**M S RAMAIAH INSTITUTE OF TECHNOLOGY**

(Autonomous Institute, affiliated to VTU)

**DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING**

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| Term: | 17th Aug – 17th Dec, 2016 | Course Code: | IS 532 |
| Course: | Operation Research | Semester: | 5 |
| CIE: | Test – II | Max Marks: | 30 |
| Date: | 10.11.2016 | Time: | 2 – 3 pm |

Portions for Test: Lecture Nos. from 18 to 36 as per lesson plan.

Instructions to Candidates: Answer any two full questions. Mobiles are not allowed.

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| Sl# | Question | Marks | Bloom # | COs |
| 1a | Solve the problem below using Two-phase Method.  Max Z = 5x1 + 8x2  subject to: 3x1 + 2x2 ≥ 3, x1 + 4x2 ≥ 4, x1 + x2 ≤ 5, and x1 ≥ 0, x2 ≥ 0. | 8 | Ap | 2 |
| b | Consider the following LP:  Max z = 5x1 + 2x2 + 3x3  Sub to x1 + 5x2 + 2x3 = 30, x1 - 5x2 - 6x3 ≤ 40, x1, x2, x3 ≥ 0  Given that the artificial variable x4 and the slack variable x5 form the starting basic variables and that M was set equal to 100 when solving the problem, the optimal table is given as :   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Basic | x1 | x2 | x3 | x4 | x5 | Solution | | z | 0 | 23 | 7 | 105 | 0 | 150 | | x1 | 1 | 5 | 2 | 1 | 0 | 30 | | x5 | 0 | -10 | -8 | -1 | 1 | 10 |   Write the associated dual problem, and determine its optimal solution in two ways. | 7 | Ap | 3 |
| 2a | Describe the characteristics of Game Theory. | 7 | U | 3 |
| b | Solve the problem by Revised simplex method:  Max Z = 2x1 + x2,  subject to: 3x1 + 4x2 ≤ 6, 6x1 + x2 ≤ 3, x1, x2 ≥ 0. | 8 | Ap | 2 |
| 3a | The pay-off matrix for player A is shown below. Find the value of the game, the optimum strategies for players A and B and state whether it is fair/strictly determinable.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | (i) | I | II | III | IV | V | | I | -2 | 0 | 0 | 5 | 3 | | II | 3 | 2 | 1 | 2 | 2 | | III | -4 | -3 | 0 | -2 | 6 | | IV | 5 | 3 | -4 | 2 | -6 | | (ii)   |  |  |  | | --- | --- | --- | |  | I | II | | I | 1 | 3 | | II | 4 | 2 | | | 8 | Ap | 3 |
| b | What is Degeneracy? Solve the following LPP. Does degeneracy occur in this problem?  Maximize Z = 3x1 + 5x2  Subject to: x1 + x3 = 4, x2 + x4 = 6, 3x1 + 2x2 + x5 = 12 and x1 , x2, x3 , x4 , x5 >= 0 | 7 | An | 2 |

OR Scheme CIE 2 (Aug – Dec 2016)

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| Sl# | Question | Marks |
| 1a | Solve the problem below using Two-phase Method.  Max Z = 5x1 + 8x2  subject to: 3x1 + 2x2 ≥ 3, x1 + 4x2 ≥ 4, x1 + x2 ≤ 5,  and x1 ≥ 0, x2 ≥ 0.  Standard LPP  Max Z = 5x1 + 8x2  Subject to  3x1 + 2x2 – s1+ a1 = 3  x1 + 4x2 – s2+ a2 = 4  x1 + x2 + s3 = 5  x1 , x2 , s1, s2, s3, a1, a2 ≥ 0  Auxiliary LPP  Max Z\* = 0x1 + 0x2 + 0s1 + 0s2 + 0s3 -1a1 -1a2  Subject to  3x1 + 2x2 – s1+ a1 = 3  x1 + 4x2 – s2+ a2 = 4  x1 + x2 + s3 = 5  x1 , x2 , s1, s2, s3, a1, a2 ≥ 0 | 8 |
| b | Consider the following LP:  Max z = 5x1 + 2x2 + 3x3  Sub to x1 + 5x2 + 2x3 = 30,  x1 - 5x2 - 6x3 ≤ 40,  x1, x2, x3 ≥ 0  Given that the artificial variable x4 and the slack variable x5 form the starting basic variables and that M was set equal to 100 when solving the problem, the optimal table is given as :   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Basic | x1 | x2 | x3 | x4 | x5 | Solution | | z | 0 | 23 | 7 | 105 | 0 | 150 | | x1 | 1 | 5 | 2 | 1 | 0 | 30 | | x5 | 0 | -10 | -8 | -1 | 1 | 10 |   Write the associated dual problem, and determine its optimal solution in two ways.  Max z = 5x1 + 2x2 + 3x3 - Mx4  x1 + 5x2 + 2x3 + x4 = 30  x1 - 5x2 - 6x3 + x5 = 40  x1, x2, x3, x4, x5 ≥ 0  C:\Users\admin\Desktop\OR1B.PNG | 7 |
| 2a | Describe the characteristics of Game Theory.  1. Dual of dual is primal  2. If either the primal or dual problem has a solution then the other also has a solution and their optimum values are equal.  3. If any of the two problems has an infeasible solution, then the value of the objective function of the other is unbounded.  4. The value of the objective function for any feasible solution of the primal is less than the value of the objective function for any feasible solution of the dual.  5. If either the primal or dual has an unbounded solution, then the solution to the other problem is infeasible.  6. If the primal has a feasible solution, but the dual does not have then the primal will not have a finite optimum solution and vice versa. | 7 |
| b | Solve the problem by Revised simplex method:  Max Z = 2x1 + x2,  subject to: 3x1 + 4x2 ≤ 6, 6x1 + x2 ≤ 3, x1, x2 ≥ 0.  SLPP: Max Z = 2x1 + x2+ 0s1+ 0s2  Subject to  3 x1 + 4 x2 + s1 = 6  6 x1 + x2 + s2 = 3  and x1, x2, s1, s2 ≥ 0  Step 1 – Express the given problem in standard form – I  Z - 2x1 - x2 + 0s1 + 0s2 = 0  3 x1 + 4 x2 + s1 + 0s2= 6 -- (1)  6 x1 + x2 + 0s1 + s2= 3  and x1, x2, s1, s2 ≥ 0 | 8 |
| 3a | The pay-off matrix for player A is shown below. Find the value of the game, the optimum strategies for players A and B and state whether it is fair/strictly determinable.     |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | (i) | I | II | III | IV | V |  | | I | -2 | 0 | 0 | 5 | 3 | -2 | | II | 3 | 2 | 1 | 2 | 2 | 1 | | III | -4 | -3 | 0 | -2 | 6 | -4 | | IV | 5 | 3 | -4 | 2 | -6 | -6 |     5 3 1 5 6  Maximin (v) = 1  Minimax (v) = 1  Game is not fair, but strictly determinable   |  |  |  | | --- | --- | --- | | (ii) | I | II | | I | 1 | 3 | | II | 4 | 2 |     Optimal strategies of Player A, E(A) = 1/2, 1/2  Optimal strategies of Player B, E(B) = 1/4, 3/4  Expected Value of the game = 5/2 | 8 |
| b | What is Degeneracy? Solve the following LPP. Does degeneracy occur in this problem?  Maximize Z = 3x1 + 5x2  Subject to: x1 + x3 = 4,  x2 + x4 = 6,  3x1 + 2x2 + x5 = 12 and  x1 , x2, x3 , x4 , x5 >= 0  Soln:  x1 = 0; x2 = 6; x3= 4; x4 = 0; x5 = 0; z = 30.  Yes, degeneracy occurs. | 7 |