

INSTITUTE OF COST AND MANAGEMENT ACCOUNTANTS  
OF PAKISTAN

PROFESSIONAL-I EXAMINATION-SPRING (SUMMER), 2004

Tuesday, the 25th May, 2004

1247

QUANTITATIVE METHODS

Time Allowed – 3 Hours

Maximum Marks–100

- (i) Attempt SIX questions including compulsory question No. 1 & 2 carrying 20 marks each. All other questions carry 15 marks each.
- (ii) Show computations where necessary.
- (iii) Answer must be neat, relevant and brief.
- (iv) In marking paper, the examiners take into account clarity of exposition, logic of arguments, effective arrangement, presentation, and use of clear diagram/chart and formula, where appropriate.
- (v) Read the instructions printed on the top cover of answer script CAREFULLY before attempting the paper.
- (vi) Use of non-programmable scientific calculators of : 0 Casio fx-82 LB, 0 Casio fx-82 Super, 0 Casio fx-350 D, 0 Casio fx-350 HA models is allowed.
- (vii) DO NOT write your Name, Reg. No. or Roll No. anywhere inside the answer script.

|   | Marks |
|---|-------|
| Q. 1 Choose the correct answer from the following :   | 20    |
| (i) After simplification, the expression $\left(3\frac{3}{4} - \frac{2}{3} \times \frac{3}{4} + \frac{7}{8} \div 1\frac{3}{4}\right)$ is equal to : |       |
| (a) $1\frac{23}{28}$ (b) $\frac{204}{343}$ (c) $3\frac{3}{4}$ (d) none of these   |       |
| (ii) For binomial distribution with $n=9$ , $p=0.5$ the standard deviation is :   |       |
| (a) 1.5 (b) 4.5 (c) 18 (d) none of these  |       |
| (iii) A retailer makes a profit of Rs. 0.375 on cost. The cost of an article he sells for Rs. 8.25 is :   |       |
| (a) Rs. 6.000 (b) Rs. 7.875 (c) Rs. 8.628 (d) none of these   |       |

P.T.O.

(iv) For normal distribution with mean zero and variance one, the area below 1.96 is :

- (a) 0.025 (b) 0.500 (c) 0.975 (d) none of these

**Note : (The value for a z score of 1.96 is 0.4750).**

(v) A wholesaler allows a retailer 25% trade discount and 5% cash discount. The cash price of an article with the catalogue price of Rs. 36 will be :

- (a) Rs. 25.20 (b) Rs. 23.75 (c) Rs. 25.65 (d) none of these

(vi) Partial derivative  $f_x$  of function  $f(x,y) = 5x + 6y$  is :

- (a) 5 (b) 6 (c) 5/6 (d) 6/5

(vii)  $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$  equals :

- (a) 0 (b) 2 (c) 4 (d) infinity

(viii) If  $\log_8(64) = 6$ , then  $\log_{25}(256)$  is :

- (a) 12 (b) 4 (c) 16 (d) none of these

(ix) On the rectangular coordinate system the distance of a point (3, 4) from origin is :

- (a) 5 (b) 3 (c) 4 (d) none of these

(x) If 6 men reap a farm in 15 days, working 12 hours a day, then 9 men working 10 hours a day will do the job in :

- (a) 12 days (b) 18 days (c) 27 days (d) none of these

Q. 2 (a) Determine the slope-intercept form of the linear equation, given that it passes through the points (-4, 5) and (-2, -3). 5

(b) Given the equation, 4

$$(-x+3y)/2 = 10 - 2x$$

Rewrite the equation in slope-intercept form and determine the slope and y intercept and interpret them.

- (c) Solve the following system of equations by the Gaussian elimination method :

8

$$5x + 20y = 25$$

$$4x - 7y = -26$$

- (d) Determine the roots of the equation,

3

$$V^2 - \frac{13}{8}V + \frac{15}{32} = 0$$

- Q. 3 (a) The demand function for a product is :

$$q_d = p^2 - 90p + 2025 \quad 0 \leq p \leq 45$$

Where  $q_d$  equals the number of units demanded and  $p$  equals the price per unit, stated in rupees.

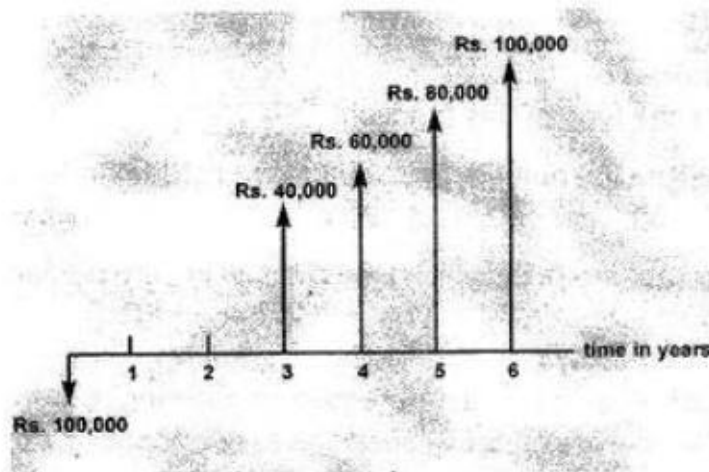
**Required :**

- (i) State the type of this function. 2
- (ii) Calculate the number of units that will be demanded at a price of Rs. 30. 2
- (iii) Calculate the price which would result in zero demand for the product. 2
- (b) A group of engineers is interested in forming a company to produce smoke detectors. They have developed a design and estimate that variable cost per unit including materials, labour and marketing costs are Rs. 22.50. Fixed costs associated with the formation, operation, and management of the company and the purchase of the equipment and machinery total Rs. 250,000. They estimate that the selling price will be Rs. 30 per detector.

**Required :**

- (i) Determine the number of smoke detectors which must be sold to break even. 2
- (ii) Preliminary marketing data indicate that the firm can expect to sell approximately 30,000 smoke detectors over the life of the project if the detectors are to be sold for Rs. 30 per unit. Determine the expected profit at this level of output. 3

- (c) A plank of wood, 4 meters long, 20 centimeters wide, and 5 centimeters thick, weighs 32 kilograms. Find the weight of one cubic decimeter of wood. 4
- (a) An investment of Rs. 100,000 earns an interest of 6% compounded semi-annually. If all interests are reinvested what will the investment be after 5 years? 4
- (b) How much money must be invested at the end of each quarter if the object is to accumulate Rs. 1,500,000 after 10 years? Assume that the investment earns interest at the rate of 8% per year compounded quarterly. How much interest will be earned? 4
- (c) Consider the cash flow pattern illustrated in the following figure : 7



**Required :**

Calculate the Net Present Value at 14% per year minimum rate of return. Also determine whether the investment in project satisfies the minimum desired rate of return.

**Note :** (Present value factors at 14% for year 3, 4, 5 and 6 are 0.67497, 0.59208, 0.51937 and 0.45559 respectively).

- (a) Suppose we are playing a game in which each player involves the flip of a coin, followed by roll of a die. Construct the tree diagram which enumerates all possible outcomes. How many combined outcomes are there? 4
- (b) A card is selected at random from a well shuffled deck of 52 cards. Find the probability that the card selected is a king or a spade. 3

(c) The Central Board of Revenue (CBR) estimates the probability of an error in personal income tax returns to be 0.30. Suppose an experiment is conducted in which three (3) returns are selected at random for purpose of an audit, determine all possible outcomes and the probabilities of these outcomes.

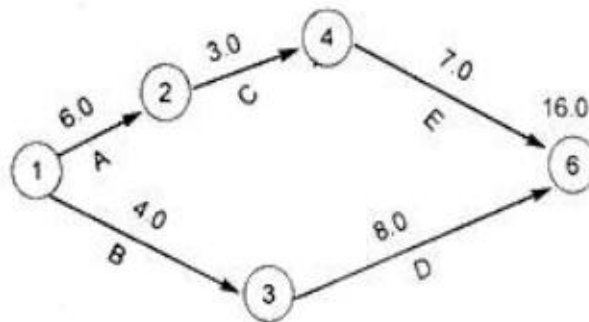
6

(d) Six football teams compete in a particular event. Assuming no ties, how many different end-of-season rankings are possible in the event ?

2

Q 6 (a) Determine the minimum length (time) at the lowest possible direct cost for the project given below using the CPM (Method).

9



| Activity | Normal Time (weeks) | Crash Time (weeks) | Normal Cost (Rupees) | Crash Cost (Rupees) |
|----------|---------------------|--------------------|----------------------|---------------------|
| A        | 6.0                 | 4.0                | 10,000               | 14,000              |
| B        | 4.0                 | 3.0                | 5,000                | 8,000               |
| C        | 3.0                 | 2.0                | 4,000                | 5,000               |
| D        | 8.0                 | 6.0                | 9,000                | 12,000              |
| E        | 7.0                 | 4.0                | 7,000                | 8,000               |

(b) Write down the formula(s) for the following :

(i) The expected time for an activity in PERT.

2

(ii) Standard Deviation of an activity in PERT.

2

(iii) Earliest Finish Time and Latest Start Time.

2

P.T.O.

(a) Find the indicated limit.

$$(i) \lim_{x \rightarrow 2} \frac{x-2}{x^2-x-2}$$

2

$$(ii) \lim_{x \rightarrow +\infty} \frac{5x}{x+3}$$

2

$$(iii) \lim_{x \rightarrow -4} \frac{x^2-16}{x+4}$$

2

(b) For the following functions determine the average rate of change in the values of  $y$  in moving from  $X = -1$  to  $x = 2$

$$(i) y = f(x) = 5x^3$$

2

$$(ii) y = f(x) = \frac{x^2}{x+4}$$

2

(c) Find  $f'(x)$ , for the following :

$$(i) f(x) = \frac{1}{4x^5 - 3x^2 + 1}$$

2

$$(ii) f(x) = \frac{\ln x}{e^{x^2}}$$

3

(a) Evaluate the following definite integrals :

$$(i) \int_1^3 \frac{6x^2}{x^3+6} dx$$

3

$$(ii) \int_2^4 \frac{-12x^2}{2x^3+3} dx$$

3

- (b) An automobile manufacturer estimates that the annual rate of expenditure  $r(t)$  for maintenance on one of its models is represented by the function :

$$r(t) = 120 + 8t^2$$

where  $t$  is the age of the automobile stated in years and  $r(t)$  is expenditure, measured in rupees per year.

**Required :**

- (i) At what annual rate are maintenance costs being incurred when the car is 4 years old ? 2
- (ii) What are total maintenance costs expected to be incurred during the first 3 years ? 3
- (c) The probability density function for a continuous random variable 'x' is : 4

$$f(x) = \frac{2+x}{30} \quad 0 \leq x \leq 6$$

**Required :**

Determine the probability that  $x$  will assume a value greater than 2.

THE END