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NO.1 INSTITUTE FOR IAS/IFOS EXAMINATIONS



MATHEMATICS CLASSROOM TEST

2020-21

Under the guidance of K. Venkanna

MATHEMATICS

LPP CLASS TEST

Date: 26 July-2020
Time: 03:00 Hours

Maximum Marks: 250

INSTRUCTIONS

- 1. Write your Name & Name of the Test Centre in the appropriate space provided on the right side.
- Answer must be written in the medium specified in the admission Certificate issued to you, which must be stated clearly on the right side. No marks will be given for the answers written in a medium other than that specified in the Admission Certificate.
- 3. Candidates should attempt All Question.
- 4. The number of marks carried by each question is indicated at the end of the question. Assume suitable data if considered necessary and indicate the same clearly.
- 5. Symbols/notations carry their usual meanings, unless otherwise indicated.
- 6. All questions carry equal marks.
- 7. All answers must be written in blue/black ink only. Sketch pen, pencil or ink of any other colour should not be used.
- 8. All rough work should be done in the space provided and scored out finally.
- 9. The candidate should respect the instructions given by the invigilator.
- The question paper-cum-answer booklet must be returned in its entirety to the invigilator before leaving the examination hall. Do not remove any page from this booklet.

READ	INSTR	UCT	IONS	ON THE
LEFT	SIDE	ΟF	THIS	PAGE
CAREI	FULLY			

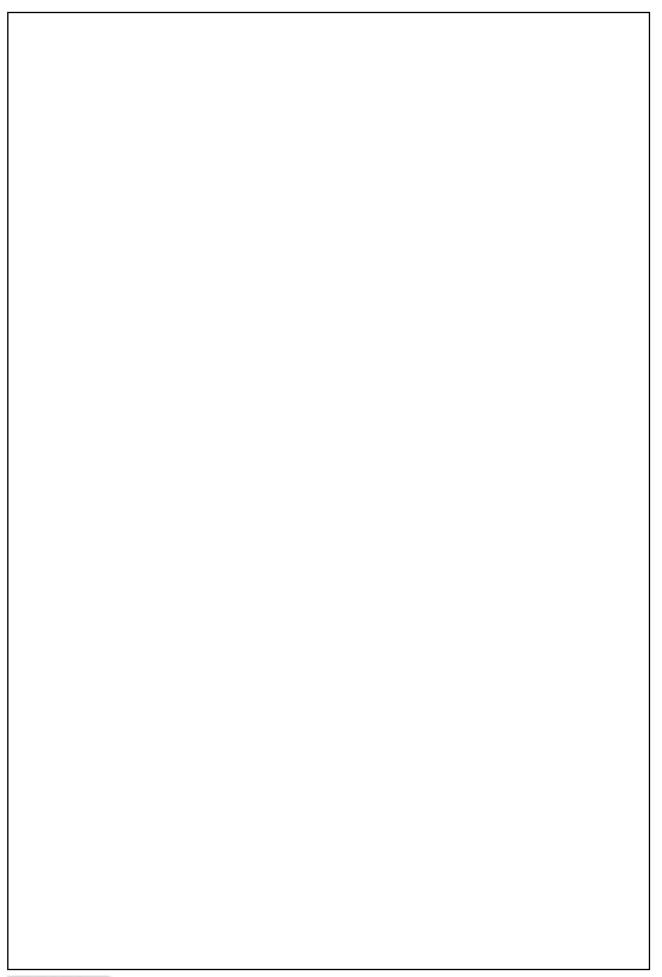
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	Name:
	Mobile No.
	Test Centre
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l	
	I have read all the instructions and shall
	abide by them
	Signature of the Candidate
	I have verified the information filled by the
	candidate above
	Signature of the invigilator

Question	Page No.	Max. Marks	Marks Ob- tained
1.		10	
2.		20	
3.		15	
4.		15	
5.		20	
6.		20	
7.		20	
8.		17	
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12.		18	
13.		12	
14.		15	
15.		12	

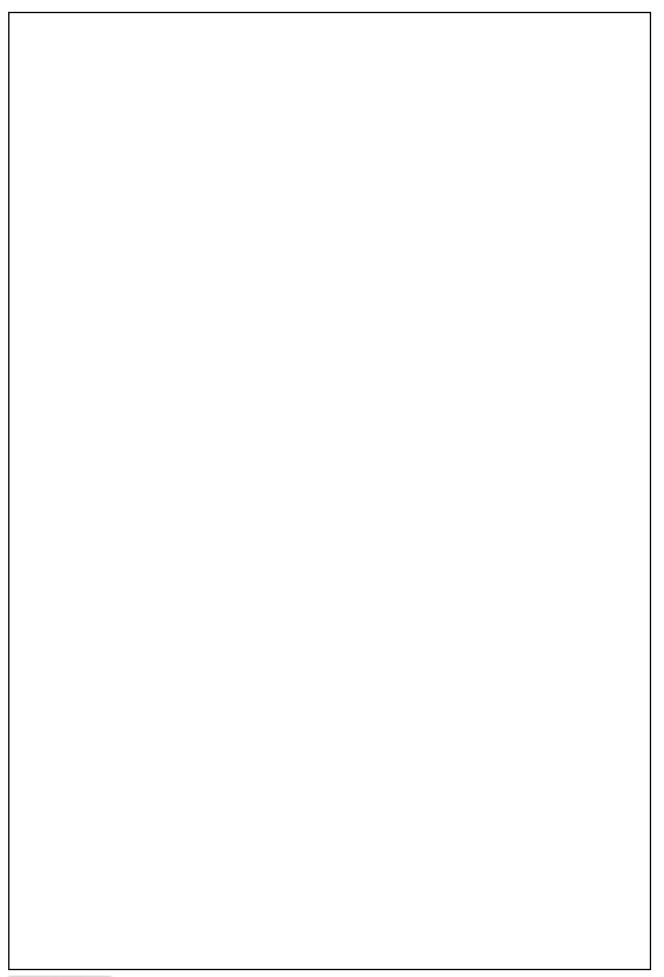
Total Marks

Old hens can be bought at Rs. 2 each and young ones at Rs. 5 each. The old hens lay 3 eggs per week and the young ones lay 5 eggs per week, each egg being worth 30 paise. A hen (young or old) costs Re. 1 per week to feed. I have only Rs. 80 to spend for hens, how many of each kind should I buy to give a profit of more than Rs. 6 per week, assuming that I cannot house more than 20 hens. Formulate L.P.P. and solve it.

2.	Min. $Z = x_1 + x_2 + 4x_3$ Write the dual Min	and of the LP problem: $x_2 + x_3$ subject to the $x_2 + x_3$ subject to the $x_2 + x_3 + x_4 = 0$. $x_1 - 2x_2 \le 3$, $2x_2 - 1$ of the problem. $x_1 - 2x_2 + 5x_3$ $x_1 + x_2 \ge 2$ $x_1 + x_2 + 6x_3 \le 6$ $x_1 - x_2 + 3x_3 = 4$ $x_1, x_2, x_3 \ge 0$.	constraints :	x ₃ is unrestricted. [10+10=20]







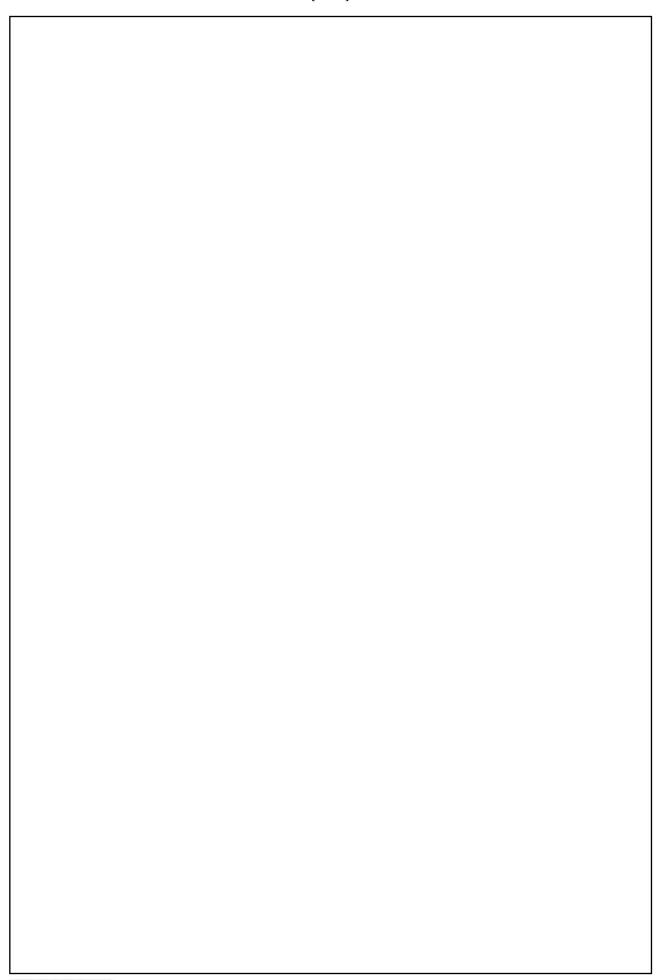


3. A firm plans to purchase at least 200 quintals of scrap containing high quality metal X and low quality metal Y. It decides that the scrap to be purchased must contain at least 100 quintals of X-metal and not more than 35 quintals of Y-metal. The firm can purchase the scrap from two suppliers (A and 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 graphically to determine the quantities that the firm should buy from the two suppliers so as to minimize total purchase cost. [15]







4.	Solve	the	following	z LPP	bv	simplex	x method.
		CIIC	TOTTO WITTS	, <u></u>	\sim y	OIIII PIC2	· mccmoa.

Maximize $Z = 4x_1 + 5x_2 - 3x_3 + 50$, subject to the constraints :

$$x_1 + x_2 + x_3 = 10$$

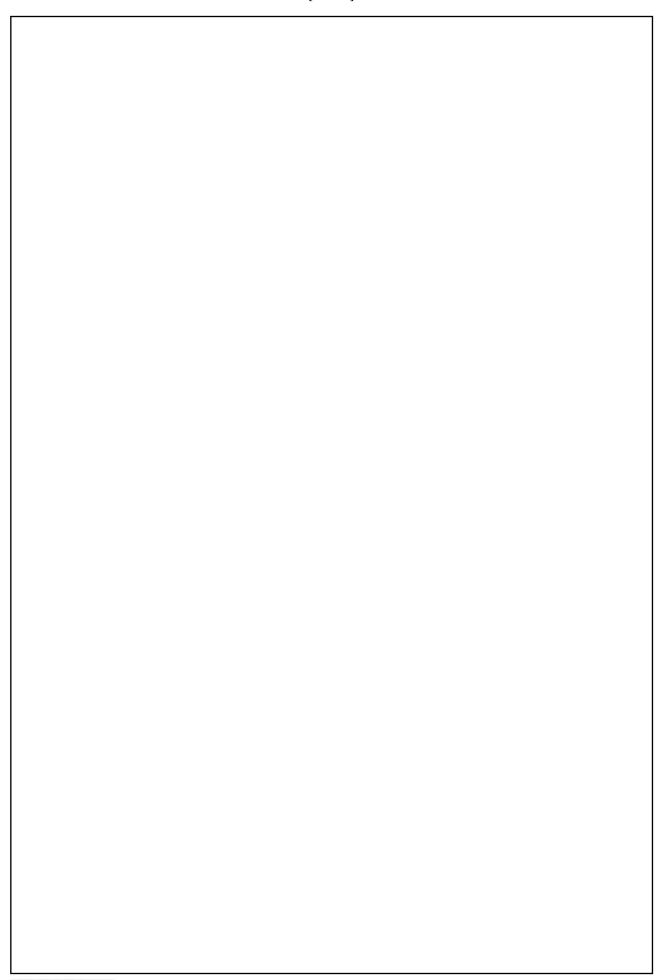
$$\mathbf{x}_1 - \mathbf{x}_2 \ge 1$$

$$2x_1 + 3x_2 + x_3 \le 40$$

$$x_1, x_2, x_3 \ge 0$$

[15]







5. (A) If $x_1 = 2, x_2 = 3, x_3 = 1$ be a feasible solution of the following Linear Programming

problem then find the basic feasible solution:

Maximize
$$Z = x_1 + 2x_2 + 4x_3$$

Subject to the constraints
$$2x_1 + x_2 + 4x_3 = 11$$

$$3x_1 + x_2 + 5x_3 = 14$$
 and

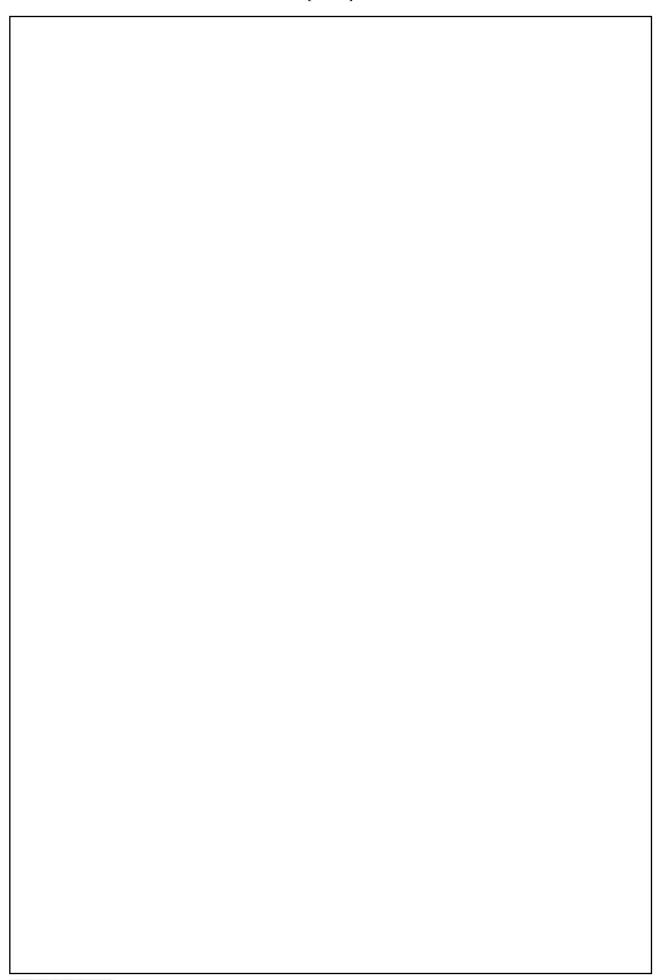
$$x_1, x_2, x_3 \ge 0.$$

(B) A pine-apple firm produces two products: canned pine-apple and canned juice. The specific amounts of material, labour and equipment required to produce each product and the availability of each of these resources are shown in the table given below:

	Canned juice	Pine-apple	Available resources
Labour(man hrs.)	3	2.0	12.0
Equipment(m/chrs.)	1	2.3	6.9
Material (units)	1	1.4	4.9

Assuming one unit each of canned juice and canned pine-apple has profit margins of Rs. 2 and Re. 1 respectively. Formulate it as L.P. problem and solve it graphically.

[10+10=20]





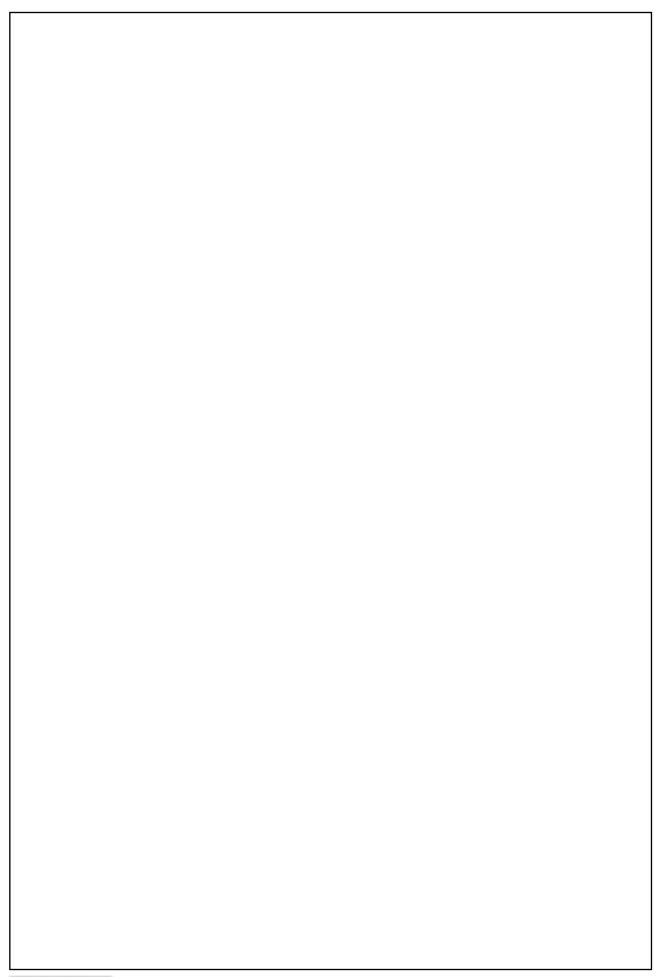
6. The following table gives the cost for transporting material from supply points A, B, C and D to demand points E, F, G, H, and J.

The present allocation is as follows:

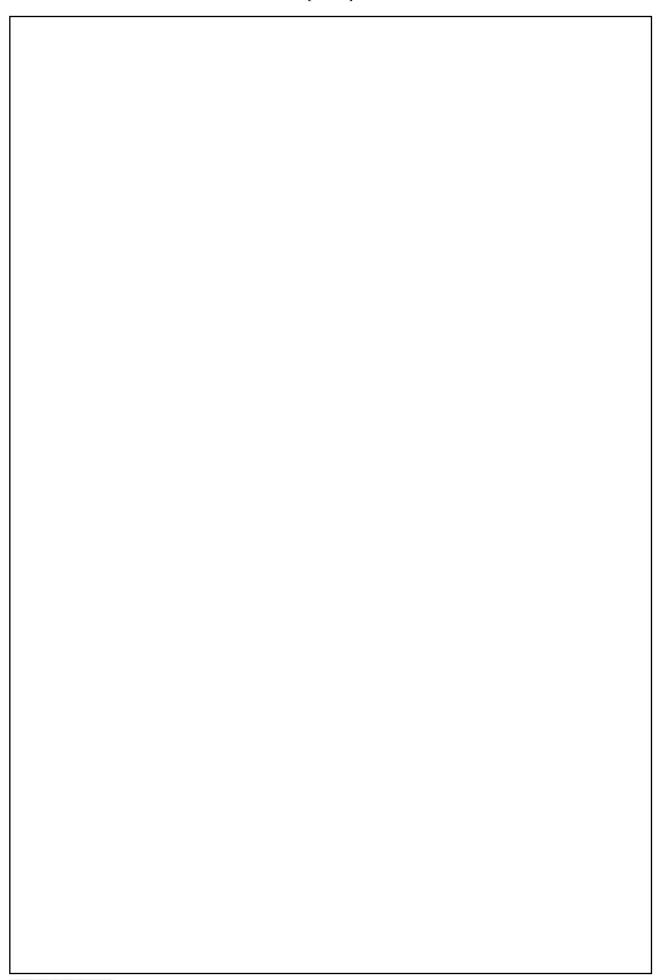
A to E 90; A to F 10; B to F 150; C to F 10; C to G 50; C to J 120; D to H 210; D to J 70.

- (a) Check if this allocation is optimum. If not, find an optimum schedule.
- (b) If in the above problem, the transportation cost from A to G is reduced to 10, what will be the new optimum schedule? [20]











7. (A) A firm has two bottling plants, one located at Coimbatore and, other at Chennai. Each plant produces three drinks, Coca-cola, Fanta, and Thumps-up named A, B, and C, respectively. The number of bottles produced per day are, as follows:

	Plant at				
	Coimbatore (E)	Chennai(F)			
Coca-cola (A)	15,000	15,000			
Fanta(B)	30,000	10,000			
Thumps $-$ up(C)	20,000	50,000			

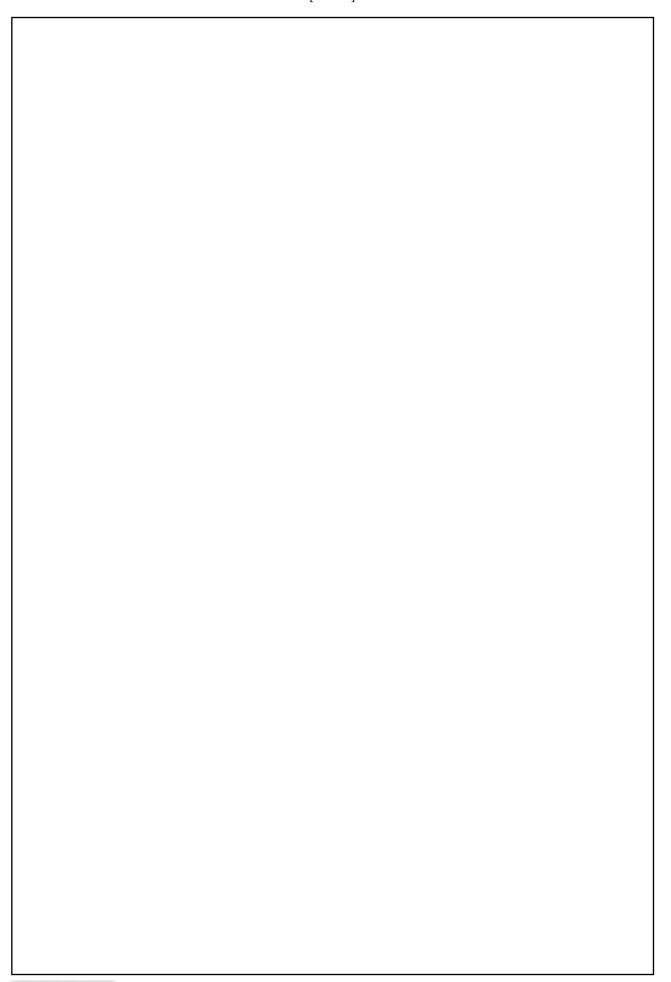
A market survey indicates that, during the month of April, there will be a demand of 200,000 bottles of Coca-cola, 400,000 bottles of Fanta, and 440,000 bottles of Thumps-up. The operating cost per day for plants at Coimbatore and Chennai is 600 and 400 monetary units respectively. For how many days each plant be run in April so as to, minimize the production cost, while still meeting the market demand?

(B) A department head has four subordinates, and four tasks to be performed. The subordinates differ in efficiency, and the tasks in their intrinsic difficulty. His estimate of the times each man would take to perform each task is given in the effectiveness matrix below. How should the tasks be allocated, one to a man, so as to minimize the total men hours?

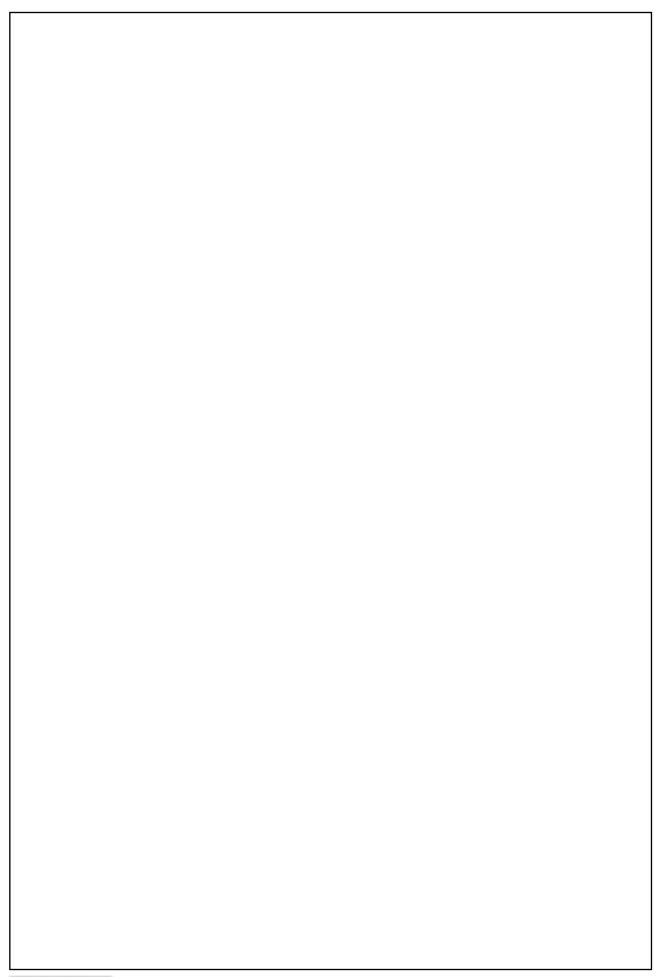
Subordinates

[10+10=20]











8. Solve the following transportation problem

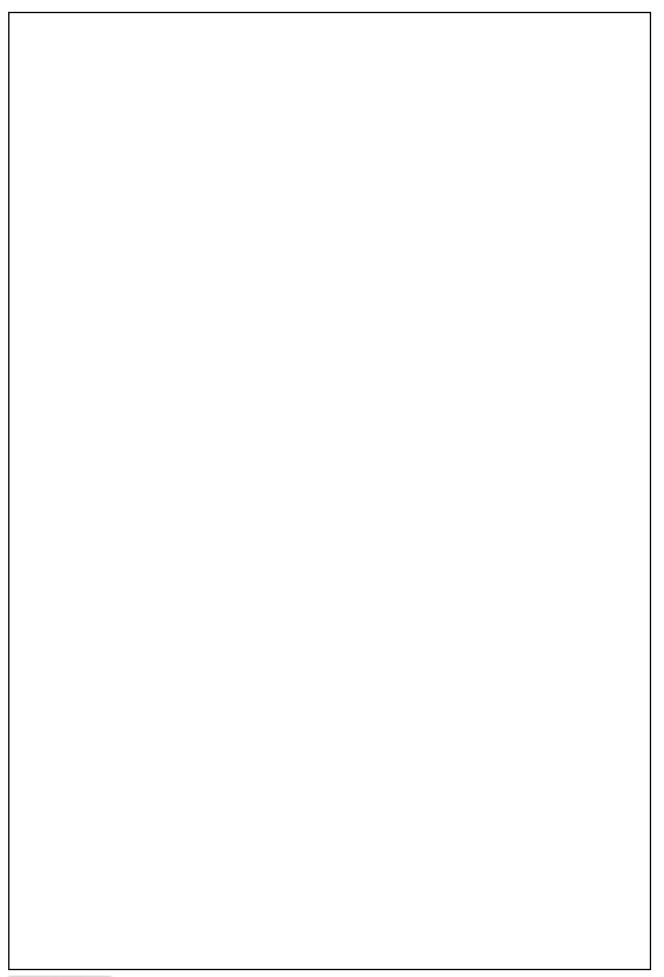
Destinations

		$D_{\scriptscriptstyle 1}$						Availability
	$\overline{F_1}$	2	1	3	3	2 3 4 2	5	50
Factories	F_2	3	2	2	4	3	4	40
acto	F_3	3	5	4	2	4	1	60
П	F_4	4	2	2	1	2	2	30
Den	and	30	50	20	40	30	10	

by finding the initial solution by "Matrix Minima method".

[17]







- **9.** (A) For each hour per day that Ashok studies mathematics, it yields him 10 marks and for each hour that he studies physics, it yields him 5 marks. He can study at most 14 hours a day and he must get at least 40 marks in each. Determine graphically how many hours a day he should study mathematics and physics each, in order to maximize his marks?
 - (B) Find all the basic feasible solutions of the following problem:

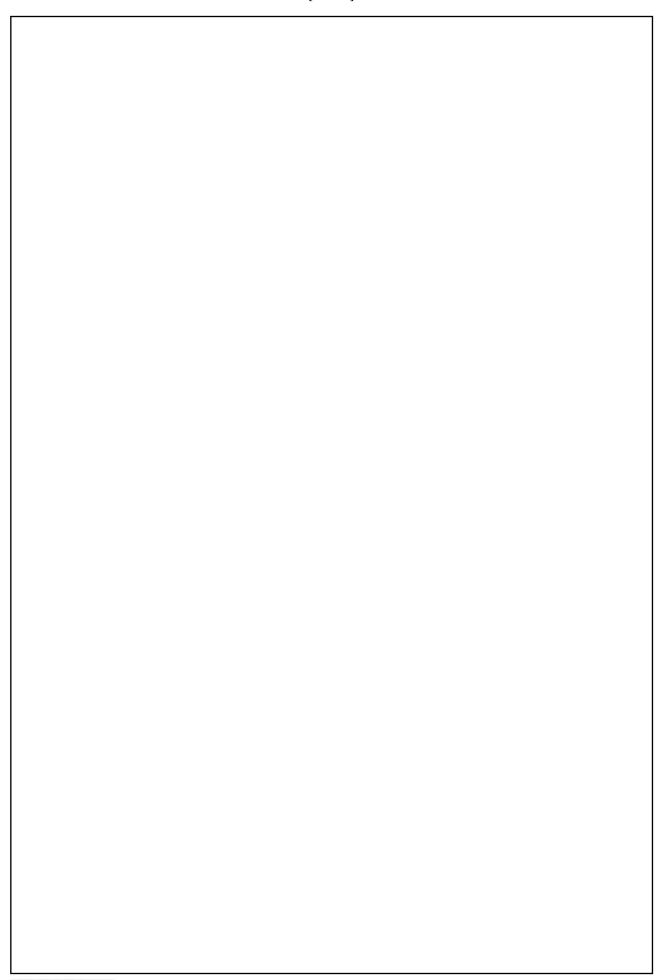
$$2x_1 + 3x_2 + x_3 + x_4 = 8$$

 $x_1 - 2x_2 + 6x_3 - 7x_4 = -3$
and choose the one which

Maximize $Z = 2x_1 + 3x_2 + 4x_3 + 7x_4$

[10+10=20]







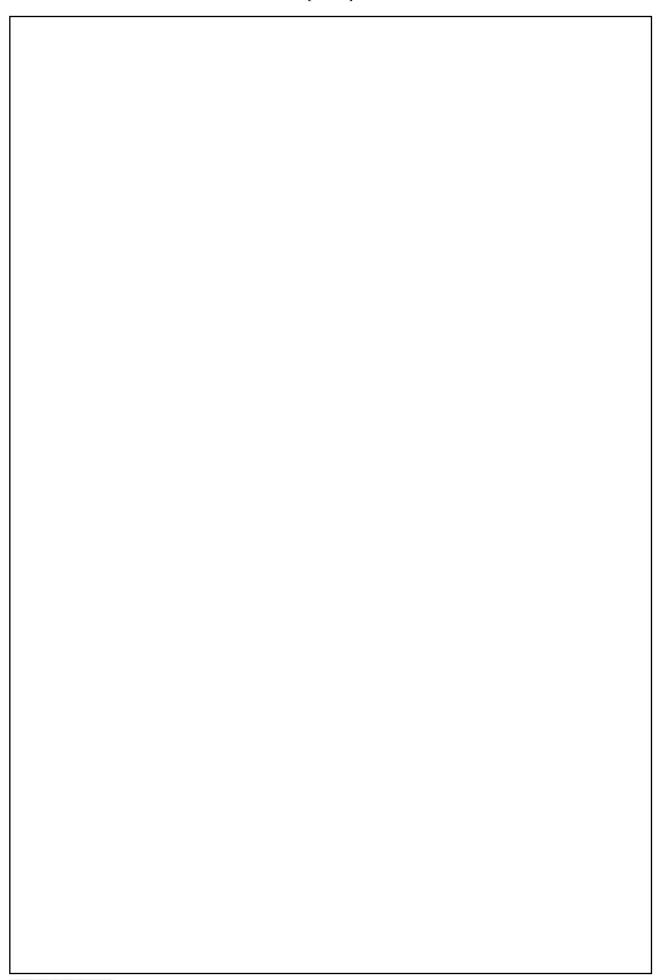
10. A job shop has purchased 5 new machines of different type. There are 5 available locations in the shop where a machine could be installed. Some of these locations are more desirable than others for particular machines because of their proximity to work centres which would have a heavy work flow to and from these machines. Therefore, the objective is to assign the new machines to the available locations in order to minimize the total cost of material handling. The estimated cost per unit time of materials handling involving each of the machines is given below for the respective locations. Locations 1, 2, 3, 4 and 5 are not considered suitable for machines A, B, C, D and E respectively.

Location (Cost in Rs.)

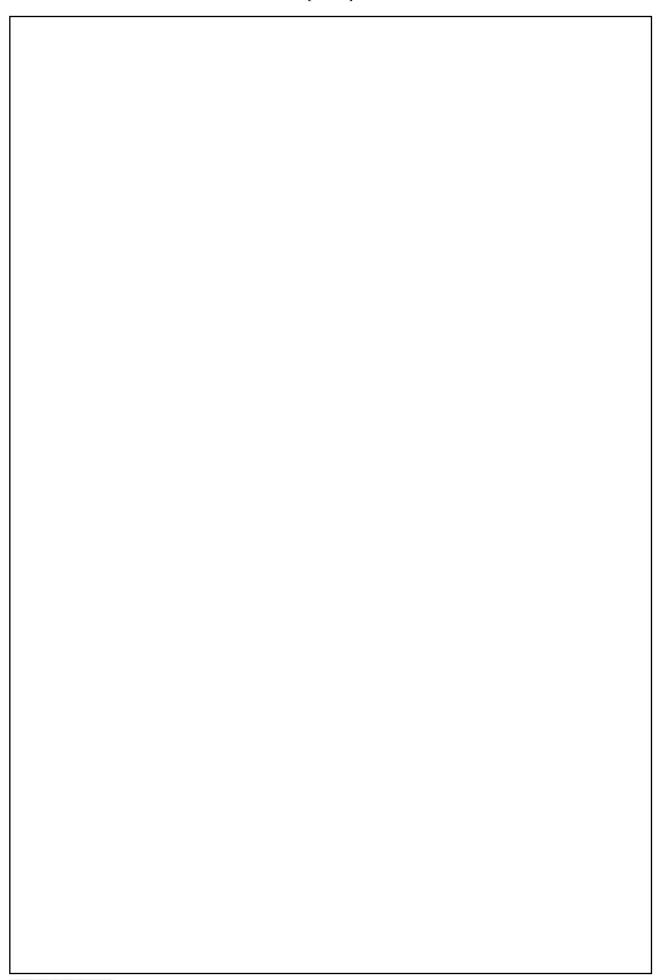
	1	2	3	4	5
A	X	10	25	25	10
Е	1	×	10	15	2
Machine C	8	9	×	20	10
Γ	14	10	24	×	15
E	10	8	25	27	×

- (i) Find the optimal solution.
- (ii) How would the optimal solution get modified if location 5 is also unsuitable for machine A? [20]









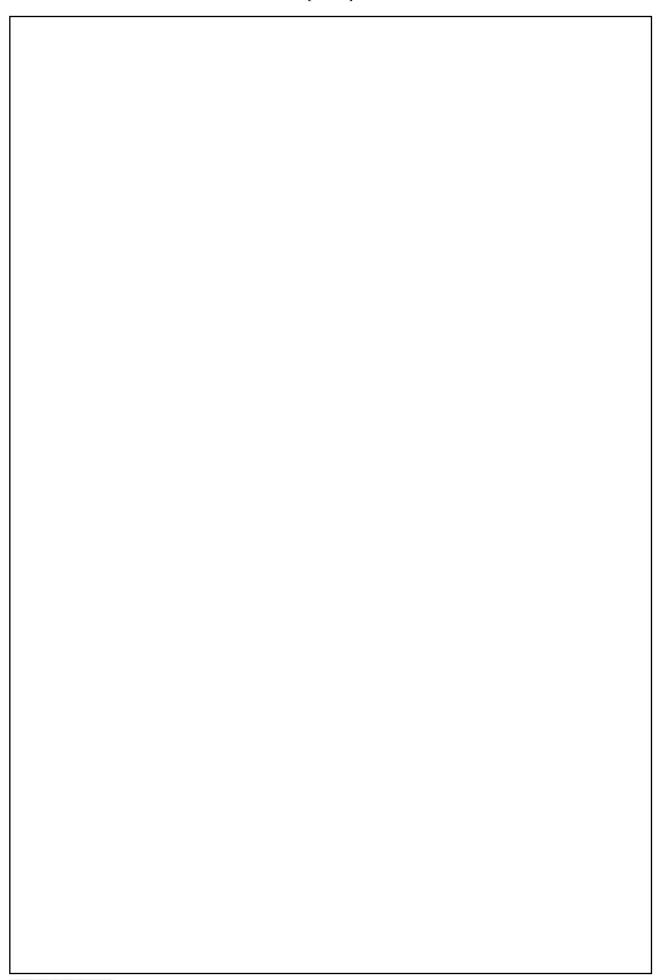


11. A product is produced by four factories F1, F2, F3, F4. The unit production costs in them are Re. 1, Rs. 3, Re. 1 and Rs. 5 respectively. Their production capacities are : F1 – 50 units, F2 – 70 units, F3 –30 units, F4 – 50 units. These factories supply the product to four stores S1, S2, S3 and S4, demands of which are 25, 35, 105 and 20 units respectively. Unit transport cost in rupees from each factory to each store is given in the table below. Determine the extent of derivaties from each of the factories to each of the stores so that the total production and transportation cost is minimum.

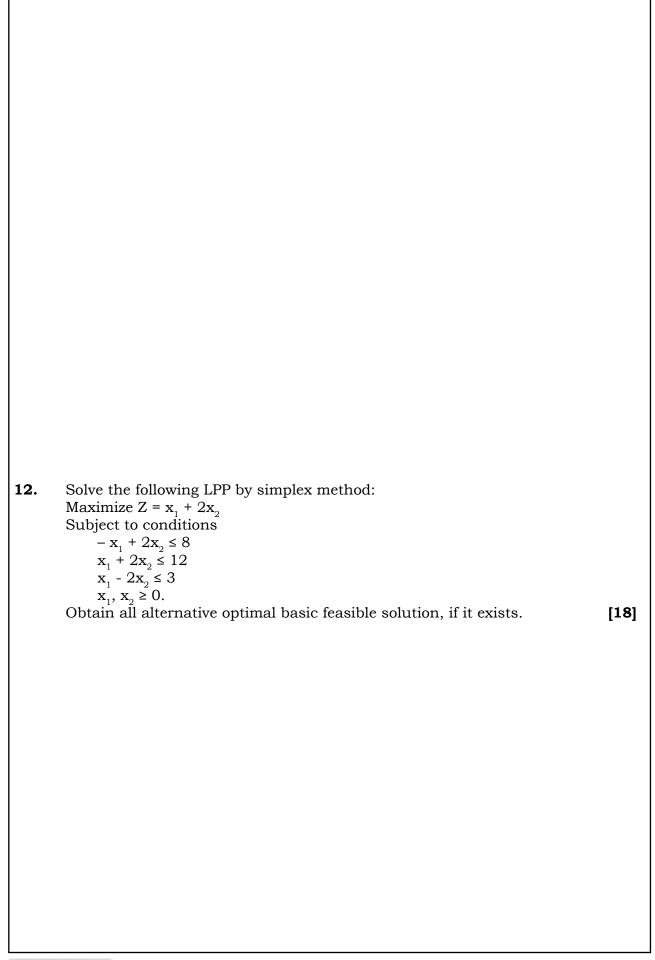
	$S_{_1}$	$\mathrm{S}_{\scriptscriptstyle 2}$	$\mathbf{S}_{\scriptscriptstyle 3}$	S_4
$\mathbf{F}_{\!\scriptscriptstyle 1}$	2	4	6	11
$\mathbf{F}_{\!_{2}}$	10	8	7	5
$\mathbf{F}_{\!\scriptscriptstyle 3}$	13	3	9	12
$\mathbf{F}_{\!\scriptscriptstyle{4}}$	4	6	8	3

[16]

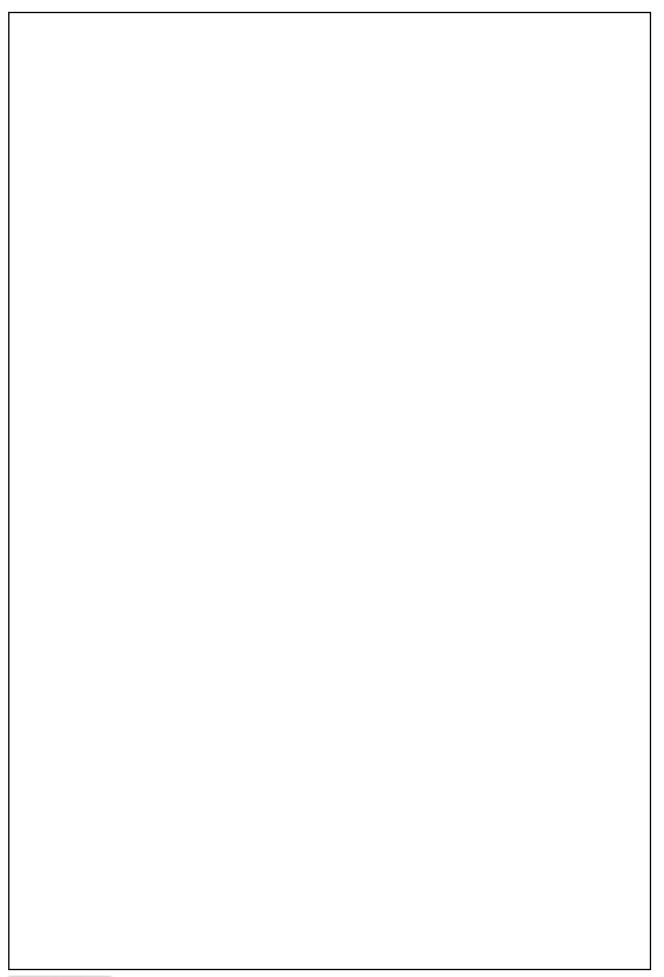




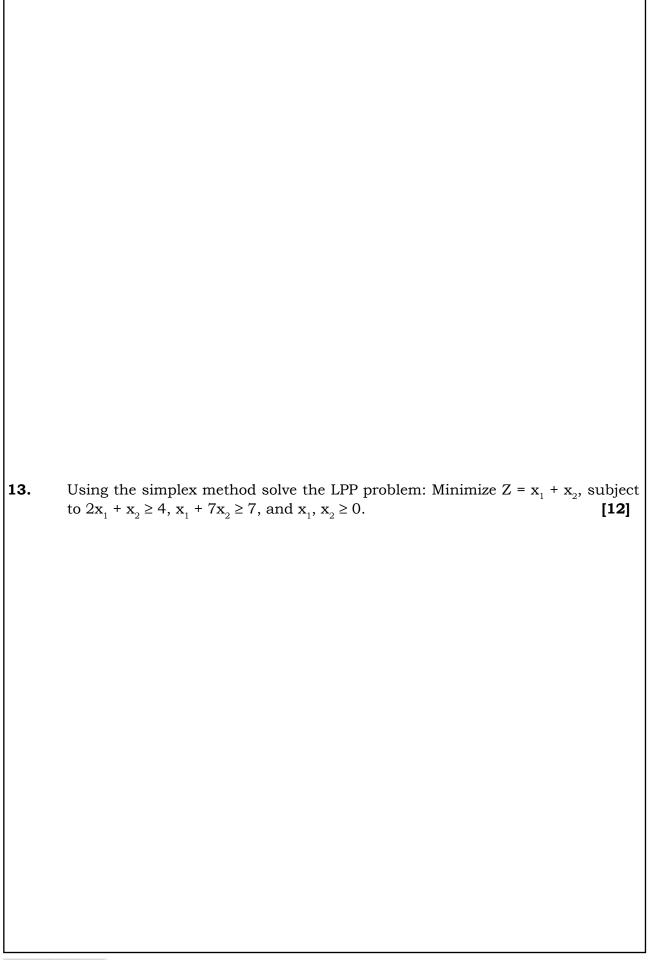




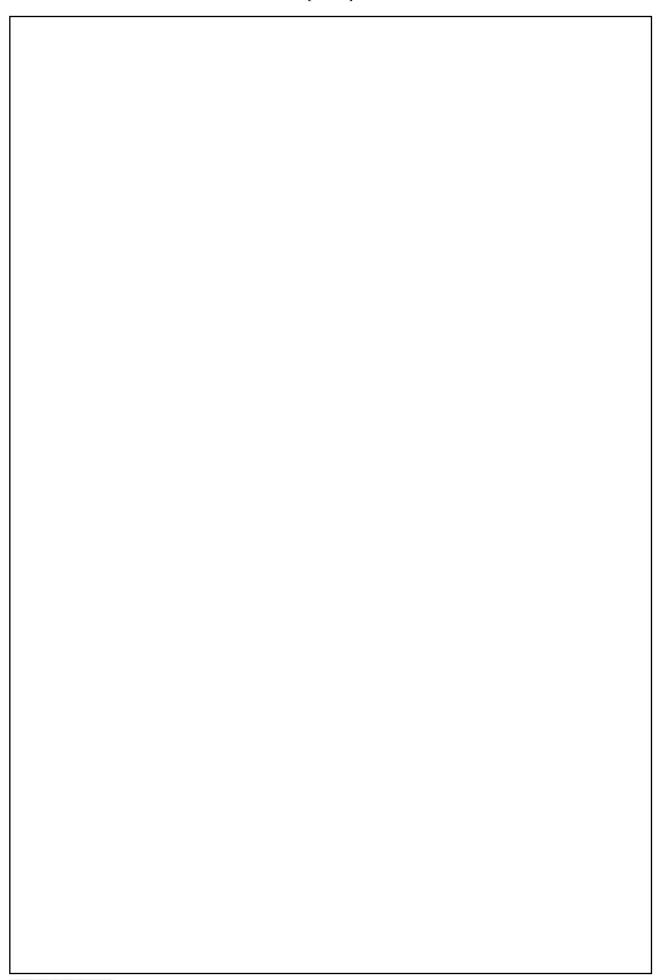












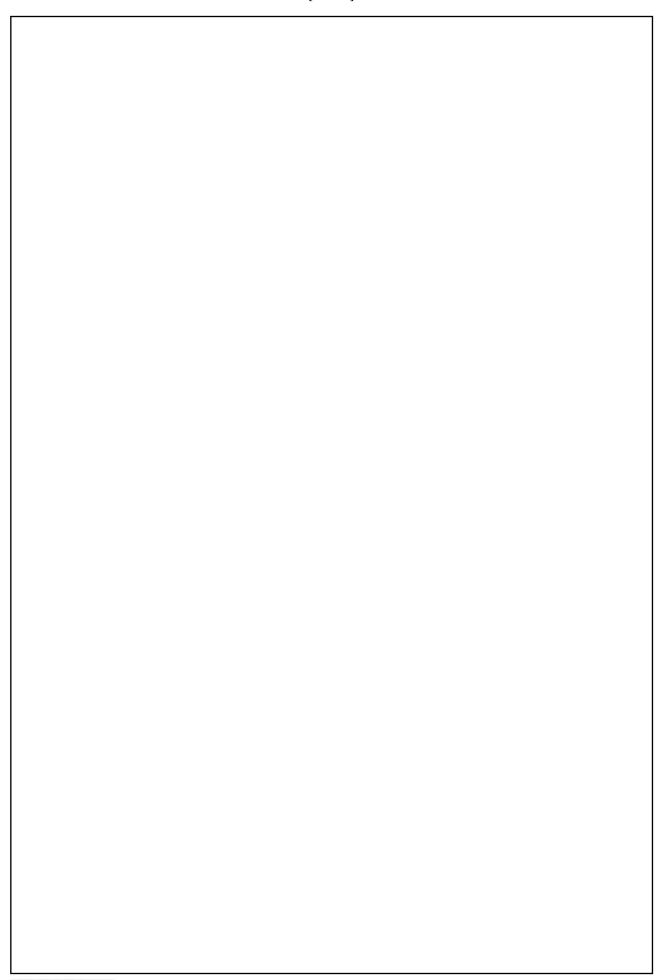


14. Find the optimal solution of the following transportation problem.

	$\mathbf{D}_{_{1}}$	D_2	$\mathbf{D}_{\scriptscriptstyle 3}$	$\mathbf{D}_{\scriptscriptstyle{4}}$	\mathbf{D}_{5}	D_6	$\mathbf{a}_{_{i}}$
$\mathbf{O}_{\scriptscriptstyle 1}$	1	2	1	4	5	2	30
O_2	3	3	2	1	4	3	50
O_1 O_2 O_3 O_4	4	2	5	9	6	2 3 2 6	75
O_4	3	1	7	3	4	6	20
b,		40	30	10	50	25	

[15]

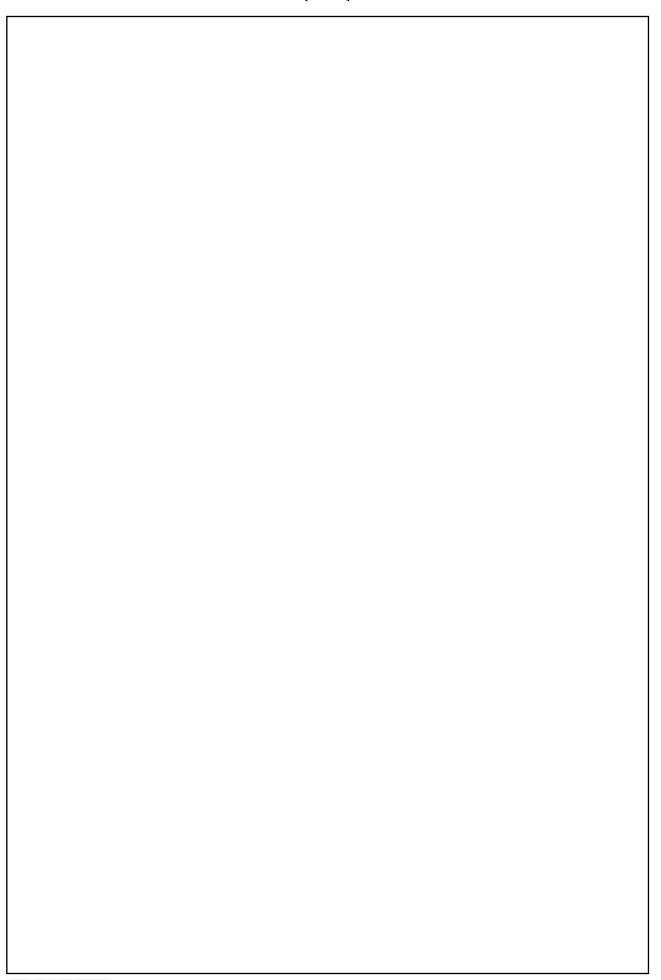




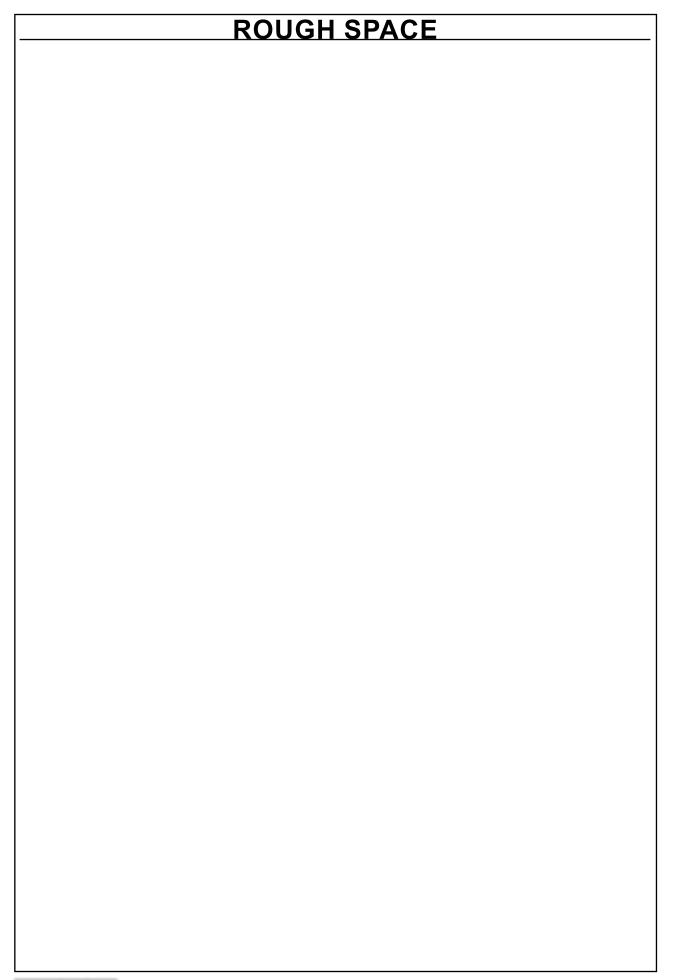


15.	Food X contains 6 units of vitamin A per gram and 7 units of vitamin B per gram and costs 12 paise per gram. Food Y contains 8 units of vitamin A per gram and 12 units of vitamin B and costs 20 paise per gram. The daily minimum requirements of vitamin A and vitamin B are 100 units and 120 units respectively. Find the minimum cost of product mix by Simplex method. [12]

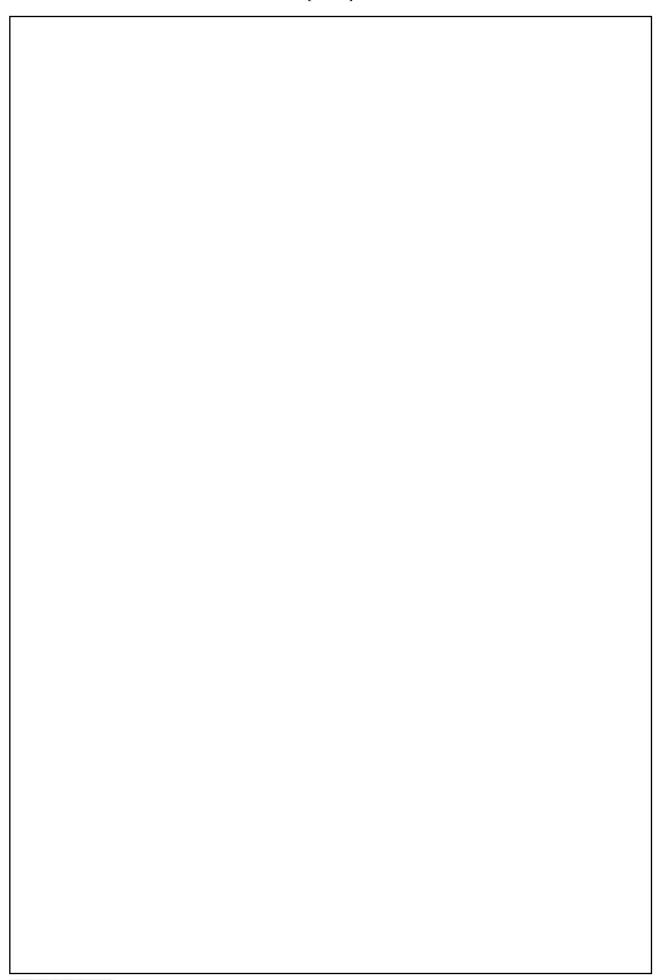














INDIA'S No. 1 INSTITUTE FOR IAS/IFoS EXAMINATION

OUR ACHIEVEMENTS IN IAS (FROM 2008 TO 2018)

























































































































































































































































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