

NPTEL  
INDUSTRIAL AND MANAGEMENT ENGINEERING DEPARTMENT, IIT KANPUR  
QUANTITATIVE FINANCE  
ASSIGNMENT-1 (2015 JULY-AUG ONLINE COURSE)

NOTE THE FOLLOWING

- 1) There are six questions and you are required to answer all of them.
- 2) Deadline for submission is Wednesday; 8<sup>th</sup> July, 2015
- 3) The total marks is 60.
- 4) To get full credit do your calculations carefully.

Question # 1:

- (a) If you are given the following utility function  $U(W) = e^{a*W} + b*W + c$ ; ( $a > 0$ ,  $b \neq 0$  and  $c \neq 0$ ), then:
- i) What can you comment regarding the absolute and relative risk aversion for the above utility function?
  - ii) What restriction should you place on  $W$ ?

- (b) Consider the data provided below:

Number of outcomes	Value per outcome	Decision X	Decision Y	Decision Z
2	10	Yes	Yes	No
4	8	No	Yes	Yes
6	6	Yes	Yes	Yes
8	4	No	Yes	Yes
10	2	Yes	Yes	No

Rank the decisions if you know that  $U(W) = -4*W + W^2$ .

Question # 2:

An individual with initial wealth of ₹1000 has a 20% chance of getting in an accident. If he gets in an accident, he will lose ₹800, leaving him with ₹200; if he doesn't, he loses nothing. He maximizes expected utility, and his VNM utility function is  $u(w) = \sqrt{w}$ .

- (a) What is the  $u''(w)$ , i.e., the second derivative of this person's utility function?
- (b) What is the expected amount of money he will lose? What is his expected wealth?
- (c) What is his expected utility?
- (d) What is his certainty equivalent wealth, i.e., the certain wealth level that gives him the same expected utility as his uncertain situation?
- (e) What is the maximum amount he would pay for full insurance, i.e. what is the maximum premium he would pay an insurance company to cover all of his losses?
- (f) What is his risk premium, i.e., how much more than his expected loss is he willing to pay for full insurance?
- (g) How do your answers to the above questions change if his utility function is  $u(w) = 3\sqrt{w} + 20$  instead of  $u(w) = \sqrt{w}$ . Explain.

**Question # 3**

(a) Consider the data as given below and answer the following:

Security	Expected return	Standard deviation
A	10%	5%
B	4%	2%

- (i) For different combinations of A and B, show the plots of the two securities in the risk-return space, assuming values of correlation coefficients to be +1.0 and -1.0.
- (ii) For each of the two values of correlation coefficient what is the combination of A and B, which yields the minimum variance for the portfolio? Remember the portfolio consists of A and B security only.
- (iii) What are the values of those minimum variances?

(b) There are two efficient portfolios denoted by A and B respectively. The return and risk of the two portfolios are as follows:  $\bar{r}_A=15\%$  and  $\sigma_A = 5\%$ ;  $\bar{r}_B=25\%$  and  $\sigma_B = 15\%$ . Assume that the correlation coefficient between the portfolios is - 0.5. (i) What will the efficient frontier look like? Show it very clearly and legibly using a diagram. (ii) What is the risk of the efficient portfolio, which has a return of 20%? (iii) Can you find out the MVP if you know that SS is allowed?

**Question # 4**

(a) Given below are the returns and standard deviations of the following:

	Rate of return (%)	Standard Deviation (%)
T-Bill	6.0	0
Stock P	10.0	14
Stock Q	14.5	28
Stock R	21.0	26

Draw clearly and legibly the four financial assets on the risk-return framework. Calculate the return and standard deviations and also draw the following portfolios: (i) 50% in T-Bill and 50% in stock P; (ii) 50% each in Q and R, assuming the shares have positive correlation.

(b) Given the data below find the risk and return of the optimal portfolio thus formed by these 3 assets, assuming the risk free interest rate ( $r_f$ ) is 10.

Asset	X	Y	Z	$\bar{r}_i$
X	16	14	22	25
Y	14	25	15	30
Z	22	15	09	15

Question # 5

You are given the following information, such that you are required to form the optimal portfolio consisting of assets A1 to A5 in some proportions. Assume SS is allowed.

Asset	A1	A2	A3	A4	A5	$\bar{r}_i$
A1	2.50	1.00	0.50	0.75	-0.25	18.00
A2	1.00	1.00	0.85	-0.50	-0.60	10.00
A3	0.50	0.85	1.50	0.00	1.25	15.00
A4	0.75	-0.50	0.00	0.90	0.25	8.00
A5	-0.25	-0.60	1.25	0.25	1.20	12.00

Question # 6

- (a) Choose the right answer giving adequate reasons/logic:  
To delineate the efficient frontier we need the concept(s)/property (ies) of:
- (i) risk-aversion only
  - (ii) non-satiation only
  - (iii) risk-aversion and non-satiation both and both of them taken together are sufficient
  - (iv) risk-aversion and non-satiation both and both of them taken together are insufficient
- (b) Diversification would always lead to a portfolio with zero risk. Answer whether this is true or false giving adequate reasons.
- (c) When you solve the Lagrangian ( $\lambda = 0$  and  $\mu = 1$ ) you always get the MVP. Answer whether this is true or false, giving adequate reasons.
- (d) Non-normalized weights can be greater than one when we have SS. Why? Answer giving adequate reasons.
- (e) Practically the T-Bill has some risk. If we consider this, then also the efficient frontier would be a straight line. Answer whether this is true or false, giving adequate reasons.