P4–Exam.–1st Half –2017–50

Con. 539–18.

DN–5186

(3 Hours)

[Total Marks : 80

N.B. : (1) Question No. **1** is **compulsory.**

(2) Attempt any **three** questions from Q.2 to Q.5.

(3) Scientific **non-programmable** handheld calculator is **allowed**.

1. Rewrite the following statements with correct option. (any **Ten**) :– 20

(i) A bank offers 5% compound interest calculated on half-yearly basis. A customer deposits Rs. 1600 each on 1st January and 1st July of a year. At the end of the year, the amount he would have gained by way of interest is:

(a) Rs. 120 (b) Rs. 121 (c) Rs. 123 (d) Rs. 122

(ii) $\lim_{x \to \infty} \dfrac{x^3 + x^2 + x + 1}{x^3 + 3x^2 + 5x + 2}$ is equal to

(a) 1 (b) 2 (c) 3 (d) 4

(iii) If the numerator of a fraction is increased by 2 and the denominator by 1, it becomes 1. In case, the numerator is decreased by 4 and the denominator by 2, it becomes ½, the fraction is –

(a) 1/4 (b) 7/8 (c) 2/5 (d) 3/6

(iv) $\lim_{x \to 5} \dfrac{x^2 - 25}{x^2 + x - 30}$ is

(a) 6/13 (b) 3/7 (c) 10/11 (d) 1/17

(v) The value of $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots \infty}}}$ is

(a) 3 or -2 (b) 1 or -4 (c) 2 or 3 (d) 3 or 4

(vi) The matrix $A = \begin{bmatrix} 2 & 1 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{bmatrix}$ is a

(a) Column (b) Row (c) Diagonal (d) Square matrix.

(vii) The roots of the quadratic equation $x^2 + x + 1 = 0$ are

(a) Real and Equal (b) Real and Distinct

(c) Imaginary and Equal (d) Imaginary and Distinct

(viii) If $f'(x) = 4x^3 - 3x^2 + 2x + k$ and $f(0) =$ then the integration constant is

(a) 2 (b) 3 (c) 1 (d) –2

(ix) Find $f'(x)$ when $f(x) = 2x^3 - 21x^2 + 72x + 17$

(a) 6(x-3)(x-4) (b) 3(x-3)(x-5) (c) 6(x-1)(x-2) (d) 3(x-2)(x-4)

(x) Marginal analysis estimates how profit, revenue and cost change. This change is measured for how many extra units?

(a) 3 (b) 2 (c) 1 (d) 4

[TURN OVER

①

(xi) Robert deposits Rs. 3000 in State Bank of India for 3 year which earns him an interest of 8%. What is the amount he gets after 2 years ?

    (a) 480   (b) 240   (c) 600   (d) 120

(xii) Two matrices A and B are multiplied to get AB if –

    (a) both are rectangular

    (b) both have same order

    (c) no of columns of A is equal to rows of B

    (d) no of rows of A is equal to no of columns of B

2. (a) A ball is thrown upwards from a roof top, 80 m above the ground. It will reach a **20** maximum vertical height and then fall back to the ground. The height of the ball from the ground at time t is h, which is given by,

$$h = -16t^2 + 64t + 80.$$

1. What is the height reached by the ball after 1 second ?

2. What is the maximum height reached by the ball ?

(b) The demand and supply curves for coffee are given by $Q = 600 - 2P$ and $Q = 300 + 4P$ respectively, where P is market price and Q is quantity. Find the equilibrium price and quantity.

(c) Find the inverse of the matrix by computing Adjoint matrix –

$$A = \begin{bmatrix} 1 & 5 & 2 \\ 0 & -1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$$

(d) Use Cramer's Rule to solve :–

$$2x + 3y - z = 1$$
$$4x + y - 3z = 11$$
$$3x - 2y + 5z = 21$$

3. (a) Mr. A is looking ahead to his retirement and wants to be able to retire at 70 and hopes **20** to live to 95 and make Rs. 3200 a month from an account compounding monthly at 4.5%. Mr. A currently is 27 and deposits Rs. 1 000 at the beginning of each quarter until the age of 70 in an account that pays 8.5% and is compounded quarterly. Will Mr. A have enough to make it happen and by how much is Mr. A above or below ? Find the amount Mr. A needs to support those requirements from age 70 to 95.

(b) Calculate the future value of 12 monthly deposits of $1,000 if each payment is made on the first day of the month and the interest rate per month is 1.1 %. Also calculate the total interest earned on the deposits if the whole amount is withdrawn on the last day of 12th month.

(c) Given that the function f (x) is continuous at x = 1. Find a when, $f(x) = ax + 5$ and $f(1) = 4$.

(d) Evaluate $\displaystyle \lim_{x \to 3} \frac{\sqrt{12-x} - x}{\sqrt{6+x} - 3}$

4. (a) $z = \log\left(\dfrac{x^3 + y^3}{x + y}\right)$. Show that $x.\dfrac{\partial z}{\partial x} + y.\dfrac{\partial z}{\partial y} = 2$ **20**

(b) A container in the shape of a right circular cylinder with no top has surface area $3\,\pi$ ft.^{2} What height h and base radius r will maximize the volume of the cylinder ?

(c) A company produces and sells a product and fixed costs of the company are Rs. 6,000 and variable cost is Rs. 25 per unit, and sells the product at Rs. 50 per unit.

    i Find the total cost function.

    ii Find the total revenue function.

    iii Find the profit function, and determine the profit when 1000 units are sold.

    iv How many units have to be produced and sold to yield a profit of Rs. 10,000?

(d) (i) Calculate the derivative of $f(x) = \sqrt[3]{x} - \dfrac{1}{\sqrt{x}}$

    (ii) Calculate the derivative of $f(x) = \dfrac{3x}{5 - \tan x}$

5. (a) Evaluate the integral $\displaystyle\int\left(\sqrt{x} + \dfrac{1}{3\sqrt{x}}\right)dx$ **20**

(b) Suppose the total cost C(x) (in millions of euros) for manufacturing x airplanes per year is given by the function

$$C(x) = 6 + \sqrt{4x + 4} \quad 0 \le x \le 30$$

    a) Find the marginal cost at a production level of x air-planes per year.

    b) Find the marginal cost at a production level of 15 and 24 air-planes per year, and interpret the results.

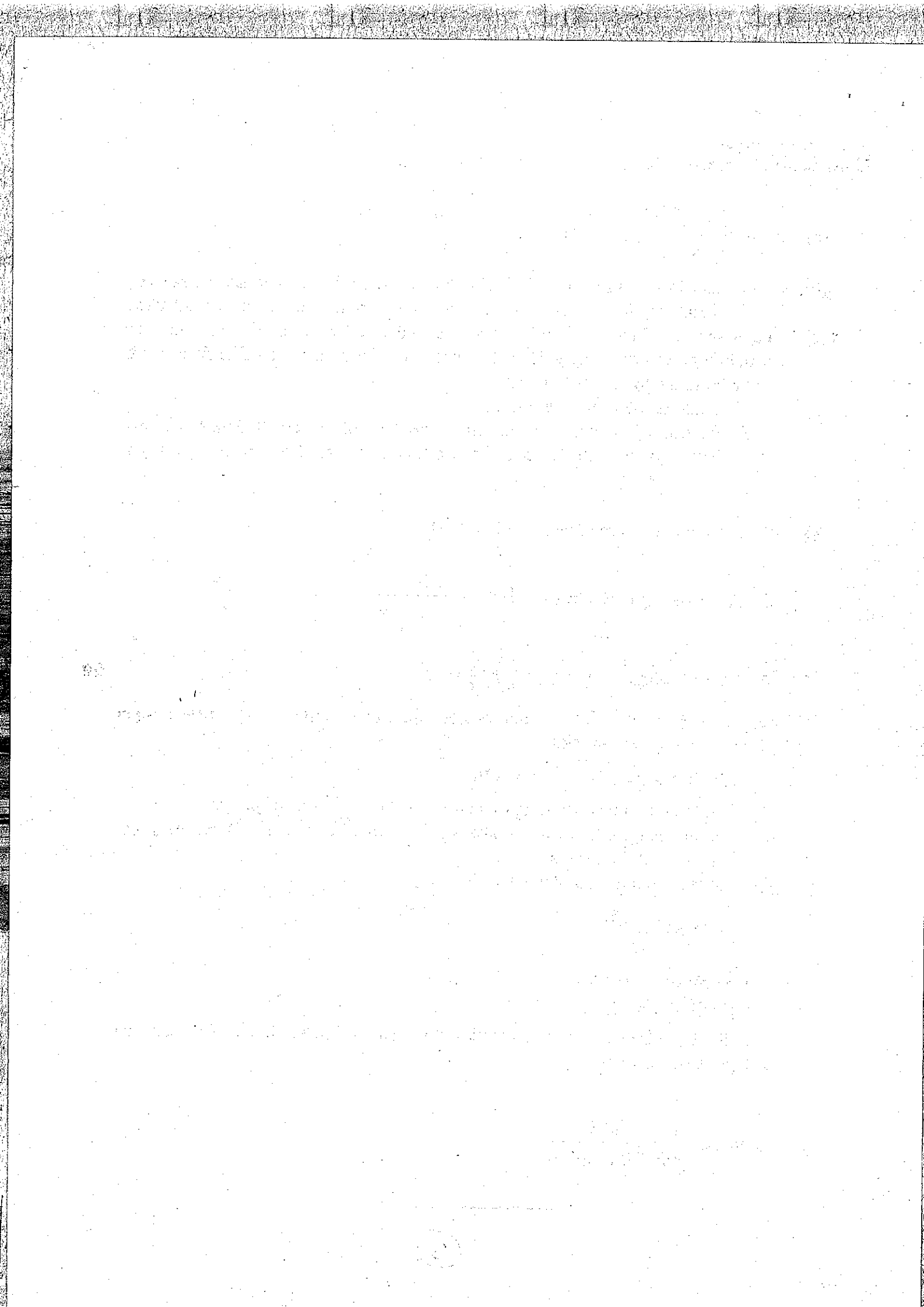(c) For a certain item the demand curve is –

$$p = D(q) = \dfrac{20}{q + 1}$$

and the supply curve is

$$p = S(q) = q + 2$$

Find the equilibrium price and equilibrium quantity. Then compute the consumer and producer surplus.

(d) Evaluate $\displaystyle\int_0^{\frac{\pi}{2}} \dfrac{\sin 2\theta}{\sin^4\theta + \cos^4\theta}\,d\theta$.

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Con. 540–18.

DN–5323

(3 Hours)   [Total Marks : 80

N.B. : (1) Question No. **1** is **compulsory** carrying **20** marks.
(2) Attempt any **3** out of Question 2 to Question 5 carrying **20 marks** each.
(3) Figures to the **right** indicate **full** marks.
(4) Use of **Non-programmable** calculator only is **allowed**.
(5) Use of **Mobile Phones** in the Exam Hall is **prohibited**.
(6) **Support** your answers with diagram / illustration wherever is **required**.
(7) Graph Paper/s will be **provided**.

1. (a) Select the appropriate alternative and write the proper sub-question number and   **10**
the correct sub-sub-question alphabet corresponding to the appropriate answer.
   (1) The Class Marks are 73, 77 and 81 where as the frequencies of the respective classes are 81, 77 and 73. Therefore exact AM will be ... .
      (a) 77.8615   (c) 79.8615
      (b) 78.8615   (d) 76.8615
   (2) Which of the following statements is the most appropriate ?
      (a) $D_8 \geq P_{77} = Q_3$ (c) $D_3 \leq P_{35} \leq Q_2$
      (b) $D_7 \# P_{77} = Q_3$ (d) $D_3 \geq P_{25} \leq Q_1$
   (3) For given value of **n and r** and **r ≠ 0** for which one out of Permutations or Combinations the following statement will be True
      (a) $nP_r \leq nC_r$ (c) $nC_r \geq nP_r$
      (b) $nP_r = nC_r$ (d) None of the above.
   (4) For The probability for any experiment, the following statement will only be held Good.
      (a) The sum of all probabilities in it is less than -1.
      (b) The sum of all probabilities is greater than 1 but less than -1.
      (c) The sum of all probabilities neither less than nor more than 1.
      (d) The sum of all probabilities is always greater than 1.
   (5) Which of the following is a Non Parametric Test?
      (a) Z-test   (c) F-test
      (b) T-test   (d) Chi-Square test
   (6) If n = 30 and p = 0.25 therefore in Binomial Distribution mean is
      (a) $\mu \neq 7.5$ (c) $\mu \geq 7.5$
      (b) $\mu = 7.5$ (d) $\mu \leq 7.5$
   (7) If there exists an exact Normal Distribution of Frequencies over 9 Classes then which of the following statements is true?
      (a) AM, Mode and Median all are equal.
      (b) AM is less than Mode but is larger the Median.
      (c) Median is always between Mode and AM.
      (d) Mode is fluctuating between AM and Median.

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(8) If the data is to be divided into 100 equal parts then Number of Percentiles obtained will be ---------.

  (a) 100   (c) 49

  (b) 10   (d) None

(9) If the entire Population is composed of Diverse Segments or Natural Subdivisions in units then -------- sampling method is most popularly used.

  (a) Simple Random Sampling

  (b) Systematic Sampling

  (c) Stratified Sampling

  (d) Multi-stage Sampling

(10) Out of which of the following representation is based on Cumulative Frequencies.

  (a) Histogram

  (b) Frequency Curve & Frequency Polygon

  (c) Subdivided Bar diagram

  (d) Ogive.

(b) Do as directed   **10**

(1) If I state that, Mean, Median and Mode are always equal. Comment in one line

(2) If H_0 is True and H_0 is not accepted. What type of error has occurred?

(3) Median does not always lie exactly in the Middle of the data. State True or False.

(4) Hypothesis H_0 and H_1 are always---------- to each other.

(5) Median and Mode are not Positional Averages. What is your opinion?

(6) How will you define Standard Deviation?

(7) Prepare Tabular form of Hypothetical Errors.

(8) Write the various types of Kurtosis curves.

(9) $P(A \cup B) = P(A) + P(B)$ if and onJy if ---------------. Complete the statement.

(10) Standard Deviation is Square of Variance. Read very carefully and comment

2. Attempt all 4 subquestions.   **20**

(a) The following table gives the distribution of monthly income of some families of certain area of Pune.

Income in Rs.	below 750	750-1500	1500-2250	2250-3000	3000-3750	3750-4500	4500 above
No. of families	60	170	200	60	50	40	20

Draw 'a less than and a more than' Ogives on same graph paper and Find: Median.

(b) State Advantages and limitations of Graphical Representation of data.

(c) A college department consist of A Professor, Assistant, and 10 Lecturers. A committee of 5 is to be formed from the departmental staff. Find the number of ways in which this can be done if, 1) Professor is to be included 2) Professor but not Assistant be included and 3) None of the two can be included.

(d) Find how many different word can be obtained by selecting all the letters of the word GEOGRAPHY. Find how of these Start and End with a letter G. Also find how many words can be obtained with all the three Vowels are together in a group.

3. Attempt all 4 subquestions.   **20**

    (a) Write all the Properties of A.M.

    (b) The test of 3 students **A, B** and **C** was taken and Marks out of 50 was recorded as follows: **A** : 42, 50, 47, 39, 48, 41. **B:** 50,38,39,42,40, 34. **C:** 36, 44, 50, 38, 30, 34. Find who is the Best student amongst them. Also State why?

    (c) The test of 3 students **A, B** and **C** was taken and Marks out of 50 was recorded as follows: **A:** 42, 50, 47, 39, 48, 41. **B:** 50, 38, 39,42,40, 34. **C:** 36, 44, 50, 38, 30, 34. Find who is the Best student amongst them. Also State why?

    (d) For the data given, Find D_8, P_{77} and Q_3 Arrange them in the Order.

Classes	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120
Frequency	11	14	17	25	27	15	11	5

4. Attempt all 4 subquestions.   **20**

    (a) State and Write complete proof of Addition Theorem in Probability. Also state its Corrolories.

    (b) From a State of Punjab Candidates appeared for an Entrance Test for NDA. The Mean of the Marks were 63 with Standard Deviation of 4 marks. Assuming Distribution of marks to be Normal Find: 1) The proportion of students marks less than 59. 2) The number of students securing marks between 53 and 58. (Refer Normal Distribution table)

    (c) Two Identical Boxes contain respectively, 4 White and 3 Red balls AND 3 White and 7 Red balls all Identical in size and Shape. A Box is chosen at random and a ball is drawn out of it. If the ball is White, Find the probability that it has come from Box-1. Also find the probability of that it has come from Box-2.

    (d) From a well shuffled pack of 52 playing cards, 3 cards are drawn at random. Find the probality that 1) All are Face cards. 2) Only one is Face card. 3) No Face card.

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5. Attempt all 4 subquestions.   **20**
   (a) In a certain town there 12000 Uneducated 6400 are Male Educated Adult and the rest are Female Educated Adults. Can we conclude that both Educated Male and Educated Females are almost Equally spread in population of town at 5% level of Significance.
   (b) The Mean breaking strength of RI-x Iron Wire is 220 Kg/sq cm with Std Dev of 13 Kg/sq cm and that of RII-y 230 Kg/sq cm with Std Dev 12 Kg/sq cm. The number of samples selected was 120 and 160 respectively. The Standard Deviation of the Company standards is 10 Kg/sq cm. State if there is any Significant Difference between the two Sample Tests at 5% of Level of Significance.
   (c) Write on Sampling Survey.
   (d) In a survey of Corporation Night Schools, it was observed that out of 900 Boys only 510 could complete SSC Educational Level and out of 650 Girls only 330 could complete SSC Educational Level. Can the difference between two proportions of the sampling studies be a cause of sampling fluctuations at level of significance 5%.

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Time : 3 hours

Max. Marks : 80

N. B.

1) Question 1 is compulsory.

2) Attempt any 3 Questions from Question 2 to Question 5.

3) Each Question carries 20 marks.

4) Figure to the right indicates marks to the sub-Question.

5) Graph paper will be provided on request.

6) Use of scientific, handheld non-programmable calculator is allowed.

Q1 Select the appropriate option .Write the number of the sub-question and the alphabet
corresponding to the correct answer. (1 X 20 = 20)

1.   A model is

(a) an essence of reality.
(b) an approximation.
(c) an idealization.
(d) all of the above.

2.   Managerial decisions are based on

(a) an evaluation of quantitative data.
(b) the use of qualitative factors.
(c) numbers produced by formal models.
(d) all of the above.

3.   An optimization model

(a) mathematically provides the best decision.
(b) provides decision within its limited context.
(c) helps in evaluating various alternatives constantly.
(d) is all of the above.

4.   Mathematical model of LP problem is important because.
(a) it helps in converting the verbal description and numerical data into mathematical
    expression.
(b) decision-makers prefer to work with formal models.

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(c) it captures the relevant relationship among decision factors.

(d) all of (a) , (b) and (c)

5.   Linear programming is

(a) a constrained optimization technique.

(b) a technique for economic allocation of limited resources .

(c) a method of getting non-negative solutions for the decision variables.

(d) all of the above.

6.   A constraint in an LP model restricts

(a) value of objective function.

(b) value of a decision variable.

(c) use of the available resource.

(d) all of the above

7.   Which of the following statements is true with respect to the optimal solution of an LP problem

(a) Every LP problem has an optimal solution.

(b) Optimal solution of an LP problem always occurs at an extreme point.

(c) At the optimal solution, all resources are used completely.

(d) If an optimal solution exists, there will always be, at least one, at a corner point of the feasible region.

8.   An iso-profit line represents

(a) infinite solutions all of which yield the same profit.

(b) infinite   solutions all of which yield the same cost.

(c) infinite   optimal solutions.

(d) a boundary of the feasible region.

9.   While plotting constraints on a graph paper, terminal points on both the axes are connected by a   straight line because

(a) the resources are limited in supply.

(b) the objective function is a linear function.

(c) the constraints are linear equations or inequalities.

(d) of all of the above.

10.   For a maximization problem, the objective function coefficient for an artificial variable is

(a) +M

(b) −M

(c) Zero

(d) None of the above.

⑨

11. If a negative value appears in the solution values column of the simplex table, then
   (a) the solution is optimal
   (b) the solution is infeasible
   (c) the solution is unbounded
   (d) (a) and (b) and(c).

12. If there are two constraints in a graphical solution and they do not intersect in the positive quadrant of the graph, then

   (a) the solution is infeasible.

   (b) the solution is unbounded.

   (c) one of the constraints is redundant.

   (d) none of the above.

13. If an optimal solution is degenerate, then

   (a) there are alternative optimal solutions.
   (b) the solution is infeasible.
   (c) the solution is of no use to the decision-making.
   (d) none of the above.

14. Dual LP problem approach attempts to optimize resource allocation by ensuring that

   (a) marginal opportunity cost of a resource equals its marginal return.
   (b) marginal opportunity cost of a resource is less than its marginal return.
   (c) either (a) or (b).
   (d) none of the above.

15. Shadow price indicates how much one unit change in the resource value will change the

   (a) optimality range of an objective function.
   (b) optimal value of the objective function.
   (c) value of the basic variable in the optimal solution.
   (d) none of the above.

16. Principle of complementary slackness states that

   (a) primal slack x dual main = 0.
   (b) primal main x dual surplus = 0.
   (c) both (a) and (b).
   (d) neither (a) nor (b).

17. If dual has an unbounded solution,then primal has

   (a) no feasible solution.
   (b) unbounded solution.
   (c) feasible solution.
   (d) none of the above solutions.

10

18. In a Simplex problem with maximization as the objective function, a non-basic variable should be brought into the new solution mix provided its contribution rate (C_j) is

   (a) $C_j = C_j + (Z_j - C_j)$.   (b) $C_j > C_j + (Z_j - C_j)$.   (c) $C_j < C_j + (Z_j - C_j)$.   (d) none of the above

19. In sensitivity analysis of the coefficient of the non-basic variable in cost minimization LP problem, the upper sensitivity limit is

   (a)   original value + lowest positive value of improvement ratio.
   (b)   original value — lowest absolute value of improvement ratio.
   (c)   positive infinity.
   (d)   negative infinity.

20. Which of the following is not correct?

   (a) After the attainment of an optimum solution of LPP, it is desirable to study the effect of changes in the different parameters of the problem on the current optimum solution.
   (b) An analysis of post-optimal solutions is known as Post-Optimality analysis or Sensitivity Analysis.
   (c) Post-optimality analysis studies only the continuous changes in the parameters of LPP.
   (d) Post-optimality analysis forms an integral part of formulating an LPP.

Q2 (a)   (10)

A ready to-wear shirt manufacturer wants to decide on the number of shirts of type A (Officewear) and type B (Partywear) to be produced each week. Each shirt of type B requires twice as much time required to produce a shirt of type A. Total time available per week is enough to manufacture 1000 shirts of type A, if only type A shirts are to be produced. Cloth required is 2 meters per shirt of type A and 2.25 meters per shirt of type B. In all 2100 meters of cloth is available. Each shirt of type B requires 10 fancy buttons and only 5000 such buttons are available every-week. Contribution is Rs. 300 per shirt of type A and Rs. 650 per shirt of type B. The shirt manufacturer is committed to supply 200 shirts of type A every week while he is certain that not more than 300 shirts of type B can be sold per week. Formulate mathematical model for the problem.DO NOT SOLVE IT.

(b)   (10)

The simplex tableau for a maximization problem of linear programming is given below :

C_j	Product mix	X_1	X_2	S_1	S_2	Quantity
5	X_2	1	0	1	0	10
0	S_2	1	0	-1	1	3
	C_j	4	5	0	0	
	Z_j	5	5	5	0	50
	C_j-Z_j	-1	0	-5	0	

(11)

Answer the following questions, giving reasons in brief :

(i)   Is the above solution optimum ?

(ii) Are there more than one optimum solutions ?

(iii) Is this solution degenerate ?

(iv) Is this solution feasible ?

(v)   If S_1 is slack in machine A (in hours/week) and S_2 is slack in machine B (in hours/week), which of these machines is being used to the full capacity when producing according to this solution ?

(vi) A customer would like to have one unit of product X_1 and is willing to pay in excess of the normal price in order to get it. How much should the price be increased in order to ensure no reduction of profit ?

(vii) How many units of the two products X_1 and X_2 are being produced according to this solution and what is the total profit ?

(viii) Machine A (associated with slack S_1 in, hours/week) has to be shut down for repairs for 2 hours next week. What will be the effect on profits ?

(ix) How much would you be prepared to pay for another hour (per week) of capacity each on machine A and machine B?

Q3 (a)   (10)

A manufacturing company makes three products, each of which requires three operations as part of the manufacturing process. The company can sell all of the products it can manufacture but its production capacity is limited by the capacity of its operations center. Additional data concerning the company is as shown in the table given below:

Product	Manufacturing requirements (hours/unit)			Cost	Selling price
	Centre I	Centre II	Centre III	(Rs.)	(Rs.)
A	1	3	2	11	15
B	3	4	1	12	20
C	2	2	2	10	16
Hours available	160	120	80		

If X_1 units of product A, X_2 units of product B, and X_3 units of product C are produced

Using simplex method, the optimum solution is obtained in the following simplex table:

[TURN OVER

Final Iteration, Optimum solution.

C_B	Product mix	Qty	X_1	X_2	X_3	S_1	S_2	S_3
0	S_1	160/3	-5/3	0	0	1	-2/3	-1/3
8	X_2	40/3	1/3	1	0	0	1/3	-1/3
6	X_3	100/3	5/6	0	1	0	-1/6	2/3
	Z	920/3	11/3	0	0	0	5/3	4/3

Thus, optimum solution to the problem is to produce Product A = nil, Product B = 40/3 units and

Product C = 100/3 units. Total profit = Rs. 920/3

1. Write the dual of the given problem
2. From the solution of the Primal , write the solution of the Dual.
3. Give the Economic interpretation of the dual.

(b) (10)

Solve the following L. P. P. graphically

Maximize $Z=2X+5Y$

subject to

$X+4Y<=24$

$3X+Y<=21$

$X+Y<=9$

$X>= 0, Y >= 0$

Q4

(20)

Solve the following L. P. problem by using Simplex method.

Minimize $Z=600 X_1+500 X_2$

subject to the constraints

$2X_1+X_2 >= 80$

$X_1+2X_2 >= 60$

$X_1, X_2>= 0$

13

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(20)

Q5

Consider the LP problem : Maximise $Z = 3X_1 + 4X_2 + X_3 + 7X_4$, subject to the constraints

$8X_1 + 3X_2 + 4X_3 + X_4 < =7$

$2X_1 + 6X_2 + X_3 + 5X_4 < =3$

$X_1 + 4X_2 + 5X_3 + 2X_4 < =8$ and

$X_1, X_2, X_3, X_4 >= 0$

The Final Simplex tableau is as follows:

Optimal Table

Basic Var	C_B	X_B	X_1	X_2	X_3	X_4	S_1	S_2	S_3
		C_j—	3	4	1	7	0	0	0
X_1	3	16/19	1	9/38	1/2	0	5/38	-1/38	0
X_4	7	5/19	0	21/19	0	1	-1/19	4/19	0
S_3	0	126/19	0	59/38	1/2	0	-1/38	-15/38	1
		Z=83/19	3	321/38	3/2	7	1/38	53/38	0

(a) Discuss the effect of discrete changes in b_i, Where b_i $(i = 1, 2, 3)$ are the constants on the right hand side.

(b) Discuss the effect of discrete changes in C_j ($j = 1, 2, 3, 4, 5, 6, 7$) on the optimality of the optimum basic feasible solution.

(14)
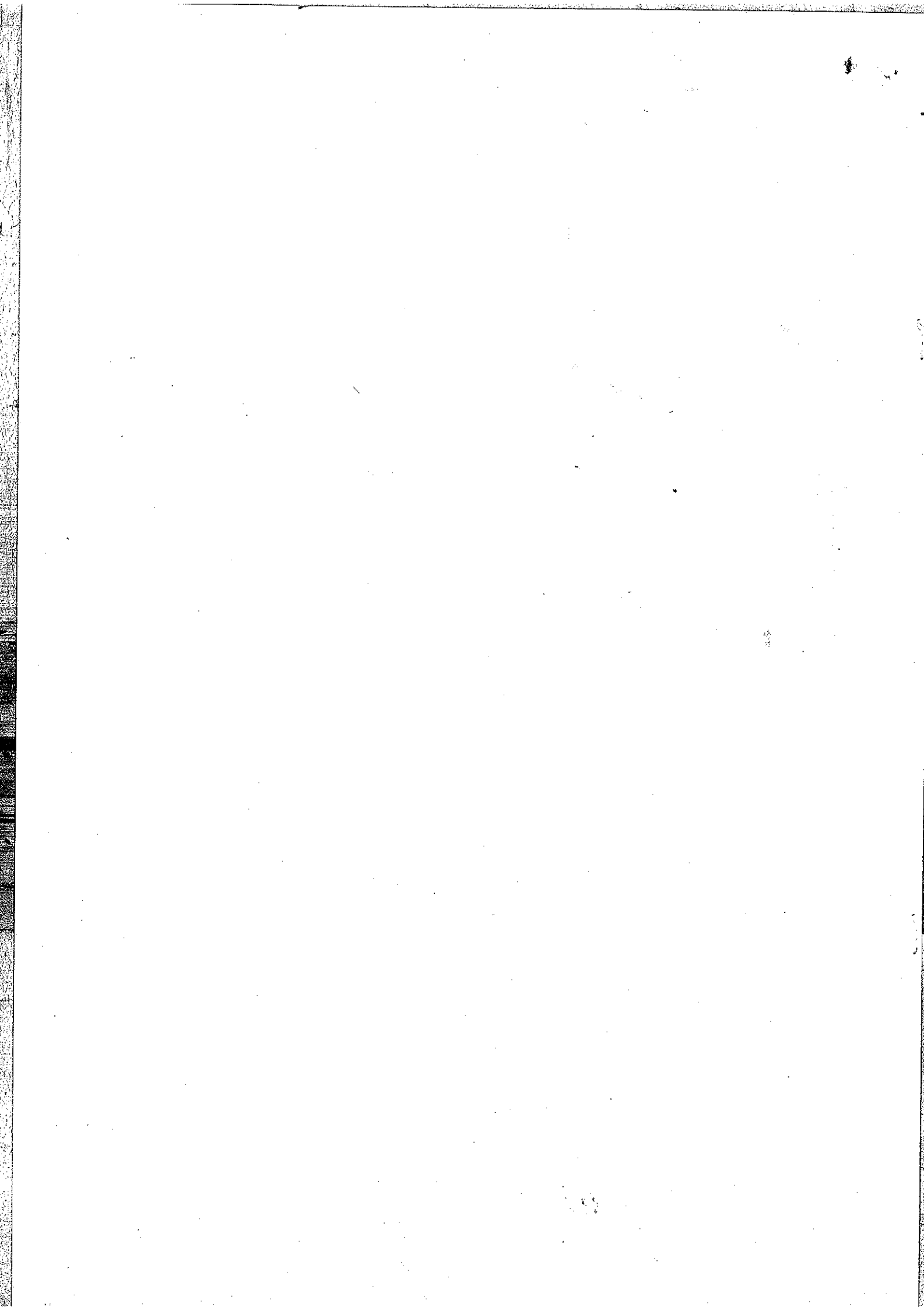
P4–Exam.–1st Half –2017–53

Con. 549-18.

(3 Hours)

DN–5049

[Total Marks : 80

N.B. :(1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from Q.2 to Q.5.
(3) **Each** question carries **20** marks.
(4) **Figure** to the **right** indicates marks to the sub-question.
(5) Use of **Scientific** handheld, **non-programmable** calculator is **allowed**.

Q.1 Select the correct option. Write the number of the sub-question and the alphabet corresponding to the correct option – $(1 \times 20 = 20)$

1. If a job has zero process time for any machine the job must –
   - (a) possess the first position only
   - (b) possess the last position only
   - (c) possess the extreme position
   - (d) be deleted from the sequencing

2. If there are 'n' jobs and 'm' machines the number of sequences of doing the jobs is –
   - (a) n x m
   - (b) $(m!)^n$
   - (c) n^m
   - (d) $(n!)^m$

3. FIFO is most application to the sequencing of –
   - (a) one machine and n jobs
   - (b) 2 machines and n jobs
   - (c) 3 machines and n jobs
   - (d) n machines and 2 jobs

4. In sequencing algorithm –
   - (a) the selection of an appropriate order for a series of jobs is to be done on a finite service facilities
   - (b) all the jobs must be processed on a first-come-first service basis.
   - (c) a service facility can process more than one job at a time
   - (d) all the service facilities are not of different type

5. Mortality problems –
   - (a) are special type of problems where failure is treated as birth and the replacement of an item on the failure is treated as death.
   - (b) use mortality tables to derive the probability distribution of the life span of an equipment / item.
   - (c) are like replacement policies for items whose value does not deteriorate gradually.
   - (d) are none of the above

(15)

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6. Replacement of an item is necessary if –
   - (a) failure rate is increasing
   - (b) failure cost is increasing
   - (c) failure probability is increasing
   - (d) any of (a) or (b) or (c) occurs

7. It is a assumed that the maintenance cost in Replacement analysis is a function of –
   - (a) calendar age
   - (b) manufacturing date
   - (c) running age
   - (d) user's age

8. In retrogressive failure, the failure probability _____ with time
   - (a) increases
   - (b) remains constant
   - (c) decreases
   - (d) either increases or decreases

9. The cost of providing service in a queueing system decreases with –
   - (a) decreased average waiting time in the queue
   - (b) decreased arrival rate
   - (c) increased arrive rate
   - (d) none of (a) or (b) or (c)

10. The system of loading and unloading of goods usually follows –
    - (a) LIFO   (b) FIFO   (c) SIRO   (d) SBP

11. Queue can form only when –
    - (a) arrivals equal service capacity
    - (b) Service facility is capable of serving all the arrivals at a time
    - (c) there are more than one service facilities
    - (d) arrivals exceed service capacity

12. Which of the cost estimates and performance measures are not used for economic analysis of a queueing system –
    - (a) cost per server per unit of time
    - (b) cost per unit of time for a customer waiting in the system
    - (c) average number of customers in the system
    - (d) average waiting time of the customers in the system

13. Operating decisions in an inventory system are concerned with –
    - (a) order quantity
    - (b) reorder level
    - (c) customer service level
    - (d) all of (a) and (b) and (c)

14. The important reason/s to carry out inventory is/are –
    (a)   to improve customer service
    (b)   to get quantity discounts
    (c)   to maintain operational capability
    (d)   all of (a) and (b) and (c)

15. The basic information required for an efficient control of inventory has to do with
    (a)   what items should be stocked ?
    (b)   when should an order be placed to replenish inventory ?
    (c)   how much should be ordered in each replenishment ?
    (d)   all of (a) and (b) and (c)

16. Which cost/s varies / vary with order quantity ?
    (a)   unit cost only
    (b)   reorder cost only
    (c)   holding cost only
    (d)   all of (a) and (b) and (c)

17. An advantage / The advantages of simulation as opposed to optimisation is/are that–
    (a)   several options of measure of performance can be examined
    (b)   complex real life problems can be studied
    (c)   it is applicable in the cases where there is an element of randomness in a system
    (d)   all of (a) and (b) and (c)

18. The important step/steps required for simulation in solving a problem is/are –
    (a)   to test and validate the model
    (b)   to design the experiment
    (c)   to conduct the experiment
    (d)   all of (a) and (b) and (c)

19. To make simulation more popular, we need to avoid –
    (a)   large cost over runs
    (b)   prolong delays
    (c)   user dissatisfaction with simulation results
    (d)   all of (a) and (b) and (c)

20. The purpose/s of using simulation techniques is/are –
    (a)   to simulate a real world situation
    (b)   to understand properties and operating characteristics of complex real life problems
    (c)   to reduce the cost of experiment on a model of real situation
    (d)   all of (a) and (b) and (c)

2.   (a) Determine the sequence that minimises the total elapsed time required to complete the   **10**
following jobs. Also evaluate the idle time.

Processing Time (Minutes)

Jobs	M1	M2	M3
A	30	40	60
B	80	30	70
C	70	20	50
D	40	50	110
E	90	10	50
F	80	40	60
G	70	30	120

(b) A company decides to hire a new mechanic to handle all tyre changes for customers   **10**
ordering a new set of tyres. Two mechanics applied for the job. First mechanic has
limited experience can be hired for ₹ 140/- per hour and can serve on an average 3
customers per hour. The other mechanic has several years of experience, can serve on
an average 4 customers per hour, but needs to be paid ₹ 200 per hour. Assume that the
customers arrive at the company garage at the rate of two customers per hour and the
company works for 8 hours a day.
Calculate the following characteristic of the queueing system using each mechanic
assuming Poisson arrivals and Exponential Service times.
   (1) Expected length of the queue
   (2) Expected length of the system
   (3) Expected waiting time in queue
   (4) Expected waiting time in the system.
If the company assigns a customer waiting time cost of Rs. 300 per hour which
mechanic provides the lower operating cost ?

3.   (a) A company would like to improve its inventory management policies for its supply of   **10**
paint used for automobiles. Annual demand for such paint is 50,000 liters and the
paint which costs Rs. 20 per litre is used at a constant rate. Annual carrying costs are
estimated at 15 per cent of the value of the paint held. Each order costs ₹ 80. Determine.
   (i) How much paint should be ordered each time ?
   (ii) How often should paint be ordered ?
   (iii) Time between two consecutive orders.
   (iv) The total annual cost associated with this policy.

(b) The details of a part to be machined are as follows –   **10**

Annual requirement	= 2400 pieces
Machine rate	= 10 pieces / shift
No. of working days in the year	= 320 shifts
Cost of machining a component	= ₹ 100 per piece
Inventory carrying cost per annuam	= 12% of the value.
Set up cost per production run	= ₹ 400

Find the optimum run size for machining.

4. Observations of the past data show the following patterns in respect of inter arrival **20**
    duration and service duration in a single channel queueing system. Using the random
    numbers table below, simulate the queue behaviour for a period of 60 minutes and estimate –
    (i)   the average queue length
    (ii) the average waiting time of the customer before service
    (iii) the average service idle time
    (iv) the average service time
    (v)   the time a customer spends in the system
    (vi) the percentage of the service idle time.

Inter Arrival Time		Service Time	
Minutes	**Probability**	**Minutes**	**Probability**
2	0.15	1	0.10
4	0.23	3	0.22
6	0.35	5	0.35
8	0.17	7	0.23
10	0.10	9	0.10

The following random numbers are to be used in pairs as per your requirement –
(93,71), (14,63), (72,14), (10,53), (21,64), (81,42), (87,07), (90,54), (38,66), (71,52),
(30,40), (51,99).

5. The following mortality rates have been observed for a certain type of fuse.   **20**

Week	Percent failing by the end of the week
1	5
2	15
3	35
4	57
5	100

There are 1,000 fuses in use and it costs Rs. 5 to replace an individual fuse. If all the
fuses were replaced simultaneously it would cost Rs. 1.25 per fuse. It is proposed to
replace all fuses at fixed intervals of time, whether or not they have burnt out, and to
continue replacing burnt out fuses as they fail. At what interval of time group
replacement should be made ? Also prove that this optimal policy is superior to the
straight forward policy of replacing each fuse only when it fails.

(Feb-18)

P.G.D.O.R.M

(Sem - I)

(19)