

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2018
(First Semester)

Branch – STATISTICS

OPERATIONS RESEARCH

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 x 1 = 10)

- 1 In a mixed integer programming problem
 - (i) All of the decision variables require integer solutions
 - (ii) Few of the decision variables require integer solution
 - (iii) Different objective functions are mixed together
 - (iv) None of the above
- 2 A type of decision making environment is
 - (i) Certainty (ii) Uncertainty (iii) Risk (iv) All of the above
- 3 LP context, post optimal analysis is a technique to
 - (i) Determine how optimum solution to an LPP changes in response to problem inputs
 - (ii) Allocate resource optimally
 - (iii) Minimize cost operation
 - (iv) Spell out the relation between dual and primal
- 4 If small orders are placed frequently then total inventory cost is
 - (i) Increased (ii) Reduced (iii) Either increased or reduced (iv) Minimised
- 5 The slack for an activity is equal to
 - (i) LF – LS (ii) EF – ES (iii) LS – ES (iv) None of the above
- 6 A dummy activity is used in the network diagram when
 - (i) Two parallel activities have the same tail and head events
 - (ii) The chain of activities may have a common event yet to be independent by themselves
 - (iii) Both (i) and (ii) (iv) None of the above
- 7 Which of the following is not correct in sequencing algorithm?
 - (i) Sequencing is concerned with determining the optimum sequence in which a set of given jobs may be performed
 - (ii) all the jobs are completely known and are ready for processing
 - (iii) all jobs are processed on the first service facility and then on the second service facility
 - (iv) Gantt charts can be used to determine optimum sequence in relatively small-sized problems.
- 8 What happens when maximin and minimax values of the game are same?
 - (i) No solution exists (ii) Solution is mixed
 - (iii) Saddle point exists (iv) None of the above
- 9 The general NLPP with inequality constraints
 - (i) Are usually solved by simplex method
 - (ii) Can be solved by using Kuhn – Tucker conditions
 - (iii) Can be solved only by Lagrange's method
 - (iv) Can be solved only if the constraints are of \leq type
- 10 The process of simulation
 - (i) is a powerful mathematical technique
 - (ii) is often referred to as 'Monte Carlo' simulation
 - (iii) usually require use of computers to solve the problems
 - (iv) involve the criterion substitution

SECTION - B (25 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 x 5 = 25)

- 11 a Write the Dual Simplex algorithm.

OR

- b A man has the choice of running either a hot snack stall or an ice cream stall at a sea side resort during the summer season. If it is a fairly cool summer, he should make Rs. 5,000 by running the hot-snack stall, but if the summer is quite hot he can only expect to make Rs. 1,000. On the other hand, if he operates the ice-cream stall, his profit is estimated at Rs. 6,500 if the summer is hot, but only Rs. 100 if it cool. There is a 40% chance if the summer being hot. Should he opt for running the not-snack stall or the ice-cream stall.

- 12 a What is post optimal analysis? Explain the variation for
- C_j
- in a LPP for which the solution as originally stated remains optimal.

OR

- b An oil engine manufacturer purchases lubricants of Rs. 42 per piece from a vendor. The requirement of these lubricants is 1800 per year. What should be the order quantity per order, if the cost per placement of an order is Rs. 16 and inventory carrying charge per rupee per year is 20 paise?

- 13 a Discuss the two problem of resource leveling.

OR

- b The following are the detail of estimated time of activities of a certain project :

Activity	:	A	B	C	D	E	F
Immediate predecessors	:	--	A	A	B, C	--	E
Estimated time (weeks)		2	3	4	6	2	8

Find the critical path and expected time of the project.

- 14 a Explain the procedure for solving a sequencing problem with n jobs in three machines.

OR

- b Determine the range of value of p and q that will make the payoff element
- a_{22}
- , a saddle point for the game whose payoff matrix
- (a_{ij})
- is given below :

		Player B		
Player A		2	4	7
		10	7	q
		4	p	8

- 15 a State and prove Kuhn – Tucker necessary and sufficient conditions in non-linear programming problem.

OR

- b The occurrence of rain in a city on a day is dependent upon whether or not it rained on the previous day. If it rained on the previous day, the rain distribution is

Event :	No rain	1 cm rain	2 cm rain	3 cm rain	4 cm rain	5 cm rain
Probability :	0.5	0.25	0.15	0.05	0.03	0.02

If it did not rain on the previous day, the rain distribution is

Event :	No rain	1 cm rain	2 cm rain	3 cm rain
Probability :	0.75	0.15	0.06	0.04

Simulate the city's weather for 10 days and determine by simulation the total days without rain as well as the total rainfall during the period. Use the following random numbers :

67 63 39 55 29 78 70 06 78 76

for simulation. Assume that for the first day of the simulation it had not rained the day before.

SECTION -C (40 Marks)Answer **ALL** questions**ALL** questions carry **EQUAL** Marks (5 x 8 = 40)

- 16 a Use dual simplex method to solve the L. P. P :

Min $Z = x_1 + 2x_2$, subject to

$$2x_1 + x_2 \geq 4$$

$$x_1 + x_2 \leq 7$$

$$x_1, x_2 \geq 0$$

OR

- b Find the optimum integer solution to the following IPP :

Maximize $Z = x_1 + 2x_2$ subject to the constraints :

$$2x_2 \leq 7$$

$$x_1 + x_2 \leq 7$$

$$2x_1 \leq 11$$

$$x_j \geq 0, j = 1, 2$$

- 17 a Given : Maximize
- $Z = -x_1 + 2x_2 - x_3$
- , subject to the constraints :

$$3x_1 + x_2 - x_3 \leq 10$$

$$-x_1 + 4x_2 + x_3 \geq 6$$

$$x_2 + x_3 \leq 4$$

$$x_j \geq 0, j = 1, 2, 3$$

Determine the ranges for discrete changes the components b_2 and b_3 of the requirement vector so as to maintain the optimality of the convert optimum solution.

OR

- b Find the optimum order quantity for a product for which the price breaks are as follows :

Quantity	Unit cost (Rs.)
$0 \leq Q_1 < 500$	10.00
$500 \leq Q_2$	9.25

The monthly demand for the product is 200 units, the cost of storage is 2% of the unit cost and the cost of ordering is Rs. 350.

- 18 a Compare and contrast CPM and PERT.

OR

- b A project consists of seven activities with the following relevant information :

Activity		Estimated duration (weeks)		
i	j	Optimistic	Most likely	Pessimistic
1	2	1	1	7
1	3	1	4	7
1	4	2	2	8
2	5	1	1	1
3	5	2	5	14
4	6	2	5	8
5	6	3	6	15

- (i) Draw the project network
- (ii) Find out the expected duration and variance of each activity. What is the expected project length?
- (iii) Calculate the variance and standard deviation of project length. What is the probability that the project will be completed :
- (i) at least 4 weeks earlier than expected?
- (ii) no more than 4 weeks later than expected?
- (iv) If the project due date is 19 weeks, what is the probability of meeting the due date?

Given : z	0.5	0.67	1	1.33	2.00
p	0.3085	0.2514	0.15871	0.0918	0.0228

Cont...

- 19 a Solve the following sequencing problem giving an optimal solution when passing is not allowed :

		Jobs(j)				
		A	B	C	D	E
Machines (i)	M1	11	13	9	16	16
	M2	4	3	5	2	6
	M3	6	7	5	8	4
	M4	15	8	13	9	11

OR

- b Solve the following 2 x 4 game :

		B			
		I	II	III	IV
A					
I	2	2	3	-1	
II	4	3	2	6	

- 20 a Solve the non-linear programming problem :

Optimize $z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$, subject to the constraints :

$$x_1 + x_2 + x_3 = 15, \quad 2x_1 - x_2 + 2x_3 = 20$$

OR

- b What is Monte-Carlo simulation? Give various types of simulation.

Z-Z-Z

END