126/E

003-007305

MCA (CBCS) Sem.-III Examination
November-2013
MCA-3006 : Operation Research

Faculty Code : 003
Subject Code : 007305

Time : 3 Hours| **|Total Marks : 70**

1. Answer the following multiple choice : **15**

Consider the following minimize assignment problem and give the answer of (1) to (5) :

	S1	S2	S3	S4	S4
T1	10	5	13	15	16
T2	3	9	18	13	6
T3	10	7	2	2	2
T4	7	11	9	7	12
T5	7	9	10	4	12

(1) T1 is assigned which subject
   (1) S1 (2) S2
   (3) S3 (4) S4

(2) T2 is assigned which subject
   (1) S1 (2) S2
   (3) S3 (4) S4

(3) T3 is assigned which subject
   (1) S3 (2) S1
   (3) S5 (4) S4

(4) T4 is assigned which subject
   (1) S1 (2) S2
   (3) S3 (4) S5

(5) T5 is assigned which subject
   (1) S1 (2) S2
   (3) S3 (4) S4

(6) To find the optimum route _____ is used
   (1) Transportation (2) Assignment
   (3) Pert-cpm (4) All of the above

(7) Which of the following is true :
   (1) An assignment problem can be solved by enumeration method
   (2) An assignment problem can be solved by transportation method
   (3) An assignment problem can be solved by Hungarian method
   (4) All of the above

(8) A basic feasible solution is called _____ if the value of at least one basic variable is zero

(1) Degenerate (2) Non degenerate

(3) Optimum (4) None of these

(9) An event that represent the joint completion of more than one activity is known as

(1) Burst event (2) Joint event

(3) Merge event (4) None of these

(10) An activity which starts immediately after one or more of the other activities are completed is known as

(1) Successor activity (2) Predecessor activity

(3) Dummy activity (4) None of these

(11) Crash cost =

(1) (crash cost - normal cost)/(normal time - crash time)

(2) (normal cost - crash cost)/(normal time - crash time)

(3) (crash cost - normal cost)/(crash time - normal time)

(4) None of these

(12) Total float =

(1) LF_{ij}-EF_{ij} (2) LS_{ij} - ES_{ij}

(3) (1) and (2) both (4) None of these

(13) _____ of an event is the difference between its latest occurrence time and its earlier occurrence time

(1) Float (2) Slack

(3) (1) and (2) both (4) None of these

(14) In normal conventional in pert L - E > 0 means

(1) Project completion is behind the schedule

(2) Project completion is ahead of the schedule date

(3) Resource are just sufficient for the completion of the activities in the project.

(4) None of these

(15) In LPP maximization case Cj - Zj <= 0, then

(1) It is basic feasible solution

(2) Basic feasible solution is optimum

(3) Can not say

(4) None of these

2. Attempt any **five** of the following : **15**

(1) A computer centre has three expert programmers. The centre wants three application programmes to be developed. The head of the computer centre, after carefully studying the programmes to be developed. Estimates the compute time in minutes required by the experts for the applications programmes as follow :

		Programmers		
		A	B	C
	1	120	100	80
Programmes	2	80	90	110
	3	110	140	120

Assign the programmers to the programme in such a way that the total compute time is minimum.

(2) Determine an initial basic feasible solution for the following transportation using LCM:

		Destination				
		D1	**D2**	**D3**	**D4**	**Supply**
Source	**S1**	1	2	1	1	30
	S2	3	3	2	1	30
	S3	4	2	5	9	40
	Demand	20	40	30	10	

(3) Solve the following LP problem graphically

Maximize Z = -x + 2y

stc

x-y<=-1

-0.5x + y <=2 and

x, y>=0

(4) What is replacement theory ? Briefly explain.

(5) Define: Optimum solution, slack variable, artificial variable.

(6) Just write the rules for constructing the dual from primal

3. Attempt any **three** of the following : **15**

(1) What is crashing ? Give the utility of crashing in detail.

(2) Only draw the pert network for the following data :

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor activity	-	A	B	B	B	C	C	F, G	D, E, H	I

(3) What is failure ? List and explain the types of failure.

(4) The cost of a machine is ₹ 6100 and its scrap value is only ₹ 100. From the experience the maintenance costs are found to be

Year	1	2	3	4	5	6	7	8
Maintenance cost (₹)	100	250	400	600	900	1250	1600	200

When should the machine be replaced ?

4. Attempt any **two** of the following : **15**

(1) Write a C program that finds the initial feasible solution for the given transportation problem using NWCM.

(2) Draw the flowchart for simplex method to solve the maximization as well as minimization LP problem.

(3) A steel company has three open hearth furnaces and five rolling mills. The transportation costs for shipping steel from furnaces to rolling meals are given the following table

	M1	M2	M3	M4	M5	Supply
F1	4	2	3	2	6	8
F2	5	4	5	2	1	12
F3	6	5	4	7	7	14
Demands	4	4	6	8	8	

What is the optimum shipping schedule ? (Use VAM to find initial basic feasible solution)

5. Attempt any **one** of the following : **10**

(1) Write a C program that finds the initial feasible solution for the given transportation problem using LCM.

(2) The required data for a small project consisting of different activities are given below:

Activity	Predecessor activity	Normal cost		Crash cost	
		Duration (days)	Costs	Duration (days)	Costs
A	-	6	300	5	400
B	-	8	400	6	600
C	A	7	400	5	600
D	B	12	1000	4	1400
E	C	8	800	8	800
F	B	7	400	6	500
G	D, E	5	1000	3	1400
H	F	8	500	5	700

(1) Draw the network diagram for the project and find the normal and minimum project length.

(2) If the project to be completed in 21 days with minimum crash cost, which activities should be crashed to how many days ?

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003-007305

MCA (CBCS) (Sem. III) Examination
December-2012
MCA – 3006 : Operation Research

Faculty Code : 003
Subject Code : 007305

Time : 3 Hours] **[Total Marks : 70**

1. Answer the following multiple choice questions : **15**

(1) Linear programming is a
- (a) Constrained optimization technique
- (b) Technique for economic allocation of limited resources.
- (c) Mathematical techniques
- (d) All of the above

(2) Constraints in an LP model represents
- (a) Limitation
- (b) Requirements
- (c) Balancing limitations and requirements
- (d) All of the above

(3) The distinguished feature of an LP model is
- (a) Relationship among all variable is linear
- (b) It has single objective function and constraints
- (c) Value of decision variables is non-negative
- (d) All of the above

(4) Alternative solution exist of an LP model when
- (a) One of the constraints is redundant
- (b) Objective function equation is parallel to one of the constrains
- (c) Two constrains are parallel
- (d) All of the above

(5) In the optimal simplex table, $C_j - Z_j$ value indicates
- (a) Unbounded solution (b) Cycling
- (c) Alternative solution (d) None of these

(6) For a maximization problem, the objective function coefficient for an artificial variable is
- (a) + M (b) – M
- (c) Zero (d) None of these

(7) If an optimal solution is degenerate, then
   (a) There are alternative optimal solution
   (b) The solution is infeasible
   (c) The solution is of no use to the decision maker
   (d) None of these

(8) If a primal LP problem has finite solution, then the dual LP problem should have
   (a) Finite solution (b) Infeasible solution
   (c) Unbounded solution (d) None of these

(9) The degeneracy in the transportation problem indicates that
   (a) Dummy allocation needs to be added
   (b) The problem has no feasible solution
   (c) The multiple optimal solution exists.
   (d) (a) and (b) only

(10) When the total supply is not equal to total demand in a transportation problem then it is called
   (a) Balanced (b) Unbalanced
   (c) Degenerate (d) None of these

(11) The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are
   (a) $m + n$ (b) $m * n$
   (c) $m + n - 1$ (d) $m + n + 1$

(12) The activity that can be delayed without affecting the execution of the immediate succeeding activity is determined by
   (a) Total float (b) Free float
   (c) Independent float (d) None of these

(13) Critical path means
   (a) Maximum length in terms of duration
   (b) Minimum length in terms of duration
   (c) Similar to another simple path
   (d) None of these

(14) The group replacement policy is suitable for identical low cost items which are likely to
   (a) Fail over a period of time
   (b) Fail suddenly
   (c) Fail completely and suddenly
   (d) None of these

(15) The problem of replacement is felt when job performing units fall
   (a) Suddenly (b) Gradually
   (c) (a) and (b) both (d) None of these

2. Attempt any **five** of the following : **15**

(1) Draw the flow chart for MODI method.

(2) Determine the initial basic feasible solution to the following transportation problem using VAM method :

	D_1	D_2	D_3	D_4	Supply
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
Demand	6	10	15	4	

(3) Describe the computational procedure of the optimally test in a transportation problem.

(4) Use the graphical method to solve the following problem :

Maximize $z = 3x_1 + 4x_2$

Subject to constrain

(a) $x_1 - x_2 = -1$

(b) $-x_1 + x_2 <= 0$ and $x_1, x_2 >= 0$

(5) Define slack, surplus and artificial variable in a linear programming.

(6) What is duality in simplex method ? Explain in brief.

3. Attempt any **three** of the following : **15**

(1) What is critical path ? Explain only forward pass method for the network.

(2) What is replacement ? List and explain the types of failure in replacement theory.

(3) Explain the mathematical model for the assignment problem.

(4) Solve the following LP for the optimization :

Min $Z = 3X + 8Y$

Subject to constrain

$X + Y = 200$

$X <= 80$

$Y >= 60$

$X, Y >= 0$

4. Attempt any **two** of the following : **15**

(1) Write a C program that will find the initial solution for the given transportation problem using NWCM method.

(2) What is slack of an activity and event in PERT-CPM ? List the different slack and also explain the same.

(3) Explain Hungarian method to solve the given assignment problem.

5. Attempt any **one** of the following : **10**

(1) Write a C program that will find the critical path for the given network. Your program will also print all the possible critical path for the given network.

(2) What is crashing in network ? Draw the network diagram for the following and also crash the relevant activities to determine the optimal project completion time.

Activity	Normal		Crash	
	Times (weeks)	Cost (₹)	Times (weeks)	Cost (₹)
1-2	3	300	2	400
2-3	3	30	3	300
2-4	7	420	5	580
2-5	9	720	7	810
3-5	5	250	4	300
4-5	0	0	0	0
5-6	6	320	4	410
6-7	4	400	3	470
6-8	13	780	10	900
7-8	10	1000	9	1200

003-007305

M. C. A. (CBCS) (Sem. III) Examination

November – 2011

MCA-3006 : Operation Research

Faculty Code : 003

Subject Code : 007305

Time : **3** Hours] [Total Marks : **70**

Instruction : Write answer of all questions in main answer sheet.

1 Answer the following multiple choice questions. 15

(1) Operation research practitioners do not
- (A) take responsibility for solution implementation
- (B) collect essential data
- (C) predict future actions/operations
- (D) build more than one model.

(2) The mathematical model of an LP problem is important because
- (A) it helps in converting the verbal description and numerical data into mathematical expression
- (B) decision-makers prefer to work with formal models
- (C) it captures the relevant relationship among decision factors
- (D) it enables the use of algebraic technique

(3) The solution space (region) of an LP problem is unbounded due to
- (A) an incorrect formulation of the LP model
- (B) objective function is unbounded
- (C) neither (A) or (B)
- (D) both (A) and (B)

(4) In the optimal simplex table $C_j - Z_j = 0$ value indicates
(A) unbounded solution
(B) cycling
(C) alternative solution
(D) infeasible solution

(5) If dual has an unbounded solution, primal has
(A) no feasible solution
(B) unbounded solution
(C) feasible solution
(D) none of the above

(6) The initial solution of a transportation problem can be obtained by applying any known method. However, the only condition is that
(A) the solution be optimal
(B) the rim conditions are satisfied
(C) the solution not be degenerate
(D) all of the above

(7) The degeneracy in the transportation problem indicates that
(1) dummy allocations needs to be added
(2) the problem has no feasible solution
(3) the multiple optimal solution exist
(4) the problem has feasible solution
(A) 1 and 2
(B) 2 and 3
(C) 3 and 4
(D) 1 and 4

(8) If there are n workers and n jobs there would be
(A) n ! solutions
(B) (n-1)! solutions
(C) $(n!)^n$ solutions
(D) n solutions

(9) An optimal solution of an assignment problem can be obtained only if
(A) each row and column has only one zero element
(B) each row and column has at least one zero element
(C) the data are arrangement in a square matrix
(D) none of the above

(10) If C is the initial cost of an item, then the discounted valued (d) of all future costs associated with the policy of replacing the item after n years is given by
(A) $D_n = C/(1-d^n)$
(B) $D_n = C/(1+d^n)$
(C) $D_n = C/(1-d)^n$
(D) $D_n = C/(1+d)^n$

(11) The group replacement policy is suitable for identical low cost items which are likely to
(A) fail over a period of time
(B) fail suddenly
(C) fail completely
(D) none of the above

(12) The activity that can be delayed without affecting the execution of the immediate succeeding activity is determined by
(A) total float
(B) free float
(C) independent float
(D) none of the above

(13) Network models have advantages in terms of project
(A) planning
(B) scheduling
(C) controlling
(D) All of the above

(14) The another term commonly used for activity slack time is
(A) total float
(B) free float
(C) independent float
(D) all of the above

(15) In a simplex method there are (m+1) * (m+1) entries in each table then in revised simplex method there are _____ entries.
(A) (m+1) * (m+1)
(B) (m+1) * (m-1)
(C) (m+1) * (m+2)
(D) (m+1) * (m-2)

2 Attempt any five of the following : 15

(i) Define : Operation Research. List and explain in brief operation research approach.

(ii) Explain the standard form of an LP problem.

(iii) Write the dual of the following LP problem.

Min $Zx = X_1 + X_2 + X_3$

Subject to constraints

(i) $X_1 - 3X_2 + 4X_3 = 5$

(ii) $X_1 - 2X_2 \leq 3$

(iii) $2X_2 - X_3 \geq 4$

(iv) $X_1, X_2 \geq 0$ and X_3 is unrestricted

(iv) Determine an initial basic feasible solution to the following transportation problem by using NWCR.

		Destination				
		D1	D2	D3	D4	Supply
Source	S1	21	16	15	3	11
	S2	17	18	14	23	13
	S3	32	27	18	41	19
	Demand	6	10	12	15	

(v) Is replacement necessary ? Justify your answer by giving suitable example. Explain different types of failure.

(vi) What is dummy activity ? Why it is required ? Explain looping and dangling.

3 Attempt any three of the following : 15

(i) Vitamin V and W are found in two different food F_1 and F_2. One unit of food F_1 contains 2 units of vitamin V and 5 units of vitamin W. One unit of food F_2 contains 4 units of vitamin V and 2 units of vitamin W. One unit of food F_1 and F_2 cost Rs. 30 and 25 respectively. The minimum daily requirements for a person of Vitamin V and W is 40 and 50 units respectively. Assuming that anything in excess of daily minimum requirement of vitamin V and W is not harmful, find out the optimal mixture of food F_1 and F_2 at the minimum cost which meets the daily minimum requirement of vitamins V and W. Formulate this as a linear programming problem.

(ii) Using graphical method find the maximum value of
$Z = 7\ X_1 + 10\ X_2$
subject to constraints

(i) $X_1 + X_2 \leq 30000$

(ii) $X_2 \leq 12000$

(iii) $X_1 \geq 6000$

(iv) $X_1 \geq X_2$

(v) $X_1, X_2 \geq 0$

(iii) A department of a computer has five employees with five jobs to be performed. The time in hours that each man takes to perform each job is given in the effectiveness matrix.

	Employees				
Jobs	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man hours ?

(iv) Differentiate PERT Vs CPM.

4 Attempt any two of the following : 15

(i) The data on the operating cost per year and resale price of equipment A whose purchase price is Rs. 10000 are given below :

Year	1	2	3	4	5	6	7
Operating Cost	1500	1990	2300	2900	3600	4500	5500
Resale Value	5000	2500	1250	600	400	400	400

(a) What is the optimum period of replacement ?

(b) When equipment A is two years old, equipment B, which is a new model for the same usage, is available. The optimum period for replacement is four years with an average cost of Rs. 3600. Should we change equipment a with equipment B ? If so, when ?

(ii) A computer has 20000 resistors. When any of the resistors fail, it is replaced. The cost of replacing a resistor individually is Rs. 1. If all the resistors are replaced at the same time the cost per resistor is reduced to be Rs. 0.40.The percentage surviving at the end of month t, and the probability of failure during the month are given below :

	0	1	2	3	4	5	6
Percentage surviving at the end of t	100	96	90	65	35	20	0
Probability of failure during month t	-	0.04	0.06	0.25	0.30	0.15	0.20

What is the optimum replacement plan ?

(iii) Use two-phase simplex method to solve the following LP problem

Maximize $Z = 3X_1 + 2X_2 + 2X_3$

Subject to constraints

(i) $5X_1 + 7X_2 + 4X_3 \leq 7$

(ii) $-4X_1 + 7X_2 + 5X_3 \geq -2$

(iii) $3X_1 + 4X_2 - 6X_3 \geq 29/7$

(iv) and $X_1, X_2, X_3 \geq 0$

5 Attempt any one of the following : 10

(i) The time and cost estimates and precedence relationship of the different activities constituting a project are given below :

Activities	Immediate Predecessor Activities	Time in Weeks Normal	Crash	Cost in Rs. Normal	Crash
A	-	3	2	8000	19000
B	-	8	6	600	1000
C	B	6	4	10000	12000
D	B	5	2	4000	10000
E	A	13	10	3000	9000
F	A	4	4	15000	15000
G	F	2	1	1200	1400
H	C,E,G	6	4	3500	4500
I	F	2	1	7000	8000

(a) Draw project network diagram and find the critical path.

(b) If a dead line of 17 weeks is imposed for completion of the project, what activities will be crashed ? What would be the additional cost and what would be critical activities of the crashed network after crashing ?

(ii) A company has received a contract to supply gravel to three new construction projects located in towns A, B and C. The construction engineers have estimated that the required amounts of gravel which will be needed at these construction projects are :

Project location	Weekly Requirement (Truckloads)
A	72
B	102
C	41

The company has 3 gravel pits located in towns X, Y and Z. The gravel required by the construction projects can be supplied by three pits. the amount of gravel that can be supplied by each pit is as follows :

Plant	X	Y	Z
Amount available (truckloads)	76	82	77

The company has computed the delivery cost from each pit to each project site. These costs in Rupees are shown in the following table.

		Project Location		
		A	B	C
Pit	X	4	8	8
	Y	16	24	16
	Z	8	16	24

Schedule the shipment from each pit to each project in such a manner so that it minimizes the total transportation cost within the constraints imposed by pit capacities and project requirements. Also find the minimum cost. Find the initial solution using Vogel's method and optimum solution using MODI method.