Date : .....

NO.1 INSTITUTE FOR IAS/IFOS EXAMINATIONS

IMS™ (INSTITUTE OF MATHEMATICAL SCIENCES)

MATHEMATICS CLASSROOM TEST

2022-23

Under the guidance *of* K. Venkanna

MATHEMATICS

(LINEAR PROGRAMMING PROBLEM) CLASS TEST

Date: 28 Jan.-2022

Time: 02:30 Hours **Maximum Marks: 200**

INSTRUCTIONS

1. Write your Name & Name of the Test Centre in the appropriate space provided on the right side.
2. 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.
10. 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 INSTRUCTIONS ON THE LEFT SIDE OF THIS PAGE CAREFULLY

Name:

Mobile No.

Test Centre

Email.:

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

P.T.O.

Question	Page No.	Max. Marks	Marks Obtained
1.		10	
2.		18	
3.		17	
4.		10	
5.		15	
6.		20	
7.		17	
8.		10	
9.		15	
10.		15	
11.		18	
12.		20	
13.		15	

Total Marks

1. The standard weight of a special purpose brick is 5 kg and it contains two basic ingredients B_1 and B_2. B_1 costs Rs. 5 per kg and B_2 costs Rs. 8 per kg. Strength considerations state that the brick contains not more than 4 kg of B_1 and minimum of 2 kg of B_2. Since the demand for the product is likely to be related to the price of the brick, find out graphically minimum cost of the brick satisfying the above conditions. **[10]**

2. 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.

		To				
		E	F	G	H	J
From	A	8	10	12	17	15
	B	15	13	18	11	9
	C	14	20	6	10	13
	D	13	19	7	5	12

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 ? **[18]**

3. Using the simplex method solve the LPP problem: Minimize $Z = x_1 + x_2$, subject to $2x_1 + x_2 \geq 4$, $x_1 + 7x_2 \geq 7$, and $x_1, x_2 \geq 0$. **[17]**

4. 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 $x_1, x_2, x_3 \geq 0.$ **[10]**

5. Solve the linear programming problem using simplex method : **[15]**

Minimize $z = -6x_1 - 2x_2 - 5x_3$

Subject to $2x_1 - 3x_2 + x_3 \leq 14$

$-4x_1 + 4x_2 + 10x_3 \leq 46$

$2x_1 + 2x_2 - 4x_3 \leq 37$

$x_1 \geq 2,\ x_2 \geq 1,\ x_3 \geq 3$

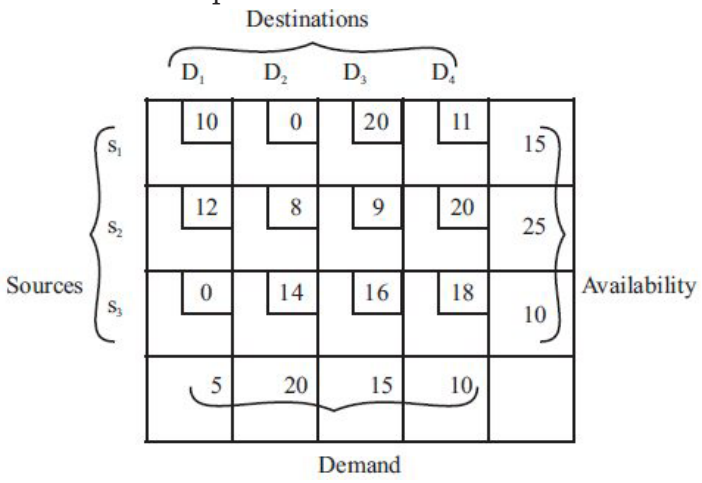
6. A product is produced by four factories F_1, F_2, F_3, F_4. The unit production costs in them are Rs. 1, Rs. 3,

Rs. 1 and Rs. 5 respectively. Their production capacities are : F_1 – 50 units, F_2 – 70 units, F_3 –30 units, F_4 – 50 units. These factories supply the product to four stores S_1, S_2, S_3 and S_4, 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	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

[20]

7. Find the initial basic feasible solution of the following transportation problem by Vogel's approximation method and use it to find the optimal solution and the transportation cost of the problem. **[17]**



8. Convert the following LPP into dual LPP :

Minimize $Z = x_1 - 3x_2 - 2x_3$

subject to

$3x_1 - x_2 + 2x_3 \leq 7$

$2x_1 - 4x_2 \geq 12$

$-4x_1 + 3x_2 + 8x_3 = 10$

where $x_1, x_2 \geq 0$ and x_3 is unrestricted in sign.

[10]

9. Solve the following linear programming problem using Big M method :

Maximize $Z = 4x_1 + 5x_2 + 2x_3$

subject to

$2x_1 + x_2 + x_3 \geq 10$

$x_1 + 3x_2 + x_3 \leq 12$

$x_1 + x_2 + x_3 = 6$

$x_1, x_2, x_3 \geq 0$

[15]

10. Use two-phase simplex method to solve the problem :

Minimize $z = \frac{15}{2}x_1 - 3x_2$,

subject to the constraints : $3x_1 - x_2 - x_3 \geq 3$, $x_1 - x_2 + x_3 \geq 2$, and $x_1, x_2, x_3 \geq 0$.

[15]

11. Consider the following transportation problem :

Factory	Godowns						Stock available
	1	2	3	4	5	6	
A	7	5	7	7	5	3	60
B	9	11	6	11	—	5	20
C	11	10	6	2	2	8	90
D	9	10	9	6	9	12	50
Demand	60	20	40	20	40	40	

It is not possible to transport any quantity from factory B to Godown 5. Determine the optimum basic feasible solution by finding the initial solution by Vogel's approximation method.

Is the optimum solution unique? If not, find the alternative optimum basic feasible solution. **[18]**

12. (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]**

13. Solve the following LPP by simplex method.

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

$x_1 + x_2 + x_3 = 10$

$x_1 - x_2 \geq 1$

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

$x_1, x_2, x_3 \geq 0$

[15]

ROUGH SPACE

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OUR ACHIEVEMENTS IN IAS (FROM 2008 TO 2018)

KANISHAK KATARIA AIR-01 (2018) | K. VARUN REDDY AIR-07 (2018) | TANMAY V. SHARMA AIR-10 (2018) | G.S.S. PRAVEENCHAND AIR-64 (2018) | MANISHA RANA AIR-67 (2018) | DALIP KUMAR AIR-73 (2018) | KHUSHBOO GUPTA AIR-80 (2018) | JAY SHIVANI AIR-81 (2018) | AANCHAL SRIVASTAVA AIR-110 (2018) | RAUSHAN KUMAR AIR-114 (2018) | HIMANSHU PRAJAPATI AIR-124 (2018) | AVDHESH DIXIT AIR-158 (2018) | SUNEEL SHEORAN AIR-192 (2018)

AKASH SINGH AIR-193 (2018) | ARCHITA V. CHANDAK AIR-206 (2018) | AVINASH C. SANDILYA AIR-215 (2018) | SACHIN BANSAL AIR-348 (2018) | KATTA RAVI TEJA AIR-349 (2018) | S. GAUTHAM RAJ AIR-353 (2018) | RAJAT BHARDWAJ AIR-366 (2018) | C. VISHNU CHARAN AIR-406 (2017) | PANKAJ KUMAWAT AIR-443 (2018) | SANJAY SAHU AIR-526 (2018) | KUMAR ASHISH AIR-536 (2018) | SHURUTI KAMBOJ AIR-586 (2018) | AYUSH KUMAR AIR-598 (2018) | AMIT KUMAWAT AIR-600 (2018)

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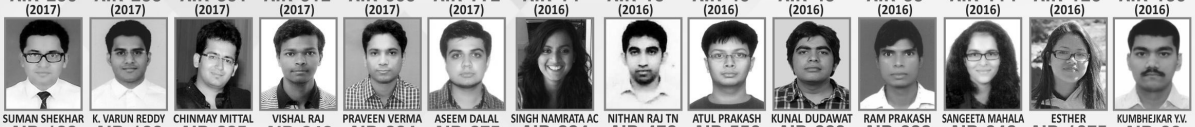
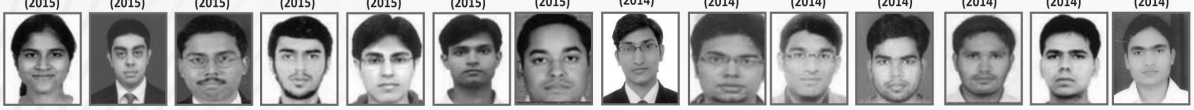
SUNEEL S. AIR-250 (2017) | NIKHIL BANSAL AIR-255 (2017) | Avinash C. S. AIR-391 (2017) | PRAVEEN CHANDRA AIR-512 (2017) | DALIP KUMAR AIR-609 (2017) | PRINCE KUMAR AIR-772 (2017) | UTSAV KAUSHAL AIR-14 (2016) | MANISH GURWANI AIR-18 (2016) | AKSHAY GODARA AIR-40 (2016) | SWAPNIL KHARE AIR-43 (2016) | VIKALP BHARADWAJ AIR-85 (2016) | VARUN SINGLA AIR-114 (2016) | MANI AGARWAL AIR-126 (2016) | SHASHANK C. AIR-130 (2016)



SUMAN SHEKHAR AIR-133 (2016) | K. VARUN REDDY AIR-166 (2016) | CHINMAY MITTAL AIR-235 (2016) | VISHAL RAJ AIR-242 (2016) | PRAVEEN VERMA AIR-264 (2016) | ASEEM DALAL AIR-275 (2016) | SINGH NAMRATA AC AIR-334 (2016) | NITHAN RAJ TN AIR-476 (2016) | ATUL PRAKASH AIR-558 (2016) | KUNAL DUDAWAT AIR-669 (2016) | RAM PRAKASH AIR-832 (2016) | SANGEETA MAHALA AIR-946 (2016) | ESTHER AIR-1075 (2016) | KUMBHEJKAR Y.V. AIR-08 (2015)

ASHISH SANGWAN AIR-12 (2015) | SIDHARTH JAIN AIR-13 (2015) | PRATAP SINGH AIR-15 (2015) | VALLURU KRANTHI AIR-65 (2015) | ATUL SHARMA AIR-118 (2015) | KETAN BANSAL AIR-155 (2015) | VARUN GUNTUPALLI AIR-183 (2015) | PADMANABH B. AIR-194 (2015) | SWAPNIL KHARE AIR-197 (2015) | SHILPI AIR-198 (2015) | AKHIL GOEL AIR-251 (2015) | SAURABH KATIYAR AIR-334 (2015) | PATEL KOMAL AIR-335 (2015) | ANKIT AIR-492 (2015)

UTSAV KAUSHAL AIR-500 (2015) | AKSHAY GODARA AIR-605 (2015) | MEET KUMAR AIR-646 (2015) | KUNAL DUDAWAT AIR-699 (2015) | NITHAN RAJ TN AIR-843 (2015) | SURYA KANT P AIR-886 (2015) | PRATAP SINGH B AIR-1060 (2015) | NITISH K. AIR-08 (2014) | GOWTHAM POTRU AIR-30 (2014) | BHAVESH MISHRA AIR-58 (2014) | K.Y. VIJAY AIR-143 (2014) | ANKIT VERMA AIR-145 (2014) | NIKHIL GOYAL AIR-159 (2014) | VIJAY GODWA G.C. AIR-175 (2014)



VALLURU KRANTHI AIR-230 (2014) | SWAPNIL KHARE AIR-236 (2014) | VARUN GUNTUPALLI AIR-261 (2014) | PARTH JAISWAL AIR-299 (2014) | MANISH GURWANI AIR-322 (2014) | ANURAG RAI AIR-371 (2014) | PARAS MANI T. AIR-433 (2014) | AJIT PRATAP SINGH AIR-436 (2014) | NIKHIL KR. GARG AIR-608 (2014) | RAJAT AGARWAL AIR-622 (2014) | SAURABH KATIYAR AIR-763 (2014) | PRATAP S. BHUKYA AIR-830 (2014) | BIPIN KUMAR AIR-861 (2014) | MEET KUMAR AIR-1150 (2014)

AJIT JOHN JOSHUA AIR-78 (2013) | SUMIT KUMAR AIR-81 (2013) | B. SASHI KANT AIR-111 (2013) | GOWTHAM POTRU AIR-318 (2013) | RAVINDER SINGH AIR-333 (2013) | ASHISH MODI AIR-350 (2013) | PARAS M TRIPATHI AIR-391 (2013) | NIKHIL GOYAL AIR-399 (2013) | NITISH K. AIR-547 (2013) | KULRAJ SINGH AIR-552 (2013) | VALLURU KRANTHI AIR-562 (2013) | SANTOSH KUMAR AIR-1013 (2013) | RAMESH RANJAN AIR-76 (2012) | ANKIT VERMA AIR-247 (2012)

B. SASHI KASNT AIR-329 (2012) | KRISHAN KANT AIR-550 (2012) | VISHAL GARG AIR-560 (2012) | PRADEEP MISHRA AIR-633 (2012) | KETAN BANSAL AIR-655 (2012) | SANJAY KR. JAIN AIR-667 (2012) | SANTOSH KUMAR AIR-849 (2012) | MEET KUMAR AIR-944 (2012) | HIMANSHU GUPTA AIR-07 (2011 | ARIJIT MUKHERJEE AIR-25 (2011) | AJAY SINGH TOMAR AIR-88 (2011) | AWAKASH KUMAR AIR-168 (2011) | GULNEET SINGH AIR-220 (2011) | AJIT P SINGH AIR-288 (2011)

JAY YADAV AIR-372 (2011) | RAVI VERMA AIR-485 (2011) | MEGHA AGARWAL AIR-538 (2011) | G.J. KRUPAKAR AIR-796 (2011) | ABHISHEK MODI AIR-223 (2011) | BHAGWATI P KALAL AIR-154 (2010) | AWAKASH KUMAR AIR-276 (2010) | NAVNEET AGARWAL AIR-362 (2010) | AJIT P SINGH AIR-497 (2010) | SHAMBHU KUMAR AIR-47 (2009) | A. ARJUN AIR-140 (2009) | NISHA GUPTA AIR-507 (2009) | K.V.S.R. KISHORE AIR-575 (2008)

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