Question Paper

MANIPAL ACADEMY OF HIGHER EDUCATION

MASTERS IN HOSPITAL ADMINISTRATION DEGREE EXAMINATIONS - JUNE 2022
SUBJECT: MHA 563.2 - OPERATIONS RESEARCH IN HEALTHCARE
BLOCK - VI (REGULARS)

Marks: 60   **Duration: 180 mins.**

1. Choose the correct option for the multiple choice questions given below:

1A)   Operations research is a discipline that deals with: (1)

The application of scientific methods to make better decisions

The collection, organization, displaying, analysis, interpretation and presentation of data

The study of general and fundamental questions about existence, knowledge, values, reason, mind, and language

That involves the understanding and design of computers and computational processes, including both hardware and software

1B)   A feasible solution to LPP is: (1)

Any set of nonnegative values of the variables

The set of negative values of the variables that satisfies some of the constraints

The set of negative values of the variables that satisfies all the constraints

The set of nonnegative values of the variables that satisfies all the constraints

1C)   In case of graphical method, which one of the following statements is true?   (1)

The optimal solution is obtained if the feasible region is unbounded

Only two decision variables are involved

For two lines, there may be more than one point of intersections

None of the above

1D)   Which one of the following define a surplus variable?   (1)

To convert ($\geq$) inequality to an equation, a negative variable is subtracted on the left hand side of the constraint

To convert ($\geq$) inequality to an equation, a nonegative variable is subtracted on the right hand side of the constraint

To convert ($\geq$) inequality to an equation, a nonegative variable is subtracted on the left hand side of the constraint

To convert ($\geq$) inequality to an equation, a nonpositive variable is subtracted on the left hand side of the constraint

1E)   A feasible solution of a *m* by *n* transportation problem is said to be a basic feasible solution if the   (1)
total number of positive allocations is exactly equal to:

_m−n+1_
_m+n+1_
_m+n−1_
_m−n−1_

1F) Which of the following is the first step in North-West corner method: (1)

Finding the minimum of the supply and demand values with respect to the current north-west corner cell of the cost matrix
Finding the minimum of the values in the cost matrix
Finding the maximum of the values in the cost matrix
Finding the maximum of the supply and demand values with respect to the current north-west corner cell of the cost matrix

1G) In a assignment problem, if x_{ij} represents the assignment of the ith origin to the jth destination, then the value of x_{ij} (1)

Lies between 0 and 1
Is either 0 or 1
Is greater than 1
Is less than 0

1H) In program Evaluation and Review Technique, which one of the following is not a time estimate? (1)

Optimistic time
Most likely time
Occurrence time
Pessimistic time

1I) The principle of maximizing the minimum guaranteed gains is known as: (1)

Minimax Principle
Maximax Principle
Maximin Principle
Minimin Principle

1J) In queuing theory, the utilization rate is the ratio of: (1)

The mean arrival rate and mean service idle rate
The mean idle rate and mean service rate
The mean waiting rate and mean service rate
The mean arrival rate and mean service rate

Answer all the following questions.

2A) List the different phases of an Operations Research study and also write any two scope. (4)

2B) A pharmaceutical firm engaged in manufacturing medicine A and medicine B has three major departments. Monthly capacities of productions are given as follows. (3)

Departments	Requirements per unit (hours)		Time available (hours)
	Medicine A	Medicine B	
Department A	4	2	1600
Department B	3	1	1200
Department C	5	2	1600

The marginal profit on Medicine A is 400 Rps, whereas on Medicine B is 100 Rps each. Assuming

that the company can sell any quantity of either product due to favourable market conditions, obtain a mathematical model for achieving highest profit.

2C) Find the region bounded by the following inequalities: (3)

$$x + y \geq 10$$
$$x \geq 0$$
$$y \geq 0$$

3A) Obtain the initial basic feasible solution for the following transportation problem table using Vogel's (5) Approximation method and also find the total cost.

Source	Destination				Supply
	A	B	C	D	
1	3	1	7	4	300
2	2	6	5	9	400
3	8	3	3	2	500
Demand	250	350	400	200	

3B) A marketing manager has 5 medical representatives and 5 sales districts. Considering the (5) capabilities of the medical representative and the nature of districts, the marketing manager estimates that sales per month (in thousand rupees) for each medical representative in each district would be follows:

Representative/District	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

4. Consider the following table containing 14 activities:

Activity	Immediate predecessors	Duration (months)
A	-	4
B	-	8
C	-	5
D	A	4
E	A	5
F	B	7
G	B	4
H	C	8
I	C	3
J	D	6
K	E	5
L	F	4
M	G	12
N	H	7
O	I	10
P	J, K, L	5
Q	M, N, O	8

4A) Construct network diagram. (3)

4B) Determine the critical path and project completion time. (4)

| 4C) | Compute total float and free float. | (3) |

5A) Solve the following game using dominance property: (5)

Player A	Player B				
	I	II	III	IV	V
I	2	5	10	7	2
II	4	4	8	12	1
III	3	3	6	6	4

5B) A hospital is exploring the level of staffing needed for a booth in the local mall, where they would test and provide information on diabetes. Previous experience has shown that, on average, every fifteen minutes a new person approaches the booth. A nurse can complete testing and answering questions, on average, in twelve minutes. If there is a single nurse at the booth, calculate system performance measures including the probability of idle time and of one or two persons waiting in the queue. What happens to the utilization rate if another workstation and nurse are added to the unit? (5)

6A) Write a short note on economic order quantity. (5)

6B) What is fixed order quantity system? Explain. (5)

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