**INSTITUTE OF COST AND MANAGEMENT ACCOUNTANTS OF PAKISTAN**

SPRING (SUMMER) 2008 EXAMINATIONS

Saturday, the 24th May, 2008

## BUSINESS MATHEMATICS & STATISTICS – (S-203)

Stage- 2

Time Allowed – 2 Hours 45 Minutes | Maximum Marks – 80

(i) Attempt ALL questions.

(ii) Answers must be neat, relevant and brief.

(iii) In marking the question paper, the examiners take into account clarity of exposition, logic of arguments, effective presentation, language and use of clear diagram / chart, where appropriate.

(iv) Read the instructions printed on the top cover of answer script CAREFULLY before attempting the paper.

(v) Use of non-programmable scientific calculators of any model is allowed.

(vi) DO NOT write your Name, Reg. No. or Roll No. anywhere inside the answer script.

(vii) Question No.1 – "Multiple Choice Question" printed separately, is an integral part of this question paper.

## SECTION - A

**Marks**

**Q. 2** **(a)** A grocer wants to mix two types of nuts, Rs.4 per kilogram of type-A and Rs.7 per kilogram of type-B. In order to make a mixture which could sell for Rs.5 per kilogram. How many kilograms of each should be mixed to get a mixture of 42 kilograms? 03

**(b)** Given the equation $x_1 - 3x_2 + 4x_3 - 2x_4 = -60$

(i) What values that satisfy the equation when $x_1 = 20$, $x_2 = 6$ and $x_3 = -4$? 02

(ii) Determine all elements of the solution set if three variables $x_1$, $x_2$, and $x_3$ equal to zero. 02

**(c)** The total cost of producing $x$ units of a product is estimated by the cost function:

$$C = f(x)=60x + 0.2x^2 + 25{,}000$$

Where C equals to the total cost measure in rupees.

**Required:**

(i) Identify the class of this function. 01

(ii) Calculate the cost associated with producing 25,000 units. 02

(iii) Calculate the cost associated with producing zero units, explain the term might be used to describe this cost. 02

PTO

**Marks**

**(d)** Determine the indefinite integral of the following:

(i) $\int (2x-3)\,(3x-1)^4\,dx$ (using by parts). 03

(ii) $\int \left(\frac{3x^2-2x+5}{x^3-9x}\right) dx$ (using partial fractions). 03

**(e)** The nominal interest rate on an investment is 12% per year. Determine the effective annual interest rate if interest is compounded bimonthly. 02

**Q. 3** **(a)** The function $f(x) = -6x^2 + 3x - 1$,

**Determine:**

(i) derivative of $f(x)$ using limit approach; 02

(ii) the slope when $x = 1$ and $x = -2$. 02

**(b)** Use linear interpolation to estimate the actual rate of return for the following project: 06

| | **(Rupees)** |
|---|---|
| Initial Investment | 100,000 |
| Cash inflows | |
| Year 1 | 20,000 |
| Year 2 | 20,000 |
| Year 3 | 20,000 |
| Year 4 | 20,000 |
| Year 5 | 20,000 |
| Year 6 | 20,000 |
| Total cash inflows | 120,000 |

Assume that cash inflows occur at the end of each year.

**(c)** Find a (3 x 4) matrix A for which: 05

$$a_{ij} = \begin{cases} 2i + j & \text{if } i = j \\ 3i - 2j & \text{if } i \neq j \end{cases}$$

**(d)** Pipe pieces each 25 centimeters in diameter and 12 meters in length are required for a gas pipe line. In the supply yard the pipes are stacked in layers with each layer containing one less pipe piece than the layer beneath it. If one stack contains 10 layers with 28 pipe pieces in the top layer, does the yard contain enough pipe pieces to complete a three and a half kilometers long pipe line? [Explain your working and give reasons]. 05

## SECTION-B

Marks

**Q. 4** **(a)** In a poker hand consisting of 5 cards, find the probability of holding:

(i) exactly 2 kings 02

(ii) at least 3 queens 02

(iii) at most 2 aces; 02

**(b)** A candidate is contesting for both National and Provisional assembly seats. The probability that he will win the national assembly seat is 5/8 and he will win the provisional assembly seat is 7/12. What is the probability that he will lose both the seats. 04

**Q. 5** **(a)** Define:

(i) Rule of permutation. 02

(ii) Rule of combination. 02

**(b)** Mean and variance of a sample of 10 observations are 15 and 50 respectively. If one observation which is 10, is replaced by 20. Find out correct (new) mean and variance. 03

**(c)** A firm that manufactures bolts expects that 10% of its output is defective in some way. Find the probability that in a sample of 10 bolts there are at least 6 non-defective bolts. 03

## SECTION – C

**Q. 6** **(a)** (i) Define CPM. How it is useful in project planning phase? (discuss any three uses/activities). 02

(ii) What is the total float of activities lying on critical path? 03

**(b)** Solve the following quadratic problem: 05

Maximize $Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$ subject to

$$x_1 + 2x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

PTO

**Marks**

**Q. 7** The dietitian at a local penal institution is preparing the menu for tonight's light meal. Two food items will be served at the meal. The dietitian is concerned about achieving the minimum daily requirement of three vitamins. Ingredients of food 1 and 2 are given below:

**Food 1 contains:**

3mg per oz vitamin 1,
4mg per oz vitamin 2 and
4mg per oz vitamin 3.

**Food 2 contains:**

2mg per oz vitamin 1,
5mg per oz vitamin 2 and
4mg per oz vitamin 3.

Minimum daily requirements of vitamin 1, 2 and 3 are 60mg, 90mg and 100mg, respectively. Cost per oz of two foods (Food 1 and Food 2) are Rs.10 and Rs.15 per unit respectively.

**Required:**

**(a)** Formulate the linear programming model for determining the quantities of the two foods which will minimize the cost of the meal ensuring that minimum requirements of all three vitamins are met. 05

**(b)** Solve the Linear Model using "corner point method". 05

**THE END**