BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : V**
BRANCH: AIML **SESSION : MO/2024**

SUBJECT: AI313 CLASSICAL OPTIMIZATION TECHNIQUES

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	What are the different OR Models in Practice? Explain briefly.	[5]	1	2
Q.1(b)	"The effective use of OR techniques requires to follow a sequence of steps". Discuss each steps briefly.	[5]	1	2
Q.2(a)	Generate LP equations for The city of Erstville is faced with a severe budget shortage. Seeking a long-term solution, the city council votes to improve the tax base by condemning an inner-city housing area and replacing it with a modern development. The project involves two phases: (1) demolishing substandard houses to provide land for the new development and (2) building the new development. The following is a summary of the situation. 1. As many as 300 substandard houses can be demolished. Each house occupies a .25-acre lot. The cost of demolishing a condemned house is $2000. 2. Lot sizes for new single-, double-, triple-, and quadruple-family homes (units) are .18, .28,.4, and .5 acre, respectively. Streets, open space, and utility easements account for 15% of available acreage. 3. In the new development, the triple and quadruple units account for at least 25% of the total. Single units must be at least 20% of all units, and double units at least 10%. 4. The tax levied per unit for single, double, triple, and quadruple units is $1000, $1900, $2700, and $3400, respectively. 5. The construction cost per unit for single-, double-, triple-, and quadruple-family homes is $50,000, $70,000, $130,000, and $160,000, respectively. 6. Financing through a local bank is limited to $15 million.	[5]	2	3
Q.2(b)	Use the simplex method to solve the following LP problem. Maximize $Z = 3x1 + 5x2 + 4x3$ subject to the constraints (i) $2x1 + 3x2 \le 8$, (ii) $2x2 + 5x3 \le 10$, (iii) $3x1 + 2x2 + 4x3 \le 15$ and $x1, x2, x3 \ge 0$	[5]	2	4
Q.3(a)	Solve the following all integer programming problem using the branch and bound method. Maximize $Z = 2x1 + 3x2$ subject to the constraints (i) $6x1 + 5x2 \le 25$, (ii) $x1 + 3x2 \le 10$ and $x1, x2 \ge 0$ and integers.	[5]	3	4

Q.3(b) Solve the following mixed-integer programming problem using Gomory's Cut Method [5] 3 4

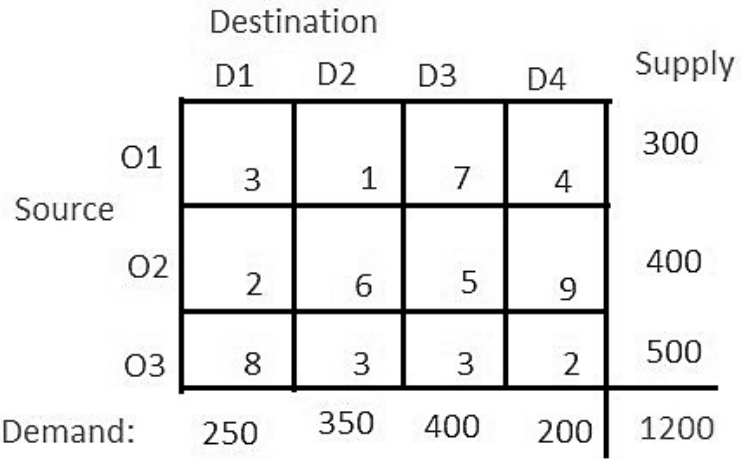
Maximize $Z = x1 + x2$

subject to the constraints

(i) $3x1 + 2x2 \leq 5$, (ii) $x2 \leq 2$

and $x1, x2 \geq 0$, $x1$ non-negative integer

Q.4(a) Solve by Vogels Approximation method: [5] 4 4



Q.4(b) Find Solution of Assignment problem using Hungarian method (MIN case) [5] 4 3

Work\Job	I	II	III	IV
A	9	14	19	15
B	7	17	20	19
C	9	18	21	18
D	10	12	18	19
E	10	15	21	16

Q.5(a) Solve graphically the following NLP problem [5] 5 4

Minimize $Z = x_1^2 + x_2^2$

subject to the constraints

(i) $x_1 + x_2 >= 8$, (ii) $x_1 + 2x_2 >= 10$, (iii) $2x_1 + x_2 >= 10$,

and $x_1, x_2 >= 0$.

Q.5(b) Solve graphically the followings NLP problem: [5] 5 4

Maximize $Z = x_1 + x_2$,

subject to the constraints

(i) $x_1x_2 - 2x_2 \geq 3$, (ii) $3x_1 + 2x_2 \leq 24$,

and $x_1, x_2 \geq 0$.

::::::25/11/2024::::::M