

Operations Research

Semester – II

1:30pm to 3:30pm

June 10, 2011

Section - A
(1 mark each)

1. Impatient customers who would not wait beyond a certain time.
 - (a) Balking
 - (b) Jockeying
 - (c) Collusion
 - (d) **Reneging**
2. 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
3. In LPP only _____ variable can only solved graphically.
 - (a) 3
 - (b) 1
 - (c) **2**
 - (d) 0
4. A dummy activity in a project network analysis has ____ duration.
 - (a) valuable
 - (b) numerical
 - (c) **zero**
 - (d) none of the above
5. 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
6. The Gormory's all constrain method also called as _____
 - (a) Branch and bound algorithm
 - (b) **Cutting-plane algorithm method**
 - (c) Matrix algorithm
 - (d) Integer algorithm

CASE: (For 7- 12 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

7. Determine an initial basic feasible solution to the following transportation problem using the northwest corner rule
 - a. 125

b. 122

c. 128

d. 123

8. What is the value of x_{11} ?**a. 6**

b. 8

c. 14

d. 2

9. What is the value of x_{23} ?

a. 3

b. 2

c. 5

d. 15

10. What is the value of x_{34} ?

a. 6

b. 35

c. 2

d. 15

11. What is the value of x_{22} ?

a. 8

b. 16

c. 9

d. 10

12. What is the value of x_{12} ?

a. 16

b. 4

c. 10

d. 9

13. 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

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. _____ and _____ goes hand in hand in \geq equations

(a) Surplus and slack

(b) Artificial and constant

(c) Slack and artificial

- (d) Artificial and surplus
16. 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
17. _____ developed game theory.
- (a) John Newman
 - (b) John Morgenstern
 - (c) Morgenstern
 - (d) **John Von Newman**
18. The maximum of the row minimum in the payoff matrix is called _____
- (a) Minimax
 - (b) Maximax
 - (c) Minimin
 - (d) **Maximin**
19. Assignment problem is solved by
- (a) **Hungarian method**
 - (b) Optimization method
 - (c) Vogel's method
 - (d) Big M
20. Queuing theory is based on _____ concepts.
- (a) Linear programming
 - (b) **Probability**
 - (c) Hypothesis
 - (d) None of above
21. If all the values of the variables in the integer solution is not the integer value than _____ is added.
- (a) **Gormory's all constrain method**
 - (b) Artificial variable
 - (c) Big M
 - (d) Slack and surplus variables.
22. 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
23. _____ factors cannot be taken into account in Operation Research.
- (a) **Human emotional.**
 - (b) Quantitative
 - (c) Human behavior
 - (d) None of the above
24. _____ is best example of the Routing problem.
- (a) executive
 - (b) river rafting

(c) train

(d) **Travelling Salesman problem**

25. PERT is a/an _____ oriented network.

(a) Time

(b) Place

(c) **Event**

(d) Occasion

26. _____ in the network diagram are identified by the numbers

(a) Event

(b) **Activity**

(c) Critical path

(d) EST/LST

27. _____ defines the measure of effectiveness of the system as a mathematical function

(a) Decision variable

(b) **Objective function**

(c) Optimal solution

(d) Constraints

28. CPM is used for projects involving activities of _____ nature

(a) Non repetitive

(b) Occurring

(c) Non occurring

(d) **Repetitive**

29. _____ 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

30. What is the method of generating pseudo random numbers?

(a) Sensitivity analysis

(b) **Mid square analysis**

(c) Monte Carlo analysis

(d) Probability distribution

31. 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**

32. _____ is formed by the intersection of finite number of closed half-planes.

(a) Non-Convex Polygon

(b) Convex

(c) Polygon

(d) **Convex Polygon**

33. 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**

34. Gormory's all constrain represents necessary condition for _____ without losing _____.

- (a) Inversibility and add some non-integer solution, non-integer solution
- (b) Interchangeability 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

35. _____ 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**

36. Transportation problem is also called

- (a) OMDI method
- (b) DOMI method
- (c) **MODI method**
- (d) MONI method

37. 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

38. Following is not the constituents of a queuing system.

- (a) **Leaving pattern**
- (b) Arrival
- (c) Service
- (d) Queue

39. _____ represents the controlled variables of the system.

- (a) Model
- (b) Constraints
- (c) **Parameters**
- (d) Objective function

40. What is the formula for J ?

- (a) FNX
- (b) $N(1-F)$
- (c) $T + U$
- (d) **$NF(1-X)$**

Section - B
(2 marks each)

CASE: (For 41-44 Questions)

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

41. What is the value of the game?

1. 12
2. 35
3. 14
4. 25

42. What is the saddle point?

1. A2, B1
2. **A1, B3**
3. A1, B4
4. A2, B2

43. ____ row dominates ____?

1. A1, A2
2. **A1, A3**
3. A2, A3
4. A3, A1

44. ____ column does not dominate ____?

- a. B3, B1
- b. B2, B1
- c. **B2, B4**
- d. B3, B2

CASE: (For 45-47 Questions)
SOLVE THE A.P.

	JOBS				
PERSONS	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

45. A is assigned to ____?

1. 4
2. 1
3. 3
4. **5**

46. B is assigned to ____?

1. 4

2. 1

3. 3

4. 5

47.C is assigned to____?

1. 4

2. 1

3. 3

4. 5

CASE: (For 48-50 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.

48.What is the average time spent by a customer waiting in the cafeteria?

1. 6

2. 3

3. 4

4. 1/6

49.What is the average time of getting the service?

1. 1/6

2. 3

3. 6

4. 4

50.What is the most probable time spent in getting the service?

1. 6

2. 1/6

3. 4

4. 3

CASE 3: (For 51-54 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

51.What is the mean customer time spent waiting in line?

1. 1 minute

2. 2 minutes

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

4. 1 customer

52.What is the mean number of persons in line?

1. 1 minute

2. 2 minutes

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

4. 1 customer

53.What is the mean customer time spent receiving or waiting for service?

1. 1 minute

2. 2 minutes

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

4. 1 customer

54. What is the mean number of persons receiving or waiting for service?

1. 1 minute

2. 2 minutes

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

4. 1 customer

CASE: (For 55-58 Questions)

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

55. What is the value of x_3 and x_1 ?

1. 1, -5

2. -5, 1

3. -1, 5

4. 5, -1

56. What is the value of x_1 and x_2 ?

1. 1, 2

2. 2, -1

3. -1, 2

4. 2, 1

57. What is the value of x_2 and x_3 ?

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

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

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

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

58. Which one of the following does not have a feasible solution?

1. x_1 & x_2

2. x_2 & x_3

3. x_3 & x_1

4. None of the above

59. 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 $3y_1 + y_2 + 5y_3 \leq 4$, $y_1 + 2y_2 + 2y_3 \leq 5$

60. 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

Section – C
(4 marks each)

CASE: (For 61-64 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

61. What is the project duration?

- 1. **7.8,20,33,18,20,9,9.8,8,4**
- 2. 7.8,20,33,18,20,9.9,8,8,4
- 3. 7.8,20,33,18,20,9,9,8,8,4
- 4. 7.8,20,33,18,20,9,9,8,8,4

62. What is the variance of critical path length?

- 1. 42.8
- 2. 42
- 3. 6.123
- 4. **6.138**

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

- 1. 2-6,3-6
- 2. 3-6,4-7,5-7
- 3. **4-7,5-7,6-7**
- 4. 4-7,5-7,6-7,7-8

64. What is the duration of the project that will have 95% chance of being completed?

- 1. 47
- 2. 42.8
- 3. 46

4. 46.85

CASE: (For 65-66 Questions)

Solve by using two phase method:

Maximize $z = 3x_1 - x_2$

Subject to, $2x_1 + x_2 \geq 2$

$x_1 + 3x_2 \leq 2$

$x_2 \leq 4,$

$x_1, x_2 \geq 0$

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

1. The first iteration table gives all the negative values, hence Phase II starts
2. The solution is $x_1 = x_2 = x_3 = 0$
3. The existence of none zero artificial variable in the basic set indicates that the problem has no solution.
4. **The optimal solution of the new objective function, $Z^* = 0$, Hence Phase II starts**

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

1. The existence of none zero artificial variable in the basic set indicates that the problem has no solution.
2. Since all elements of the last row are non negative, the current solution is optimal.
3. The maximum value of the objective function is $Z = 6$
4. **When Phase II gets completed, the objective function: $Z = 6$ for $x_1 = 2$ and $x_2 = 0$**

CASE: (For 67-69 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.

67. Find the $Z_j - C_j$ in the first iteration table.

1. -20, 6, -8, 0, 0, 0
2. **-20, -6, -8, 0, 0, 0**
3. -20, -6, 8, 0, 0, 0
4. 20, -6, -8, 0, 0, 0

68. Find the Z_j in the second iteration table.

1. 20,0,1,0,0,0,10
2. 20,0,10,0,0,10
3. 20,1,0,0,0,10,500
4. **20,0,10,0,0,10,500**

69. What is the optimal solution?

1. 50
2. 500
3. 70
4. **700**

70. 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

CASE: (For 71-72 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

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

1. 181
2. **191**
3. 119
4. 911

72. What is the optimum assignment?

1. 1-D, 2-A, 3-E, 4-C, 5-B
2. 1-B, 2-C, 3-A, 4-E, 5-D
3. 1-B, 2-A, 3-C, 4-E, 5-D
4. **1-B, 2-A, 3-E, 4-C, 5-D**

CASE: (For 73-75 Questions)

Dr. Strong is a dentist. He gives appointment to patients every half-an hour. However he does not know the nature of illness of patients arriving at this clinic. From past record he has the following probability distribution and also knows the exact treatment timings. He starts his clinic at 8.00 am using the following information determine the average waiting time of the customers and idle time of the doctor.

Nature of illness	Probability	Time taken for treatment (mts)
Filling	0.10	50
Check up	0.30	15
Crowning	0.15	40
Cleaning	0.30	15
Extraction	0.15	30

Random Numbers 39, 82, 88, 34, 25, 66, 17, 45

73.What is the average waiting time for the patients (minutes)?

- a. **13.125**
- b. 35.600
- c. 15.125
- d. 34.400

74.What is the total idle time for doctor (minutes)?

- a. 0 minutes
- b. **15 minutes**
- c. 30 minutes
- d. 45 minutes

75.At what time the service of the doctor will end?

- a. 1:15 P.M.
- b. **1:00 P.M.**
- c. 1:30 P.M.
- d. 12:30 P.M.