

Operations Research**Semester – II****7:00pm to 9:00pm****June 10, 2011****Section - A
(1 mark each)**

1. _____ are small physical systems that have similar characteristics and work like an object it represents.
 - (a) Iconic model
 - (b) Analog model**
 - (c) Deterministic model
 - (d) Mathematical model
2. _____ factors cannot be taken into account in Operation Research.
 - (a) **Human emotional.**
 - (b) Quantitative
 - (c) Human behaviour
 - (d) None of the above
3. _____ defines the measure of effectiveness of the system as a mathematical function
 - (a) Decision variable
 - (b) Objective function**
 - (c) Optimal solution
 - (d) Constraints
4. _____ represents the controlled variables of the system.
 - (a) Model
 - (b) Constraints
 - (c) Parameters**
 - (d) Objective function
5. In simplex method, the problem has solution when_____
 - (a) The artificial variable gets replaced
 - (b) The artificial variable enters the solution
 - (c) The artificial variable gets replaced and thereby drops out of the solution mix**
 - (d) The artificial variable drops out of the solution mix
6. _____ and _____ goes hand in hand in \geq equations
 - (a) Surplus and slack
 - (b) Artificial and constant
 - (c) Slack and artificial**
 - (d) Artificial and surplus
7. The linear equality in two variables is known as _____
 - (a) Boundary of the plane
 - (b) Boundary of the half plane**
 - (c) Boundary of the closed half plane
 - (d) Boundary of the open half plane
8. _____ developed game theory.
 - (a) John Newman
 - (b) John Morgenstern
 - (c) Morgenstern
 - (d) John Von Newman**

9. The maximum of the row minimum in the payoff matrix is called ____
- (a) Minimax
 - (b) Maximax
 - (c) Minimin
 - (d) Maximin**
10. PERT is a/an _____ oriented network.
- (a) Time
 - (b) Place
 - (c) Event**
 - (d) Occasion
11. _____ in the network diagram are identified by the numbers
- (a) Event
 - (b) Activity**
 - (c) Critical path
 - (d) EST/LST
12. A dummy activity in a project network analysis has ____ duration.
- (a) valuable
 - (b) numerical
 - (c) zero**
 - (d) none of the above
13. CPM is used for projects involving activities of _____ nature
- (a) Non repetitive
 - (b) Occurring
 - (c) Non occurring
 - (d) Repetitive**
14. In PERT, 'a' denotes _____
- (a) The optimistic time, which will be required if the execution of the project goes extremely well**
 - (b) The most likely time, which will be required if execution is normal
 - (c) The pessimistic time, which will be required if everything goes bad
 - (d) Expected duration of the whole activity
15. In the context of business problem simulation is often referred to as _____
- (a) Sensitivity analysis
 - (b) Mid square analysis
 - (c) Monte Carlo analysis**
 - (d) Probability distribution
16. What is the method of generating pseudo random numbers?
- (a) Sensitivity analysis
 - (b) Mid square analysis**
 - (c) Monte Carlo analysis
 - (d) Probability distribution
17. Following is not the application of simulation.
- (a) For finding out the optimal solution of job responsibilities.**
 - (b) Job shop scheduling
 - (c) Routing problem
 - (d) Stock control
18. Simulation is used when _____
- (a) Probabilities are assigned.
 - (b) When large number of experiment is given.
 - (c) When problem cannot be formulated in Linear, integer programming, assignment and transportation problem.
 - (d) Formulation of mathematical model is very difficult**

19. In LPP only _____ variable can only solved graphically.
 (a) 3
 (b) 1
(c) 2
 (d) 0
20. _____ is formed by the intersection of finite number of closed half-planes.
 (a) Non-Convex Polygon
 (b) Convex
 (c) Polygon
(d) Convex Polygon
- 21) Queuing theory is based on _____ concepts.
 (a) Linear programming
(b) Probability
 (c) Hypothesis
 (d) None of above
- 22) Following is not the constituents of a queuing system.
(a) Leaving pattern
 (b) Arrival
 (c) Service
 (d) Queue
- 23) Impatient customers who would not wait beyond a certain time.
 (a) Balking
 (b) Jockeying
 (c) Collusion
(d) Reneging
- 24) When only some of the variables are restricted to take integral value and rest variables are free to take any non negative values than the problem is known as _____.
 (a) Linear programming
 (b) Pure integer programming
 (c) Variable integer programming
(d) Mixed integer programming
- 25) If all the values of the variables in the integer solution is not the integer value than _____ is added.
(a) Gomory's all constrain method
 (b) Artificial variable
 (c) Big M
 (d) Slack and surplus variables.
- 26) Gomory's all constrain represents necessary condition for _____ without losing _____.
 (a) Inversibility and add some non-integer solution, non-integer solution
 (b) Interchangibility and add up some non-integer solution, integer solution
(c) Integrability and eliminates some non-integer solution, integer solution
 (d) Integrability and eliminates some non-integer solution, non-integer solution
- 27) The Gomory's all constrain method also called as _____.
 (a) Branch and bound algorithm
(b) Cutting-plane algorithm method
 (c) Matrix algorithm
 (d) Integer algorithm
- 28) _____ is a technique applicable to both mixed and pure IPP.
 (a) Cutting-plane method
 (b) Branch and bound method

- (c) Pure integer programming
(d) Both
- 29) Transportation problem is also called
 (a) OMDI method
 (b) DOMI method
(c) MODI method
 (d) MONI method
- 30) Assignment problem is solved by
(a) Hungarian method
 (b) Optimization method
 (c) Vogel's method
 (d) Big M
- 31) _____ is best example of the Routing problem.
 (a) executive
 (b) river rafting
 (c) train
(d) Travelling Salesman problem
- 32) In Queuing process when we have difference in mean and S.D. it follow
 (a) Binomial distribution
(b) Erlang distribution
 (c) Exponential Distribution
 (d) Normal distribution
- 33) If the primal has n variables and m constraints, the dual will have _____
 (a) n variables and m constraints
(b) m variables and n constraints
 (c) m constraints and n variables
 (d) none of the above
- 34) What is the formula for J ?
 (a) FNX
 (b) $N(1-F)$
 (c) $T + U$
(d) $NF(1-X)$

TABLE 1: (For 35-40 Questions)

	D1	D2	D3	D4	
O1	6	4	1	5	14
O2	8	9	2	7	16
O3	4	3	6	2	5
	6	10	15	4	35

- 35) Determine an initial basic feasible solution to the following transportation problem using the northwest corner rule
 a. 125
 b. 122
c. 128
 d. 123
- 36) What is the value of x_{11} ?
a. 6
 b. 8
 c. 14
 d. 2
- 37) What is the value of x_{23} ?

- a. 6
- b. 14**
- c. 4
- d. 1

38) What is the value of x_3 ?

- a. 2
- b. 8
- c. 4**
- d. 14

39) What is the value of x_2 ?

- a. 6
- b. 1
- c. 2**
- d. 4

40) What is the value of x_1 ?

- a. 2
- b. 8**
- c. 4
- d. 14

Section - B
(2 marks each)

41. Write the dual of $\min Z = 4x_1 + 5x_2$, subject to $3x_1 + x_2 \geq 15$, $x_1 + 2x_2 \geq 10$, $5x_1 + 2x_2 \geq 20$

- (a) $\min W = 15y_1 + 10y_2 + 20y_3$, subject to $3y_1 + y_2 + 5y_3 \leq 4$, $y_1 + 2y_2 + 2y_3 \leq 5$
- (b) $\max W = 15y_1 + 10y_2 + 20y_3$, subject to $3y_1 + y_2 + 5y_3 \geq 4$, $y_1 + 2y_2 + 2y_3 \geq 5$
- (c) $\min W = 15y_1 + 10y_2 + 20y_3$, subject to $3y_1 + y_2 + 5y_3 \geq 4$, $y_1 + 2y_2 + 2y_3 \geq 5$
- (d) $\max W = 15y_1 + 10y_2 + 20y_3$, subject to $3y_1 + y_2 + 5y_3 \leq 4$, $y_1 + 2y_2 + 2y_3 \leq 5$**

42. If it is needed to be 95% certain of being correct in an experiment with marginal error of 1% of the true value, what should be the sample size?

- (a) 9600**
- (b) 9503
- (c) 9603
- (d) 9500

TABLE 1: (For 42-46 Questions)

	B1	B2	B3	B4
A1	20	15	12	35
A2	25	14	8	10
A3	-5	4	11	0

43) What is the value of the game?

- a. 12**
- b. 35
- c. 14
- d. 25

44) what is the saddle point?

- a. A2,B1

b. A1,B3

c. A1,B4

d. A2,B2

45) ____row dominates ____?

a. A1, A2

b. A1, A3

c. A2, A3

d. A3, A1

46) _____ column does not dominate ____?

(a) B3, B1

(b) B2, B1

(c) **B2, B4**

(d) B3, B2

TABLE 2: (For 47-49 Questions)

In a cafeteria at a bus depot the customers will have to pass through three counters. At the first counter the customers buy Coupons at the second they select and collect the snacks to be taken, and at the, third they collect coffee or tea as required. The server at each counter takes on an average two minutes although the distribution of the time of service is approximately exponential. The arrivals of customers to the cafeteria are approximately Poisson at an average rate of six per hour.

47) what is the average time spent by a customer waiting in the cafeteria?

a. 6

b. 3

c. 4

d. 1/6

48).What is the average time of getting the service?

a. 1/6

b. 3

c. 6

d. 4

49)What is the most probable time spent in getting the service?

a. 6

b. 1/6

c. 4

d. 3

TABLE 3: (For 50-53 Questions)

Patrons arrive at a small post office at the rate of 30 per hour. Service by the clerk on duty takes an average of 1 minute per customer

50) what is the mean customer time spent waiting in line?

a. 1 minute

b. 2 minutes

c. ½ customer

d. 1 customer

51) what is the mean number of persons in line?

a. 1 minute

b. 2 minutes

c. $\frac{1}{2}$ customer

d. 1 customer

52) what is the mean customer time spent receiving or waiting for service?

a. 1 minute

b. 2 minutes

c. $\frac{1}{2}$ customer

d. 1 customer

53) what is the mean number of persons receiving or waiting for service?

a. 1 minute

b. 2 minutes

c. $\frac{1}{2}$ customer

d. 1 customer

TABLE 4: (For 54-57 Questions)

$$x_1 + 2x_2 + x_3 = 4, 2x_1 + x_2 + 5x_3 = 5$$

54) What is the value of x_3 and x_1 ?

a. 1, -5

b. -5, 1

c. -1, 5

d. 5, -1

55) What is the value of x_1 and x_2 ?

a. 1, 2

b. 2, -1

c. -1, 2

d. 2, 1

56) What is the value of x_2 and x_3 ?

a. $\frac{3}{5}, \frac{3}{2}$

b. $\frac{2}{3}, \frac{5}{3}$

c. $\frac{5}{3}, \frac{2}{3}$

d. $\frac{3}{2}, \frac{3}{5}$

57) Which one of the following does not have a feasible solution?

a. x_1 & x_2

b. x_2 & x_3

c. x_3 & x_1

d. None of the above

TABLE 5: (For 58-60 Questions)

SOLVE THE A.P.

PERSONS	JOBS				
	1	2	3	4	5
A	8	4	2	6	1
B	0	9	5	5	4
C	3	8	9	2	6
D	4	3	1	0	3
E	9	5	8	9	5

58) A is assigned to___?

a. 4

b. 1

c. 3

d. 5

59) B is assigned to___?

a. 4

b. 1

c. 3

d. 5

60) C is assigned to ____?

a. 4

b. 1

c. 3

d. 5

Section - C
(4 marks each)

TABLE 6: (For 61-63 Questions)

A manufacturing firm has discontinued production of a certain unprofitable product line. This created considerable excess production capacity. Management is considering devoting this excess capacity to one or more of three products A, B and C. following is the table giving the detailed information:

Machine type	Products			Available time
	A	B	C	
Milling machine	8	2	3	250
Lathe	4	3	0	150
Grinder	2	0	1	50

The unit profit would be Rs. 20, Rs. 6 and Rs. 8 for products A, B and C.

61. find the $Z_j - C_j$ in the first iteration table.

(a) -20,6,-8,0,0,0

(b) **-20,-6,-8,0,0,0**

(c) -20,-6,8,0,0,0

(d) 20,-6,-8,0,0,0

62. find the Z_j in the second iteration table.

a. 20,0,1,0,0,0,10

b. 20,0,10,0,0,10

c. 20,1,0,0,0,10,500

d. 20,0,10,0,0,10,500

63. what is the optimal solution?

a. 50

b. 500

c. 70

d. 700

TABLE 7: (For 64-65 Questions)

Solve by using two phase method:

Maximise $z = 3x_1 - x_2$

Subject to $2x_1 + x_2 \geq 2$

$x_1 + 3x_2 \leq 2$

$x_2 \leq 4,$

$x_1, x_2 \geq 0$

64. Which one of the following statement is most true?

a. The first iteration table gives all the negative values, hence Phase II starts

- b. The solution is $X_1 = S_2 = S_3 = 0$
- c. The existence of non zero artificial variable in the basic set indicates that the problem has no solution.

d. The optimal solution of the new objective function, $Z^* = 0$, Hence Phase II starts

65. which one of the following statement is most true?

- a. The existence of non zero artificial variable in the basic set indicates that the problem has no solution.
- b. Since all elements of the last row are non negative, the current solution is optimal.
- c. The maximum value of the objective function is $Z = 6$
- d. When Phase II gets completed, the objective function: $Z = 6$ for $x_1 = 2$ and $x_2 = 0$**

TABLE 8: (For 66-69 Questions)

ACTIVITY	a	b	m
1-2	5	10	8
1-3	18	22	20
1-4	26	40	33
2-5	16	20	18
2-6	15	25	20
3-6	6	12	9
4-7	7	12	10
5-7	7	9	8
6-7	3	5	4

66. what is the project duration?

- a. 7.8, 20, 33, 18, 20, 9, 9, 8, 8, 4**
- b. 7.8, 20, 33, 18, 20, 9, 9, 8, 8, 4
- c. 7.8, 20, 33, 18, 20, 9, 9, 8, 8, 4
- d. 7.8, 20, 33, 18, 20, 9, 9, 8, 8, 4

67. What is the variance of critical path length?

- a. 42.8
- b. 42
- c. 6.123
- d. 6.138**

68. Which of the following activities have their LCT = critical path?

- a. 2-6, 3-6
- b. 3-6, 4-7, 5-7
- c. 4-7, 5-7, 6-7**
- d. 4-7, 5-7, 6-7, 7-8

69. What is the duration of the project that will have 95% channel of being completed?

- a. 47
- b. 42.8
- c. 46
- d. 46.85**

TABLE 9: (For 70-71 Questions)

	A	B	C	D	E
1	32	38	40	28	40
2	40	24	28	21	36
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

70. Find the assignment of salesman to districts that will result in maximum sales.

- a. 181
- b. 191**
- c. 119
- d. 911

71. what is the optimum assignment?

- e. 1-D,2-A,3-E,4-C,5-B
- f. 1-B,2-C,3-A,4-E,5-D
- g. 1-B,2-A,3-C,4-E,5-D
- h. 1-B,2-A,3-E,4-C,5-D**

TABLE 10: (For 72-74 Questions)

A bread vendor buys every morning loaves of bread at 0.45 each by placing his order one day in advance (at the time of receiving his previous order) and sells them at Rs. 0.70 each. Unsold bread can be sold the next day at Rs. 0.20 per loaf and thereafter should be treated as of no value. The pattern of demand for bread is given below:

Fresh Bread		One day old Bread	
Daily sales	Probability of demand	Daily sales	Probability of demand
50	0.01	0	0.7
51	0.03	1	0.2
52	0.04	2	0.08
53	0.07	3	0.02
54	0.09		
55	0.11		
56	0.15		
57	0.21		
58	0.18		
59	0.09		
60	0.02		

The vendor adopts the following order rule. If there is no stock with him at the end of the previous day, he orders 60 units. Otherwise he orders 50 or 55 whichever is nearest the actual fresh bread sale on the previous day. Starting with zero stock and a pending order for 55 loaves, simulate for 10 days.

Random nos. for fresh bread: 72,6,12,74,79,70,85,71,21,98

Random nos. for one day old bread: -, -,86,54,-, -,88,58,-,48

72.what is the sales of fresh bread?

- a. 384.7
- b. 128.2
- c. 384.3**
- d. 256.5

73.what is the total sales?

- a. 384.7**

- b. 128.2
- c. 384.3
- d. 256.5

74. what is the total cost?

- a. 384.7
- b. 128.2
- c. 384.3
- d. **256.5**

TABLE 11: (For 75th Question)

Obtain an initial basic feasible solution to the following T.P using the Vogel's approximation method.

WAREHOUSES	STORES				AVAILABILITY
	I	II	III	IV	
A	5	1	3	3	34
B	3	3	5	4	15
C	6	4	4	3	12
D	4	-1	4	2	19
REQUIREMENT	21	25	17	17	80

- a. **164**
- b. 202
- c. 183
- d. 145