## MBA (FT)

A

### Paper MBAFT–6102 – QUANTITATIVE METHODS

(Admissions of 2010 and onwards)

*Time : 3 Hours*                                                    *Maximum Marks : 50*

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*Attempt any* **five** *questions.* **All** *questions carry equal marks.*

1.  Formulate the following problems as linear programming problems:

(a) A company uses nitrates, phosphates, potash, and an inert filler material, in the manufacture of chemical fertilizers. The firm mixes these four ingredients to make three basic fertilizers: 5-10-5, 5-8-8 and 8-12-12 (numbers represent percent by weight of nitrates, phosphates, and potash in each tonne of fertilizer). The company receives RS. 3500, Rs. 3750, and Rs.4000respectively, for each tone of 5-10-5, 5-8-8 and 8-12-12 fertilizer. The cost of ingredients is Rs 10000 per tonne of nitrates, Rs. 3000 per tonne of phosphates, Rs.5000 per tonne of potash, and Rs1000 per tonne of the inert filler material. The direct cost of mixing, packing, and sellingthe fertilizer is Rs. 1250 per tonne. The company has 1200 tonnes of nitrates, 2000 tonnes of phosphates, 1500 tonnes of potash, and an unlimited supply of the inert filler on hand. They will not receive additional chemicals until next month. The Managers of the company believe that they can sell or store at negligible cost for all fertilizer produced during the month. Determine the optimal product- mix.

(5)

(b) A Feed company makes two feed mixes of cattle. The first mix, Fertilex, requires at least twice as much barley as wheat. Wheat cost Rs. 1.50 per kg, and only 1000 kg are available this month; Barley costs Rs. 1.25 per kg, and, 1200 kg are available Fertilex sells for Rs. 1.80 per kg up to 99 kg, and each additional kg over 99 kg sells for Rs. 1.55. Bharat farms will buy any and all amount of both mixes which the Feed company will mix Set up a linear programming problem to determine the product mix that results in maximum profit.

(5)

2(a) Linear Programming is useful Management Science technique, but it has some limitations" Discuss it and give appropriate examples.

(4)

(b) A Company sells two types of porch furniture, gliders and chairs. It makes a profit of Rs.100 on each glider and Rs.40 on each chair. Each glider requires 40 square feet of display space and each chair requires 25square feet of display space. It takes one and half hours to assemble a glider and 2/3 hour to assemble a chair. The company has 900 square feet of display space and 30 hours of labour available for assembly. The sales manager wants at least two chairs displayed for every glider displayed. Formulate and solve the LP model

(6)

3.  Three food products are available at costs of Rs 10, Rs36 and Rs. 42 per unit, respectively. They contain 1000, 4000 and 2000 calories per unit, respectively, and 200, 900 and 500 protein units per unit, respectively. Required is the minimum cost diet containing at least 20000 calories and 3000 units of protein. Formulate and solve the problem. Write the dual and use it to check the optimal solution of the above problem. (10)

4. (a) Three machines are available to make 5000 units which are required for the internal use of a company as components to another product. If the production is to be made by any one of these machines, a set-up cost is incurred apart from the cost of making each unit of different machines the cost data are given below:

| Machine | Set-Up cost(Rs.) | Cost per Unit(Rs.) | Maximum production |
|---------|------------------|--------------------|--------------------|
| 1 | 8000 | 5 | 4000 |
| 2 | 5000 | 4 | 3000 |
| 3 | 4000 | 8 | 1000 |

What is the best production strategy? (5)

(b) A manufacturing company produces two products, each of which requires stamping, assembly, and painting operations. Total productive capacity by operation if it were devoted solely to one product or the other is :

| Operation | Product A | Product B |
|-----------|-----------|-----------|
| Stamping | 50 | 75 |
| Assembly | 40 | 80 |
| Painting | 90 | 45 |

Pro-rata allocation of productive capacity is permissible so that combinations of production of the two products are permissible. Demand for the two products is unlimited and the profits on A and B are Rs. 150 and Rs. 120, respectively. Determine the optimal product mix.

(A non-integer solution will not be accepted.) (5)

5(a) A market research firm used a sample of individuals to rate the purchase potential of a particular product before and after the individuals saw a new television commercial about the product. The purchase potential ratings were based on 0 to 10 scale, with higher values indicating a higher purchase potential. Test the hypothesis that the commercial improved the mean purchase potential rating. Use level of significance 5% and comment on the value of the commercial.

Individual:   1   2   3   4   5   6   7   8

Purchase rating: 6   6   7   4   3   9   7   6
 After

Purchase rating: 5   4   7   3   5   8   5   6       (5)
 Before

(b) Each day the major stock markets have a group of leading gainers in price (stocks that go up the most). On one day the standard deviation in the percent change for a sample of 12 NASDAQ leading gainers was 15.2. On the same day, the standard deviation in the percent change for a sample of 12 NYSE leading gainers was 8.9. Conduct a significance test for equal population variances to see whether it can be concluded that there is a difference in the volatility of the leading gainers on the two exchanges. What is your conclusion at 5% level of significance? (5)

6(a) The ABC Investment Company is in the business of making bids on investments offered by various firms that desire additional financing. The company has collected the following data on yearly investments and interest rates

| Year : | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|
| Yearly Investments: (thousands of dollars) | 1060 | 940 | 920 | 1110 | 1590 | 2050 | 2070 | 2030 | 1780 | 1420 |
| Average Interest rates(%): | 4.8 | 5.1 | 5.9 | 5.1 | 4.8 | 3.8 | 3.7 | 4.5 | 4.9 | 6.2 |

Is the relationship between these variables significant? If the average interest rate is 4% five years from now, can yearly investment be forecast? (5)

(b) Newspapers in India are complaining that rising level of Unemployment is affecting the level of crime in the country. To study this claim; a research team studied a random sample of 12 states in the country. For each state they measured the level of unemployment rate and the crime rate in the state. Then they did a ranking X=level of unemployment, Y=crime rate, the results are shown in the following table. Higher X ranks more unemployment, and higher Y ranks means higher crime rate. Test the claim of Newspapers.

| States: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Level of X Unemployment | 5 | 8 | 3 | 2 | 6 | 1 | 10 | 12 | 7 | 4 | 9 | 11 |
| Crime Rate Y | 8 | 6 | 9 | 12 | 7 | 10 | 2 | 1 | 5 | 11 | 4 | 3 |

(5)

7(a) The personnel department of a company is doing a study about job satisfaction. A random sample of 310 employees was given a test designed to diagnose the level of job satisfaction. Each employee's salary was also recorded in the table below. Use an appropriate significance test to determine if salary and job satisfaction are independent at 5% level of significance.

#### Salary Versus Job Satisfaction

| Satisfaction | Under Rs.200000 | $20000-$350000 | Over RS350000 |
|---|---|---|---|
| High | 20 | 20 | 10 |
| Medium | 100 | 65 | 35 |
| Low | 40 | 15 | 5 |

(5)

(b) Security investments use three methods to select stocks for their portfolio. Use Kruskal-Wallis test, at 5% level of significance, to determine if there is a significant difference in the rates of return for each method based on the following data.

| Portfolio | Rate of return | | | | | | |
|---|---|---|---|---|---|---|---|
| A | 29 | 17 | 14 | 28 | 27 | 22 | 22 |
| B | 27 | 20 | 13 | 15 | 22 | 21 | -- |
| C | 38 | 28 | 27 | 34 | 32 | --- | --- |

(5)

8(a)  A consulting firm bids for two large research projects A and B. The probability that it will get the project A is 60% and that it gets the project B is 50%. What is the probability that the company's bid will be successful only in any of the two projects?

(5)

(b)  A vending machine automatically pours soft drinks into cups. The amount of soft drink dispensed into a cup is normally distributed with mean 7.6 oz and standard deviation 0.4 oz.

(i)     Estimate the probability that the machine will overflow an 8 oz cup
(ii)    Estimate the probability that the machine will not overflow an 8 oz cup
(iii)   The machine has just been loaded with 850 cups. How many of these do you expect will overflow when served?

(5)

(100)****

[This question paper contains 4 printed pages.]

4224                                                          *Your Roll No. ..............*

**, MBA (FT)**                                                    **A**

Paper MBAFT-6103 – MANAGERIAL ECONOMICS

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*Time : 3 Hours*                                          *Maximum Marks : 50*

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## Question 1

(a). In the following two panels, the demand for good X shifts due to a change in income (Panel A) and a change in the price of a related good Y (Panel B). Holding the price of good X constant at USD 50, calculate the following elasticities:
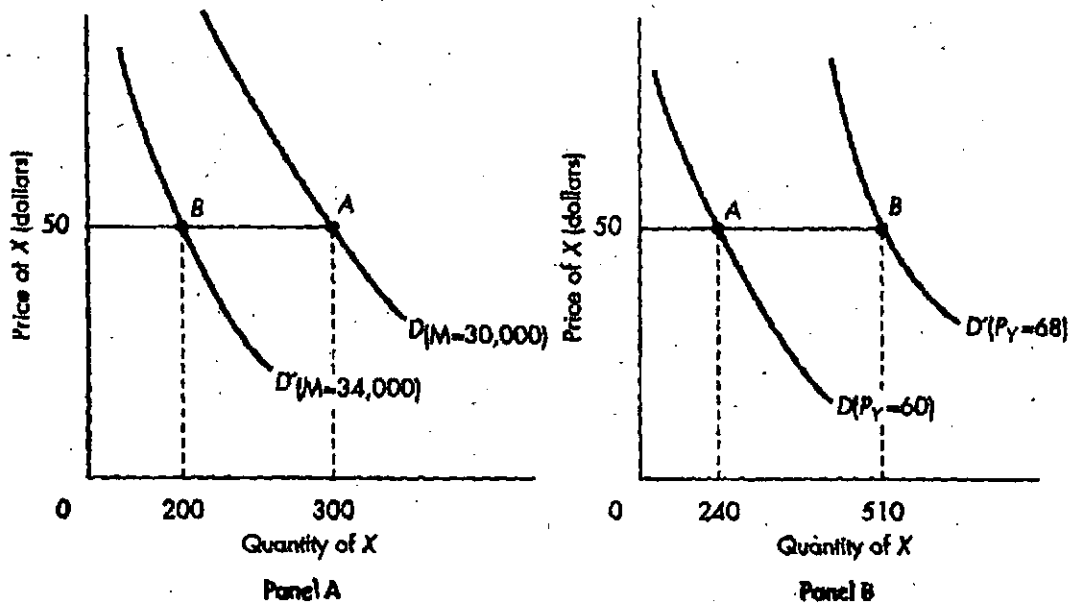


Panel A                                                    Panel B

i.   Panel A shows how the demand for X shifts when income increases from $30,000 to $34,000. Use the information in Panel A to calculate the income elasticity of demand for X. Comment on the nature of good X.

ii.  Panel B shows how the demand for X shifts when the price of related good Y increases from $60 to $68. Use the information in Panel B to calculate the cross-price elasticity. Comment on the nature of relationship between good X and good Y.

P.T.O.

(b) Suppose the demand for good X is

$Q = 20\ P^{-1}$

Find the Total Revenue when

- $P = Rs.1$
- $P = Rs.4$

## Question 2
### Part a

For each pair of price elasticities, which elasticity (in absolute value) is larger?

a. The price elasticity for carbonated soft drinks or the price elasticity for Coca-Cola
b. The price elasticity for socks (men's or women's) or the price elasticity for business suits (men's or women's).
c. The price elasticity for electricity in the short run or the price elasticity for electricity in the long run.

### Part b

Explain the concept of dead weight loss when tariff is imposed by the Government on the imported commodity.

## Question 3

a. What is the profit maximizing equilibrium condition? Why does a sales maximizing producer produce more than a profit maximizing producer? Illustrate the same using the TR-TC approach.
b. Comment whether the following statement is *true* or *false*. Give reasons for your answer.

   *"The rising portion of the firm's MC curve above the firm's AVC curve is the competitive firm's short run supply curve of the product".*

## Question 4

Given two isolated markets supplied by a single monopolist, let the two corresponding demand functions be:

$$P_1 = 12 - Q_1 \text{ and } P_2 = 20 - 3Q_2$$

Suppose the monopolist's total cost function is

$$TC = 3 + 2(Q_1 + Q_2)$$

What will the price and output be if the monopolist
- *Cannot discriminate*
- *Can discriminate*

Illustrate the same graphically also.

## Question 5

### Part a

Given the production function and input prices as:

$$Q = 100K^{0.5}L^{0.5}$$

Price of labour = 30
Price of capital = 40

And assuming that the producer has only Rs.1000 to spend, derive the firm's optimal input combination of labour and capital. Represent the same graphically also.

### Part b

Consider the following Cobb-Douglas production function for the public transportation system in the city:

$$Q = \alpha L^{\beta_1} F^{\beta_2} B^{\beta_3},$$

(Where, Q = output, L = labor, F = fuel, B = capital).

Suppose the parameters $(\alpha, \beta_1, \beta_2, \beta_3)$ of this model were estimated using annual data for the past 25 years, and the following results were obtained: $\alpha = 0.0012$, $\beta_1 = 0.45$, $\beta_2 = 0.20$, $\beta_3 = 0.30$.

a) Determine the capital input production elasticity.
b) Determine the % change in output if labor is increased by 2% (other inputs held constant).
c) What type of returns of scale appears to characterize the transportation system?

## Question 6

Alpha and Beta, two oligopoly rivals in a duopoly market, choose prices of their products on the first day of the month. The following payoff table shows their monthly pay-offs resulting from the pricing decisions they can make.

4

$300

Alpha's price

|  | High | Low |
|---|---|---|
| **High** | A $200, $300 | B $50, $350 |
| **Low** | C $300, $150 | D $75, $200 |

Beta's price

a. Is the pricing decision facing Alpha and Beta a prisoners' dilemma? Why or why not?
b. What is the cooperative outcome? What is the non-cooperative outcome?
c. Which cell(s) represents cheating in the pricing decision? Explain.
d. If Alpha and Beta make their pricing decision just one time, will they choose the co-operative outcome? Why or why not?

(100)****