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BBG-003-1016052 Seat No. _____

B. Sc. (Sem. VI) (CBCS) (W.E.F. 2016) Examination

July - 2021

Statistics : Paper - 602

(Statistical Quality Control & Operation Research)

Faculty Code : 003

Subject Code : 1016052

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions : (1) Attempt any five question from the following.
(2) Each question carries 14 marks.

1 (a) (1) Variation in the items produced in a factory may be due to _____. **4**

(2) Cent percent inspection is preferable when _____.

(3) The Shewhart control charts are meant to find _____.

(4) _____ charts is used for controlling number of defects in a TV set.

(b) Define charts for attributes. **2**

(c) Write the difference between variable charts and attribute charts. **3**

(d) Discuss different assignable cause of variations. **5**

2 (a) (1) For $\overline{X}$-chart UCL=325 and LCL =275, then CL = _____. **4**

(2) If $\overline{c}$ = 2.25, the lower control limit of C-chart is _____.

(3) The control charts help to achieve _____ control.

(4) Main tools of statistical quality control are _____.

(b) Write Short Note : Theory of Runs. **2**

(c) Write Difference between p chart and np chart. **3**

(d) Explain U - chart and Determine its limits. **5**

3 (a) (1) The small fraction of defectives p_2, on the basis of which a lot is not rejected except for a small number of times is called _____. **4**

(2) OC curve reveals the ability of the sampling plan to distinguish between _____.

(3) Acceptance sampling plans are preferable due to _____.

(4) The maximum limit of percentage defective in a finally accepted product is called _____.

(b) If in single sampling plan (1000, 100, 2) and also AQL = 0.01 and $LTPD$ = 0.06 then obtain producer's and consumer's risk. $[e^{-1} = 0.368 \ e^{-6} = 0.002479]$. **2**

(c) Find the value of AOQ and ATI for single sampling plan (8000, 400, 1) when p' = 0.5%. **3**
$[e^{-2} = 0.1353, \ e^{-4} = 0.0183]$

(d) Derive OC function for single sampling plan. **5**

4 (a) (1) The probability of rejecting a lot having $\overline{p}$ as the process average defectives is known as _____. **4**

(2) Explain consumer's risk.

(3) Explain AQL.

(4) Explain Average Sample Number.

(b) Explain Average Total Inspection. **2**

(c) Find the probability of accepting a lot if the fraction defective of lot is 0.02 using single sampling plan (100, 20, 1) by using Hyper Geometric Distribution. **3**

(d) Derive OC function for double sampling plan. **5**

5 (a) (1) The role of artificial variables in the simplex method is _____. **4**

(2) The solution space of an LP problem unbounded due to _____.

(3) For maximum LP model the simplex method is terminated when all value _____.

(4) If two constraints do not intersect in the positive quadrant of the graph then _____.

(b) Define optimum feasible solution. **2**

(c) Write the applications of Linear Programming. **3**

(d) A manufacturer produces two types of machines *A* and *B*. There are two sections in his factory. In Section-I the assembling of parts is done and in Section - II the finishing of the product is done. The following are certain information available : **5**

Section	No. of workers required	
	A	B
I	5	2
II	3	3

In Section-I not more than 180 workers can be employed and in Section II not more than 135 workers can be employed. The numbers of *B* type machines are to be manufactured, double or less than that of *A* type of machines. If each *A* type machine gives profit of Rs. 100 and *B* types machines gives profit of Rs. 150. Find how many machines of each type the manufacturer should produce so as to obtain maximum profit.

6 (a) (1) To convert $\geq$ inequality constraints into equality constraints, we must _____. **4**

(2) A feasible solution to LP problem _____.

(3) The graphical method of LP problem uses _____.

(4) In the optimal simplex table, $c_j - z_j = 0$ value indicates _____.

(b) Define Linear programming. **2**

(c) Define basic solution. **3**

(d) Write the assumptions of LP problem. **5**

7 (a) (1) If a primal LP problem has a finite solution then the dual LP problem should have _____. **4**

(2) The dual of the primal minimization LP problem having m constraints and n non-negative variables should _____.

(3) A _____ variable represents amounts by which solution values exceed a resource.

(4) Model in which at least one decision variable is random is known as _____ model.

(b) Write steps to solve LP Problem by Big –M method. **2**

(c) Solve the following LP problem. **3**

Maximize : $Z = 2x_1 + x_2$

Subject to constraints :

$x_1 + 2x_2 \leq 10$; $x_1 + x_2 \leq 6$; $x_1 - x_2 \leq 2$; $x_1 - 2x_2 \leq 1$; $x_1, x_2 \geq 0$

(d) Obtain solution of the following LP problem by **5**

Simplex method Maximize : $Z = 3x_1 + 5x_2 + 4x_3$

Subject to constraints :

(i) $2x_1 + 3x_2 \leq 8$;

(ii) $2x_1 + 5x_3 \leq 10$;

(iii) $3x_1 + 2x_2 + 4x_3 \leq 15$ and $x_1, x_2, x_3 \geq 0$.

8 (a) (1) In Big-M method, _____ basic feasible solution is obtained by assigning zero value to the original value. 4

(2) For a maximization problem, the objective function coefficient for an artificial variable is _____.

(3) Optimality is indicated for a maximization problem when all elements in the $c_j - z_j$ rows _____.

(4) Optimality is indicated for a minimization problem all elements must be _____.

(b) Explain mathematical form of LP problem. 2

(c) Write the dual of the following problem. 3

Minimize : $Z_x = 3x_1 - 2x_2 + 4x_3$

Subject to constraints :

$3x_1 + 5x_2 + 4x_3 \geq 7 ; 6x_1 + x_2 + 3x_3 \geq 4; 7x_1 - 2x_2 - x_3 \leq 0;$

$x_1 - 2x_2 + 5x_3 \geq 3 ; 4x_1 + 7x_2 - 2x_3 \geq 2 ; x_1, x_2, x_3 \geq 0$

(d) Obtain solution of the following LP problem by 5

Simplex method Maximize : $Z = 3x_1 + 4x_2$

Subject to constraints :

$2x_1 + 3x_2 \leq 16 ; 2x_1 + x_2 \leq 8 ; x_1, x_2 \geq 0$

9 (a) (1) If there were n workers and n iobs there would be _____. 4

(2) An assignment problem can be solved by _____.

(3) The solution to a transportation problem with m *rows* and n *columns* is feasible if number of positive allocation _____.

(4) If there were to use opportunity cost value for an unused cell to test optimality it would be _____.

(b) Explain general mathematical form of transportation problem. 2

(c) Obtain a solution of following transportation problem by North-West Corner method. **3**

	D_1	D_2	D_3	D_4	D_5	Supply
O_1	2	11	10	3	7	4
O_2	1	4	7	2	1	8
O_3	3	9	4	8	12	9
Requirement	3	3	4	5	6	21

(d) Obtain a solution of following transportation problem by Vogel's method. **5**

	D_1	D_2	D_3	Supply
O_1	3	7	1	20
O_2	2	9	12	30
O_3	10	2	5	50
Requirement	35	15	50	100

10 (a) (1) The _____ serves the same purpose for the transportation method all slack variables in the simplex method. **4**

(2) The _____ method provides an ,efficient method of finding the optimal solution without making a direct comparison of every solution.

(3) For a salesman who has to visit n cities which _____ ways of his tour plan.

(4) Explain transportation problem.

(b) Explain assignment problem with example. **2**

(c) Solve the assignment problem that the objective is to maximize the total cost. **3**

	Work		
Persons	A	B	C
I	20	8	4
II	16	5	6
III	10	2	3

(d) Obtain a solution of following transportation problem. **5**

	D_1	D_2	D_3	D_4	Supply
O_1	21	16	25	13	11
O_2	17	18	14	23	13
O_3	32	27	18	41	19
Requirement	6	10	12	15	43