59	35.83	1283.79	672.17
3	-48.52	-26.86	721.46	-45.11	-52.67	2774.13	1414.71
4	-12.48	9.18	84.27	14.61	7.05	49.70	64.71
5	-30.18	-8.52	72.59	26.60	19.04	362.52	-162.22
6	-9.77	11.89	141.37	4.57	-2.99	8.94	-35.55
7	4.10	25.76	663.58	-10.28	-17.84	318.27	-459.55
8	-33.11	-11.45	131.10	-17.35	-24.91	620.51	285.21
9	-42.94	-21.28	452.84	17.29	9.73	94.67	-207.05
	<b>-194.96</b>		<b>2625.4006</b>	<b>68.08</b>		<b>6230.7686</b>	<b>1637.98</b>

$$\bar{x} = \frac{-194.96}{9} = -21.66$$

$$\sigma_x = 17.079$$

$$\bar{y} = \frac{68.08}{9} = 7.56$$

$$\sigma_y = 26.3117$$

$$\text{Cov}_{xy} = \frac{1637.98}{9} = 181.997$$

$$r_{xy} = \frac{\text{COV}_{xy}}{\sigma_x \times \sigma_y} = \frac{181.97}{17.079 \times 26.3117} = 0.405$$

Since correlation is not zero hence market is not weak form of efficient.

### **SHARPE OPTIMIZATION MODEL**

#### **Question – 53**

Ramesh wants to invest in stock market. He has got the following information about individual securities:

Security	Expected Return	Beta	$\sigma^2_{cl}$
A	15	1.5	40
B	12	2	20
C	10	2.5	30
D	09	1	10
E	08	1.2	20
F	14	1.5	30

Market index variance is 10 percent and the risk free rate of return is 7%. What should be the optimum assuming no short sales?

**(SM TYK – 35)**

**Solution:**

**Step 1: Calculate treynor's ratio & give rank highest to lowest**

$$\text{Treynor's ratio} = \frac{E_R - R_f}{\beta}$$

Stock	$\frac{E_R - R_f}{\beta}$	Rank
A	5.33	I
B	2.50	III
C	1.20	V
D	2.00	IV
E	0.833	VI
F	4.667	II

Stock	TP	Bi	$\sigma e_1^2$	$\frac{\beta^2}{\sigma e_1^2}$	$\left(\frac{E_R - R_f}{\sigma e_1^2}\right) \beta$	Cum.6	Compilation 5	
A	5.33	1.5	40	0.056	0.30	0.30	0.056	CA = 1.923
F	4.667	1.5	30	0.075	0.35	0.65	0.131	CF = 2.814
B	2.50	2	20	0.20	0.50	1.15	0.331	CB = 2.668
D	2.00	1	10	0.10	0.20	1.35	0.431	CD = 2.542
C	1.20	2.5	30	0.208	0.25	1.60	0.639	CC = 2.165
E	0.833	1.2	20	0.072	0.06	1.66	0.711	CE = 2.047

**Step 2: Calculation of Cut off Point**

$$C = \frac{\sigma_M^2 \times \sum \left( \frac{E_R - R_f}{\sigma e_1^2} \right) B_i}{1 + \left( \sigma_M^2 \times \sum \frac{B_i^2}{\sigma e_1^2} \right)}$$

$$CA = \frac{10 \times 0.30}{1 + (10 \times 0.056)} = 1.923$$

$$CF = \frac{10 \times 0.65}{1 + (10 \times 0.131)}$$

**Step 3:** Select the stock having Treynor's Ratio is more than highest cut off  
 Stock A & F should be selected because Treynor's Ratio is more than 2.814

**Step 4:** calculation of weights of stock & stock F

$$Z_i = \frac{B_i}{\sigma e_1^2} \left( \frac{E_R - R_f}{B_i} - \text{Cut off} \right)$$

$$Z_A = \frac{1.5}{40} (5.33 - 2.814) = 0.0943$$

$$Z_F = \frac{1.5}{30} (4.67 - 2.814) = 0.0928$$

$$W_A = \frac{0.0943}{0.0943 + 0.0928} = 0.504 \text{ [50.40\%]}$$

$$W_f = 1 - 0.504 = 0.496 \text{ [49.60\%]}$$

**MULTIPLE CHOICE QUESTIONS**

**Case Scenario 1**

Mr. A is interested in investing ₹ 1,00,000 for which he is considering following three alternatives:

- (1) Invest ₹ 1,00,000 in mutual fund X (MFX)
- (2) Invest ₹ 1,00,000 in mutual fund of Y (MFY)
- (3) Portfolio- invest ₹60,000 in mutual fund X (MFX) and ₹ 40,000 in mutual fund Y (MFY)

Average annual return earned by MFX and MFY is 12% and 11% respectively. risk free rate of return is 8% and market rate of return is 10%

Covariance of return of MFX, MFY and market portfolio mix are as follow:  
MFX

	MFX	MFY	Portfolio
MFX	4.400	4.300	3.700
MFY	4.300	4.200	2.800
Portfolio	3.370	2.800	4.200

Based on the above information answer the following questions:

I. Standard deviation of MFX is \_\_\_\_\_

Answer-1 : 2.0736

Answer-2 : 2.0976

Answer-3 : 1.8358

Answer-4 : 2.0494

II. Portfolio return would be\_\_\_\_\_

Answer-1 : 11.00 %

Answer-2 : 12.00%

Answer-3 : 11.50%

Answer-4 : 11.60%

III. Based on standard deviation, the optimum investment for Mr. A would be\_\_\_\_\_

Answer-1 : Portfolio

Answer-2 : All investment in MFX

Answer-3 : All investment in MFY

Answer-4 : Both MFY and mix are indifferent

**Case Scenario 2**

Two friend Mr. A and Mr. N were discussing about the risks of market. While Mr. A is sort of risk averse, Mr. N is an aggressive investor and believes in taking risk.

Mr. N said we cannot diversify the market risk at all, and he quoted the Modern Portfolio Approach. Both friends analyze the market data for the few months and came out with expected returns on two stocks for a particular market.

Market Return	Aggressive	Defensive
7%	4%	9%
25%	40%	18%

**Based on above scenario, answer the following questions:**

I. The Beta of Defensive stock is.....

(a) 2

(b) 0.5

(c) 4

- (d) 1
- II. If the market return is equally likely to be 7% or 25% then expected return of Aggressive stock shall be.....
- (a) 18%
- (b) 13.50%
- (c) 22%
- (d) 11%
- III. The Alpha of the Defensive stocks is.....
- (a) -10%
- (b) 22%
- (c) 5.50%
- (d) 12%
- IV. The Modern Portfolio Theory was propounded by .....
- (a) William Sharpe
- (b) Black Scholes
- (c) Stephen Ross
- (d) Harry Markowitz
- V. As per Capital Market Line (CML) Theory the Portfolios lying on the CML over the market portfolio are called .....
- (a) Lending Portfolios
- (b) Borrowing Portfolios
- (c) Diversified Portfolios
- (d) Risk- Free Portfolios

**Case Scenario 3**

Mr. Abhishek is interested in investing ₹ 2,00,000 for which he is considering following three alternatives:

- (i) Invest ₹ 2,00,000 in Mutual Fund X (MFX)
- (ii) Invest ₹ 2,00,000 in Mutual Fund Y (MFY)
- (iii) Invest ₹ 1,20,000 in Mutual Fund X (MFX) and ₹ 80,000 in Mutual Fund Y (MFY)

Average annual return earned by MFX and MFY is 15% and 14% respectively. Risk free rate of return is 10% and market rate of return is 12%.

Covariance of returns of MFX, MFY and market portfolio Mix are as follow:

	<b>MFX</b>	<b>MFY</b>	<b>Mix</b>
<b>MFX</b>	4.800	4.300	3.370
<b>MFY</b>	4.300	4.250	2.800
<b>Mix</b>	3.370	2.800	3.100

I. Variance of Market

- (a) 4.800
- (b) 3.370
- (c) 4.250
- (d) 3.100

II. Portfolio standard Deviation

- (a) 2.115
- (b) 3.100
- (c) 2.800
- (d) 1.725

III. Systematic Risk of Portfolio

- (a) 3.663
- (b) 2.528
- (c) 2.800
- (d) 3.181

IV. Based on standard deviation, the optimum investment for Mr A would be.....

- (a) Portfolio
- (b) All investment in MFX
- (c) All investment in MFY
- (d) Both MFY and mix are indifference

V. Standard Deviation of MFX

- (a) 2.191
- (b) 2.071
- (c) 1.761
- (d) 1.433

VI. Portfolio Return would be

- (a) 13.50%
- (b) 14.60%
- (c) 15.50%
- (d) 18.60%

**Case Scenario 4**

Stock	ER	Beta	Specific Risk	TR
A	18%	1.2	5%	?
B	10%	0.5	4%	?
C	?	1.4	7%	22%

Assuming CAPM holding good.

I. Total Risk (SD) of Stock A

(A) 55.25

(B) 15.25

(C) 18.56

(D) 9.45

II. Total Risk (SD) of Stock B

(A) 8.45

(B) 76.24

(C) 8.45

(D) 14.35

III. Expected Return of Stock C

(A) 15

(B) 14.90

(C) 8.45

(D) 20.28