Reg. No. : | | | | | | | | | | | | |

Question Paper Code : J1116

M.B.A. DEGREE EXAMINATION, FEBRUARY/MARCH 2018

Third Semester

DBA 7301 — APPLIED OPERATIONS RESEARCH

(Common to all branches)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Solve by graphical Method

   Maximize $Z = 2x_1 + 3x_2$; subject to $x_1 + x_2 < 30$, $x_2 \geq 3$, $x_2 \leq 12$, $x_1 - x_2 \geq 0$, $0 \leq x_1 \leq 20$.

2. State any two basic assumptions of Linear Programming.

3. What are “loops” in a transportation table?

4. State why an assignment problem is not a LPP?

5. Define saddle point.

6. What are the assumptions made in game theory?

7. Explain the terms lead time, reorder point.

8. What are the advantages of simulation?

9. Define traffic intensity.

10. What is the probability that a customer has to wait more than 15 minutes to get his service completed in an $(M/M/1):(\infty/FCFS)$ queuing system if $\lambda = 6$ per hour and $\mu = 10$ per hour?

PART B — ($5 \times 13 = 65$ marks)

11. (a) A firm manufactures two products A and B on which the profits earned per unit are Rs. 3 and Rs. 4 respectively Each product is processed on two Machines M_1 and M_2 Product A requires one minute of processing time on M_1 and two minutes of processing on M_2 while processing of product B requires one minute on M_1 and one minute on M_2, Machine M_1 is available for not more than 7 hours 30 minutes while Machine M_2 is available for 10 hours during any working day. Find the number of units of products A and B need to be manufactured to get maximum profit. Formulate the above as a LPP and solve by graphical method. (13)

Or

(b) Use simplex method to solve the following problem

Maximize $Z = 2x_1 + 5x_2$

Subject to $x_1 + 4x_2 \le 24$

$$3x_1 + x_2 \le 21$$
$$x_1 + x_2 \le 9$$

and $x_1, x_2 \ge 0$. (13)

12. (a) A product is produced by four factories F_1, F_2, F_3, F_4. Their unit production costs are Rs. 2, 3, 1 and 5 respectively. Production capacity of the factories are 50, 70, 30 and 50 units respectively. The product is supplied to four stores S_1, S_2, S_3, S_4 the requirements of which are 25, 35, 105 and 20 respectively. Unit cost of transportation are given in the following table. Find the transportation plan such that the total production and transportation cost is minimum. (13)

	S_1	S_2	S_3	S_4
F_1	2	4	6	11
F_2	10	8	7	5
F_3	13	3	9	12
F_4	4	6	8	3

Or

(b) A company is faced with the problem of assigning four different salesman to four territories for promoting its sales. Territories are not equally rich in their sales potential and the salesman also differ in their ability to promote sales. The following table gives the expected annual sales (in thousands of Rs.) for each salesman if assigned to various territories. Find the assignment of salesman so as to maximize the annual sales. (13)

		Territories			
		T_1	T_2	T_3	T_4
Salesman	S_1	60	50	40	30
	S_2	40	30	20	15
	S_3	40	20	35	10
	S_4	30	30	25	20

13. (a) Using Gomory's cutting plane method (13)

Maximize $Z = 2x_1 + 2x_2$

Subject to $5x_1 + 3x_2 \leq 8$

$2x_1 + 4x_2 \leq 8$

and $x_1, x_2 \geq 0$ and are all integers.

Or

(b) Use the notion of dominance to simplify the rectangular game with the following pay off and solve it graphically. (13)

		Player B			
		I	II	III	IV
Player A	1	18	4	6	4
	2	6	2	13	7
	3	11	5	17	3
	4	7	6	12	2

14. (a) A manufacturing company purchases 9,000 parts of a machine for its annual requirements ordering one month requirement at a time with each part costs Rs. 20. The ordering cost per order is Rs. 15 and the carrying charges 15 percent of the average inventory per year. You have been assigned to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year? (13)

Or

(b) The probability of the demand for lorries for hiring on any day in a given district is as follows:

No. of lorries demanded:	0	1	2	3	4
Probability:	0.1	0.2	0.3	0.2	0.2

Lorries have a fixed cost of Rs. 90 each day to keep the daily five charges (net of variable costs of running) Rs. 200. If the lorry-hire company owns 4 lorries, what is its daily expectation? If the company is about to go into business and currently has no lorries how many lorries should it buy? (13)

15. (a) On an average 96 patients per 24 hour per day require the service of an emergency clinic. Also, on an average, a patient requires 10 minutes of active attention. Assume that the facility can handle only one emergency at a time. Suppose that it costs the clinic Rs. 100 per patient treated to obtain an average servicing time of 10 minutes, and that each minute of decrease in their average time would cost Rs. 10 per patient treated. How much would have to be budgeted by the clinic to decrease the average size of the queue from $1\frac{1}{3}$ patients to $\frac{1}{2}$ patient. (13)

Or

(b) Machine 'A' costs Rs. 9000 and its annual operating cost is Rs.200 for the first year and then increased by Rs. 2000 every year. Determine the optimum replacement policy. Machine 'B costs Rs. 10,000 and its annual operating cost is Rs. 400 for the first year and then increased by Rs. 800 every year. You now own a machine A which one year old. Should you replace it with B? if so, when? (13)

PART C — ($1 \times 15 = 15$ marks)

16. (a) Use Branch and Bound technique to solve the following:

Maximize $Z = x_1 + 4x_2$

Subject to constraints

$$2x_1 + 4x_2 \leq 7$$
$$5x_1 + 3x_2 \leq 15$$

and $x_1, x_2 \geq 0$ and integers.

Or

(b) (i) Write a note on group replacement policy. (5)

(ii) Find the cost per period of individual replacement policy of an installation of 400 light bulbs, given the following:

(1) Cost of replacing an individual bulb is Rs. 2/-

(2) Conditional probability of failure is given below:

Week No. :	0	1	2	3	4
Conditional probability of failure:	0	0.1	0.3	0.7	1.0

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : BS2116

M.B.A. DEGREE EXAMINATION, AUGUST/SEPTEMBER 2017.

Third Semester

DBA 7301 — APPLIED OPERATIONS RESEARCH

(Regulations 2013)

(Common to All Branches)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the limitations of an O.R. Model?
2. When can we use the graphical method for solving a LPP?
3. What is the purpose of MODI Method?
4. Define an assignment problem.
5. State the rule of dominance.
6. What is the fractional part of -2/3?
7. What are the cost involved in Inventory?
8. Name the methods of random number generation.
9. Explain Kendall's notation.
10. Define discount factor.

PART B — (5 × 13 = 65 marks)

11. (a) Use Simplex method to solve the LPP.

Maximize $Z = 4x_1 + 10x_2$

Subject to :

$2x_1 + x_2 \leq 50$

$2x_1 + 5x_2 \leq 100$

$2x_1 + 3x_2 \leq 90$

and $x_1, x_2 \geq 0$.

Or

(b) Solve by Two Phase simplex method.

Maximize $Z = 5x_1 + 8x_2$

Subject to :

$3x_1 + 2x_2 \geq 3$

$x_1 + 4x_2 \geq 4$

$x_1 + x_2 \leq 5$

and $x_1, x_2 \geq 0$.

12. (a) Solve the Transportation Problem.

		Market					
		A	B	C	D	E	Available
Factory	P	4	1	2	6	9	100
	Q	6	4	3	5	7	120
	R	5	2	6	4	8	120
	Demand	40	50	70	90	90	

Or

(b) The processing time in hours for the Jobs when allocated to the different machines are indicated below. Assign the machines for the Jobs so that the total processing time is minimum.

		Machines				
		M_1	M_2	M_3	M_4	M_5
Jobs	J_1	9	22	58	11	19
	J_2	43	78	72	50	63
	J_3	41	28	91	37	45
	J_4	74	42	27	49	39
	J_5	36	11	57	22	25

13. (a) Find the optimum integer solution to the following LPP.

Maximize $Z = x_1 + 2x_2$

Subject to :

$2x_2 \leq 7$

$x_1 + x_2 \leq 7$

$2x_1 \leq 11$

$x_1, x_2 \geq 0$ and are integers.

Or

(b) Reduce the following game by dominance and find the game value.

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

14. (a) Find the optimal order quantity for a product for which the price-break is as follows:

Quantity	Price
$0 \leq Q_1 < 50$	Rs. 10
$50 \leq Q_2 < 100$	Rs. 9
$100 \leq Q_3$	Rs. 8

The monthly demand for the product is 200 units, the cost of the storage is 25% of the unit cost and ordering cost is Rs. 20.00 per order.

Or

(b) (i) Explain Basic Terminologies in Decision Theory. (6)

(ii) What are the advantages and disadvantages of simulation techniques? (7)

15. (a) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that inter-arrival time and service time distribution follows an exponential distribution with an average of 30 minutes, calculate the following.

(i) The mean queue size.

(ii) The probability that queue size exceeds 10.

(iii) If the input of the train increases to an average of 33 per day, what will be the changes in (i) and (ii)?

Or

(b) A computer contains 10,000 resistors. When any resistor a tiles, it is replaced. The cost of replacing a resistor individually is Rs. 1 only. If all the resistors are replaced at the same time, the cost per resistor would be reduced to 35 paisa. The percentage of surviving resistors say S(t) at the end of month (t) and p(t) the probability of failure during the month (t) are :

T	0	1	2	3	4	5	6
S(t)	100	97	90	70	30	15	0
P(t)	–	0.03	0.07	0.20	040	0.15	0.15

What is the optimal replacement plan?

PART C — (1 × 15 = 15 marks)

16. (a) A company produces 2 types of hats A and B. Every hat A requires twice as much labour time as the second hat B. If the company produces only hat B then it can produce a total of 500 hats per day. The market limits daily sales of hat A and B to 150 and 250 respectively. The profits on hat A and B are Rs. 8 and Rs. 5 respectively. Solve graphically to get the optimal solution.

Or

(b) A tax-consulting firm has 3 counters in its office to receive people who have problems concerning their income, wealth and sales taxes. On an average 48 persons arrive in an 8 hour day. Each Tax advisor spends 15 minutes on the average on an arrival. If the arrivals are Poisson distributed and service times are according to exponential distribution, find (i) Average number of customers in the system. (ii) Average time a customer spends in the system. (iii) Average waiting time for a customer in the queue. (iv) The probability that a customer has to wait before he gets service.

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : JK4116

M.B.A. DEGREE EXAMINATION, FEBRUARY/MARCH 2017.

(From Academic Year – 2015 – New Question Paper Pattern)

Third Semester

DBA 7301 — APPLIED OPERATIONS RESEARCH

(Common to All Branches)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define feasible region.

2. List the applications of Operation research model.

3. What do you mean by degeneracy in a Transportation problem?

4. State the difference between the Transportation problem and Assignment problem.

5. Define two person zero sum game.

6. When do players apply mixed strategies?

7. What are the different types of inventories?

8. What are the advantages of simulation?

9. What are the basic characteristics of a queueing system?

10. State the conditions under which group replacement is superior to individual replacement.

PART B — (5 × 13 = 65 marks)

11. (a) Solve the following LPP by graphical method.

Minimize $Z = 3x_1 + 5x_2$

Subject to $-3x_1 + 4x_2 \geq 12$

$x_1 \leq 4$

$2x_1 - x_2 \geq -2$

$x_2 \geq 2$

$2x_1 + 3x_2 \geq 12$

and $x_1, x_2 \geq 0$.

Or

(b) Use simplex method to solve the LPP.

Maximize $Z = 3x_1 + 2x_2$

Subject to $x_1 + x_2 \leq 4$

$x_1 - x_2 \leq 2$

and $x_1, x_2 \geq 0$.

12. (a) Solve the following Transportation problem starting with the initial solution obtained by Vogel's approximation method

Source	Destination					
		P	Q	R	S	Supply
	A	21	16	25	13	11
	B	17	18	14	23	13
	C	32	17	18	41	19
	Demand	6	10	12	15	43

Or

(b) A Company has five Jobs to be done on five machines. Any Job can be done on any machine. The cost of doing the Jobs on different machines are given below. Assign the Jobs for different machines so as to minimize the total cost.

	Machines					
Jobs		A	B	C	D	E
	I	13	8	16	18	19
	II	9	15	24	9	12
	III	12	9	4	4	4
	IV	6	12	10	8	13
	V	15	17	18	12	20

13. (a) Find the optimum integer solution to the following LPP

Maximize $Z = x_1 + x_2$

Subject to $3x_1 + 2x_2 \leq 5$

$x_2 \leq 2$

$x_1, x_2 \geq 0$ and are integers.

Or

(b) Solve the following game graphically

	Player B	
Player A	1	−3
	3	5
	−1	6
	4	1
	2	2
	−5	0

14. (a) Annual demand for an item is 6000 Units. Ordering cost is Rs.600 per order. Inventory carrying cost is 18% of the purchase price/unit/year. The price break-up is as shown below.

Quantity	Price
$0 \leq Q_1 < 2000$	20
$2000 \leq Q_2 < 4000$	15
$Q_3 \geq 4000$	9

Find the optimal order size.

Or

(b) Discuss about Monte-Carlo Simulation in detail.

15. (a) Customers arrive at the first class ticket counter of a theatre at a rate of 12 per hour. There is one clerk servicing the customers at the rate of 30 per hour.

(i) What is the probability that there is no customer at the counter?

(ii) What is the probability that there are more than 2 customers at the counter?

(iii) What is the probability that there is no customer waiting to be served?

Or

(b) The following failure rates have been observed for a certain type of transistors in a digital computer.

End of the week	1	2	3	4	5	6	7	8
Probability of failure to date	0.05	0.13	0.25	0.43	0.68	0.88	0.96	1.00

The cost of replacing a single failed transistor is Rs.1.25. The decision is made to replace all these transistors simultaneously at fixed intervals, and to replace the single transistors as they fail in service. If the cost of group replacement is 30 paisa per transistor, what is the best interval between group replacements? At what group replacement price per transistor would a policy of strictly single replacement become preferable to the adopted policy?

PART C — (1 × 15 = 15 marks)

16. (a) A Salesman has to travel to five cities in a month without revisiting any city. Determine an optimal travel plan for the time matrix (in hours) given

		To city				
		A	B	C	D	E
From City	A	∞	4	7	3	4
	B	4	∞	6	3	4
	C	7	6	∞	7	5
	D	3	3	7	∞	7
	E	4	4	5	7	∞

Or

(b) A supermarket has two servers servicing at counters. The customer arrive in a poisson fashion at the rate of 10 per hour. The service time for each customer is exponential with mean 4 minutes. Find (i) the probability that a customer has to wait for the service, (ii) average queue length. (iii) the average time spent by a customer in the queue.

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Reg. No. | | | | | | | | | | | | |

Question Paper Code : KJ1116

M.B.A. DEGREE EXAMINATION, FEBRUARY/MARCH 2017

Third Semester

DBA 7301 – APPLIED OPERATIONS RESEARCH

(Regulations 2013)

(Common to all Branches)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write any two situations where L.P.P is applied.
2. What is the use of artificial variables in LPP?
3. Define degeneracy in transportation problem.
4. Give a note on travelling salesmen problem.
5. What is mean by mixed integer programming problem?
6. What is two person zero-sum game?
7. What is meant EOL?
8. Write a note on simulation technique.
9. Define reneging.
10. Define group replacement.

PART B — (5 × 16 = 80 marks)

11. (a) Use Penalty Method to maximize

$Z = 2x_1 + x_2 + x_3$

Subject to:

$4x_1 + 6x_2 + 3x_3 \leq 8$

$3x_1 - 6x_2 - 4x_3 \leq 1$

$2x_1 + 3x_2 - 5x_3 \geq 4$

And $x_1, x_2, x_3 \geq 0$

Or

(b) Use Two Phase method to Minimize

$-2x_1 - x_2$

Subject to the constraints

$x_1 + x_2 \geq 2$

$x_1 + x_2 \leq 4$

and $x_1, x_2 \geq 0$

12. (a) Solve the following transporation problem using Vogel's method

Warehouse

		A	B	C	D	E	F	Available
	1	9	12	9	6	9	10	5
Factory	2	7	3	7	7	5	5	6
	3	6	5	9	11	3	11	2
	4	6	8	11	2	2	10	9
Requirement		4	4	6	2	4	2	

Or

(b) A batch of 4 jobs can be assigned to 5 different machines. The set up time(in hours) for each job on various machines is given below: Find an optimal assignment of jobs to machines which will minimize the total set up time.

Machines

		1	2	3	4	5
	1	10	11	4	2	8
Jobs	2	7	11	10	14	12
	3	5	6	9	12	14
	4	13	15	11	10	7

13. (a) Solve the following LPP

Minimize

$Z = -2x_1 - 3x_2$

Subject to :

$2x_1 + 2x_2 \leq 7$

$x_1 \leq 2$

$x_2 \leq 2$ and $x_1, x_2 \geq 0$ and integers

Or

(b) (i) Solve the following game whose payoff matrix for player A is given (8)

$$\begin{array}{c} \\ A \end{array} \begin{array}{c} B \\ \begin{pmatrix} 1 & 7 & 2 \\ 6 & 2 & 7 \\ 5 & 1 & 6 \end{pmatrix} \end{array}$$

(ii) Reduce the following game by dominance and solve it graphically (8)

		PLAYER B			
		I	II	III	IV
	I	18	4	6	4
PLAYER A	II	6	2	13	7
	III	11	5	17	3
	IV	7	6	12	2

14. (a) The demand for an item in a company is 18,000 units per year and the company can produce the item at a rate of 3000 per month. The cost of one set up is Rs. 500 and the holding cost of one unit per month is 15 paise. The shortest cost of one unit is Rs. 20 per month. Determine the optimum manufacturing quantity and the number of shortages. Also determine the manufacturing time and time between set—ups.

Or

(b) An automobile production line turns out about 100 cars a day. but deviations occur owing to many causes. The production is more accurately described by the probability distribution given below :

	Production/day	Probability		Production/day	Probability
1	95	0.03	7	101	0.15
2	96	0.05	8	102	0.10
3	97	0.07	9	103	0.07
4	98	0.10	10	104	0.05
5	99	0.15	11	105	0.03
6	100	0.20	12		1.00

Finished cars are transported across the bay at the of each day ferry. If the ferry has space for only 101 cars, what will be the average number of cars waiting to be shipped and what will be the average number of empty spaces on this ship?

15. (a) Cars arrive at a petrol pump, having one petrol unit, in poisson fashion with an average oil 10 cars per hour. The service time is distributed exponentially with a mean of 3 minutes. Find (i) average number of cars in the system (ii) average waiting Lime in the queue (iii) average queue length (iv) the probability that the number of cars in the system is 2.

Or

(b) The following failure rates have been observed for a certain type of light bulbs :

Week	1	2	3	4	5
% of failed by the end of week	10	25	50	80	100

There are 1000 bulbs in use, and it coss Rs. 2 to replace an individual bulb which has burnt out. If all bulbs were replaced simultaneously it would be cost 50 paise per bulb. It is proposed to replace all bulbs at fixed intervals of time, Whether or not they have burnt out, and to continue replacing burnt out bulbs as and when they fail. At what interval should all the bulbs be replaced? At what group replacement price per bulb would a policy of strictly individual replacement become preferable to the adopted policy?

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : K1116

M.B.A. DEGREE EXAMINATION, AUGUST/SEPTEMBER 2016.

Third Semester

DBA 7301 — APPLIED OPERATIONS RESEARCH

(Common to all branches)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you mean by two phase method for solving a given L.P.P?
2. Define slack and surplus variables as involved in the L.P.P
3. Write a short note on traveling sales man problem.
4. How does the problem of degeneracy arise in a transportation problem?
5. Write a short note on Integer Programming.
6. How is the concept of dominance used in simplifying the solution of a rectangular game?
7. What is Monte Carlo simulation?
8. Describe any two methods used for decision making with uncertainty.
9. State some of the simple replacement policies.
10. What is a multi- channel queuing problem?

PART B — (5 × 16 = 80 marks)

11. (a) Use two-phase simplex method to solve the problem:

Max. $Z = 3x_1 - x_2$

$2x_1 + x_2 \geq 2$

$x_1 + 3x_2 \leq 2$

$x_2 \leq 4$

and $x_1, x_2 \geq 0$.

Or

(b) A person require 10, 12 and 12 units of chemicals A, B and C respectively for his garden. A liquid product contains 5, 2 and one unit of A, B and C respectively per jar. A dry product contains, 1, 2 and 4 units of A, B and C per carton. If the liquid product sells for Rs.3 per jar and the dry product sells for Rs.2 per carton, how many of each should be purchased to minimize the cost and meet the requirements.

12. (a) With an example, explain about the North — West corner rule, the least cost method, and the Vogel's Approximation method for obtaining an initial basic feasible solution of a transportation problem.

Or

(b) A car hire company has one car at each of five depots a,b,c,d and e. A customer requires a car in each town, namely A,B,C,D and E. Distance (in kms) between depots (orgins) and towns (destinations) are given in the following distance matrix:

	a	b	c	d	e
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110
E	55	35	70	80	105

How should cars be assigned to customers so as to minimize the distance travelled?

13. (a) What is game theory? Include in your answer various approaches in solving strategies and game values.

Or

(b) Use Branch and Bound technique to solve the following integer programming problem:

Max $Z = 3x_1 + 3x_2 + 13x_3$

Subject to $-3x_1 + 6x_2 + 7x_3 \leq 8$

$5x_1 - 3X_2 + 7X_3 \leq 8$

$0 \leq x_j \leq 5$

And all x_j are integers.

14. (a) It is said that 'EOQ models, however complex, are restricted by so many assumptions that they have very limited practical value'. Do you agree with this view? Illustrate your answer with example.

Or

(b) A business man has two independent investments A and B available to him; but he lacks the capital to undertake both of them simultaneously. He can choose to take A first and then stop, or if A is successful then take B, or vice versa. The Probability of success on A is 0.7, while for B it is 0.4. Both investments require an initial capital outlay of Rs.2,000 and both return nothing if the venture is Unsuccessful. Successful completion of A will return Rs.3,000 (over cost) and Successful completion of B will return Rs.5,000 (overcast) Draw the decision tree and determine the best strategy

15. (a) A Photocopying machine in an office is operated by a person who does other jobs also. The average service time for a job is 6 minutes per customer. On an average, every 12 minutes one Customer arrives for Photocopying.

Find the following :

(i) the machine utilization (4)

(ii) percentage of times that an arrival has to wait (3)

(iii) average time spent by a customer (3)

(iv) average queue length (3)

(v) arrival rate if the management is willing to deploy the person exclusively for photocopying when the average time spent by a customer exceeds 15 minutes. (3)

Or

(b) Discuss the policy of replacement of items whose maintenance cost increase with time but the value of money remains constant during the period

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : S1116

M.B.A. DEGREE EXAMINATION, FEBRUARY/MARCH 2016.

Third Semester

DBA 7301 — APPLIED OPERATIONS RESEARCH

(Common to All Branches)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State any two basic assumptions of Linear Programming.
2. State any two limitations of LP.
3. State why an assignment problem is not a LPP.
4. What are "loops" in a transportation table?
5. What is a mixed integer problem?
6. Define saddle point.
7. What are the various types of inventory carrying costs?
8. What is simulation?
9. State the features of a multiple channel queueing model.
10. What is mean by traffic intensity?

PART B — (5 × 16 = 80 marks)

11. (a) Solve the following problem by graphically. (16)

Maximize $Z = 2x_1 + x_2$

Subject to $x_1 + 2x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_2 \leq 2$

$x_1 - 2x_2 \leq 1$

and $x_1, x_2 \geq 0$.

Or

(b) Solve the following LPP by Simplex method. (16)

Maximize $Z = 4x_1 + 7x_2$

Subject to $2x_1 + x_2 \leq 1000$

$x_1 + x_2 \leq 600$

$x + 2x_2 \leq 1000$

and $x_1, x_2 \geq 0$.

12. (a) Solve the following transportation problem to minimize the cost. (16)

		Destination				Supply
Source		D_1	D_2	D_3	D_4	
	S_1	500	1000	150	800	10000
	S_2	200	700	500	100	12000
	S_3	600	400	100	900	8000
Demand		9000	9000	10000	4000	

Or

(b) A company having four machines accepts three jobs, one to be assigned to one machine only. The cost of each job on each machine is given in the following table : (16)

	M_1	M_2	M_3	M_4
J1	18	24	28	32
J2	8	13	17	19
J3	10	15	19	22

Obtain an optimal assignment of the jobs to the machines.

13. (a) Solve the following IPP. (16)

Maximize $Z = 3x_1 + 4x_2$

Subject to $2x_1 + x_2 \leq 6$

$2x_1 + 3x_2 \leq 9$

and $x_1, x_2 \geq 0$ and integers.

Or

(b) Solve the following game. (16)

		Player B			
Player A		B1	B2	B3	B4
	A1	150	–18	78	90
	A2	6	102	54	70
	A3	130	–30	78	80

14. (a) Explain the various types of inventory models. (16)

Or

(b) A bakery keeps stock of a popular brand of cake. Daily demand based on past experience is given below :

Daily Demand :	0	15	25	35	45	50
Probability :	0.01	0.15	0.20	0.50	0.12	0.02

Consider the following sequence of random numbers : 48, 78, 09, 51, 56, 77, 15, 14, 68 and 09.

(i) Using the sequence, simulate the demand for the next 10 days. (6)

(ii) Find the stock situation if the owner of the bakery decides to make 35 cakes every day. Also estimate the daily average demand for the cakes on the basis of the simulated data. (10)

15. (a) There are four booking counters in a railway station. The arrival rate of customers follow poisson distribution and it is 30 customers per hour. The service rate also follow poisson distribution and it is 10 customers per hour. Find

(i) Average waiting number of customers in the queue as well as in the system. (8)

(ii) Average waiting time per customer in the queue as well as in the system. (8)

Or

(b) If money value is ignored suggest when to replace a machine which has a capital cost of Rs. 12,200. Scrap value of Rs. 200 and running costs as given in the table below : (16)

Year :	1	2	3	4	5	6	7	8
Running cost (Rs.) :	200	500	800	1200	1800	2500	3200	4000

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80116

M.B.A DEGREE EXAMINATION, AUGUST 2015

Third Semester

DBA 7301 –APPLIED OPERATIONS RESEARCH

(Common to All Branches)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the applications of Operations Research in marketing functions?

2. What is the coefficient of the artificial variables in Phase 1 of the 2 Phase method and what is the objective equation?

3. Out of the algorithms for Initial basic feasible solution in a transportation model which one yields the near optimal solution and why?

4. What is the advantage of using Branch and bound algorithm in an assignment model?

5. List the applications of Integer programming algorithm.

6. List the applications of competitive games in advertising.

7. What is shortage cost? Should it be reduced or increased?

8. List the applications of simulation in management decision making.

9. Can a queuing model help in reducing traffic congestion? How?

10. Why must replacement of capital items be planned with considering time value for money?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Using a neat diagram explain safety stock, reorder point, economic batch quantity and lead time. (8)

(ii) The annual requirement for an item is 50000 units, ordering cost is Rupees 200, unit cost is Rupees 25 and carrying cost is 25% of the unit cost per year. Determine the EOQ, Number of orders and time between orders. (8)

Or

(b) A manufacturing company keeps stock of a special product. Previous experience indicates the daily demand as given below.

Daily demand	15	20	25	30	35
Probability	0.1	0.15	0.15	0.5	0.1

Using the given random numbers 82, 96, 18, 96, 20, 84, 56, 11, 52, 03 simulate the demand for 10 days and determine the average daily demand.

12. (a) Solve the following LPP

Minimise $Z = 6x_1 + 4x_2$ subject to: $3x_1 + 0.5x_2 >= 12$, $2x_1 + x_2 >= 16$, and $x_2 >= 0$

Or

(b) Solve the following LPP by simplex method

Minimise $Z = 60x_1 + 80x_2$ subject to : $20x_1 + 30x_2 >= 900$, $40x_1 + 30x_2 >= 1200$ and $x_1, x_2 >= 0$

13. (a) Solve the following transportation problem to minimize the cost

		Destination				Supply
		A	B	C	D	
Source	I	500	1000	150	800	10000
	II	200	700	500	100	12000
	III	600	400	100	900	8000
Demand		9000	9000	10000	4000	

Or

(b) Assign the Zones to men to minimise the total time.

		Zones			
		I	II	III	IV
Men	A	45	40	51	67
	B	57	42	63	55
	C	49	52	48	64
	D	41	45	60	55

14. (a) Solve the following IPP

Maximise $Z = 200x_1 + 300x_2$ Subject to : $2x_1 + 4x_2 <= 17$, $3x_1 + 3x_2 <= 15$, $x_1, x_2 >= 0$ and integers

Or

(b) Solve the following game

		Player B			
		B1	B2	B3	B4
Player A	A1	150	-18	78	90
	A2	6	102	54	70
	A3	130	-30	78	80

15. (a) A bank has two typists, If the service time for each letter is exponential with mean 6 minutes and if letters arrive in a Poisson fashion at a counter at the rate of 19 per hour, then calculate

(i) The probability of a letter having to wait (6)

(ii) The expected percentage of idle time for each typist (5)

(iii) Find the expected length of waiting time for each typist (5)

Or

(b) If money value is ignored suggest when to replace a machine which has a capital cost of ₹ 12200, scrap value of ₹ 200 and running costs as given in the table below

Year	1	2	3	4	5	6	7	8
Running cost in ₹	200	500	800	1200	1800	2500	3200	4000

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 22118

M.B.A. DEGREE EXAMINATION, FEBRUARY/MARCH 2015.

Third Semester

DBA 7301 — APPLIED OPERATIONS RESEARCH

(Common to all branches)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State any two basic assumptions of LP.
2. What is an unbounded solution in the simplex method of LPP?
3. What are "loops" in a transportation table?
4. What is an unbalanced assignment problem?
5. What is a mixed integer problem?
6. What is a Pay off matrix in Game Theory?
7. What are the various types of inventory carrying costs?
8. What is simulation?
9. State the features of a multiple channel queuing model.
10. What are the rules meant for calculating rate o replacement in a group replacement decisions?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the applications of OR in various functional areas of management. (8)

(ii) What are the various steps involved in using simplex method for minimization problems? (8)

Or

(b) A firm plans to purchase at least 200 quintals of scrap containing high quality metal X and low quality metal Y. it decides that the scrap to be purchased must contain at least 100 quintals of X-metal and not more than 35 quintals of Y- metal. The firm can purchase the scrap from two Suppliers (A and B) in unlimited quantities. The percentage of X and Y metals in terms of Weight in the scraps supplied by A and B is given below:

Metals	Supplier A	Supplier B
X	25%	75%
Y	10%	20%

The price of A's scrap is Rs. 200 per quintal and that of B's is Rs. 400 per quintal. formulate this problem as LP model and solve it to determine the quantities that the firm should buy from the two suppliers so as to minimize total purchase cost.

12. (a) An automobile dealer wishes to put four repairmen to four different jobs. The repairmen have somewhat different kinds of skills and they exhibit different levels of efficiency from one job to another. The dealer has estimated the number of man hours that would be required for each job man combination. This is given in the matrix form in adjacent table :

Man \ Job	A	B	C	D
1	5	3	2	8
2	7	9	2	6
3	6	4	5	7
4	5	7	7	8

Find the optimum assignment that will result in minimum man hours needed.

Or

(b) A distribution system has the following constraints:

Factory	Capacity(in units)	Ware house	Demand (in units)
A	45	I	25
B	15	II	55
C	40	III	20

The transportation cost per unit (in Rs.) allocated with each route are:

		To		
		I	II	III
From	A	10	07	08
	B	15	12	09
	C	07	08	12

Find the optimum transportation schedule and the minimum total cost of transportation.

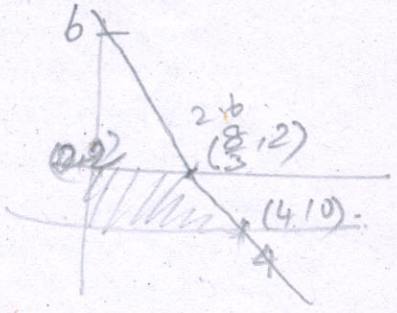
13. (a) Solve the following problem by branch and bound technique:

Maximize $Z = x_1 + x_2$

Subject to $3x_1 + 2x_2 \leq 12$,

$x_2 \leq 2$,

$x_1, x_2 \geq 0$ and are integers.



Or

(b) Two firms are competing for business under the conditions so that one firm's gain is another firm's loss. Firm A's pay —off matrix is given below:

		Firm B		
		No advertising	Medium advertising	Heavy advertising
Firm A	No advertising	10	5	-2
	Medium Advertising	13	12	15
	Heavy advertising	16	14	10

Suggest optimum strategies for the two firms and the net outcome thereof.

14. (a) Explain the various types of inventory models.

Or

(b) A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 mopeds to 204 mopeds, whose probability distribution is as given below:

Production per day	Probability
196	0.05
197	0.09
198	0.12
199	0.14
200	0.20
201	0.15
202	0.11
203	0.08
204	0.06

The finished mopeds are transported in a specially designed three storyed lorry than can accommodate only 200 mopeds. Using the following 15 random numbers 82,89,78,24,53,61,18,45,04,23,50,77,27,54,10 simulate the process to find out:

(i) What will be the average number of mopeds, waiting in the factory?

(ii) What will be the average number of empty spaces on the lorry?

15. (a) A truck — owner finds from his past experience that the maintenance costs are Rs. 200 for the first year and then increase by Rs. 2,000 every year. The cost of the truck type A is Rs. 9,000. Determine the best age at which to replace the truck. If the optimum replacement is followed. What will be the average yearly cost of owing and operating the truck? Truck type B costs Rs. 20,000. Annual operating costs are Rs. 400 for the first year and then increase by Rs. 800 every year. The truck owner has now the truck type A which is one year old. Should it be replaced by B type, and if so, when?

Or

(b) A super market has a single cashier. During the peak hours, customers arrive at a rate of 20 customers per hour. The average number of customers that can be processed by the cashier is 24 per hour. Calculate:

(i) The probability that the cashier is idle.

(ii) The average number of customers in the queuing system.

(iii) The average time a customer spends in the system.

(iv) The average number of customers in the queue.

(v) The average time a customer spends in the queue waiting for service.