EE871 Reg.No. : . . . . . Marks :

NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA SURATHKAL, SRINIVASNAGAR-PIN:575 025

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ACADEMIC SESSION January-May 2020

Assignment-1

Course Code	: EE871	Course Title	: **Machine Learning**
Credits	: 3-1-2 : 5	Instructor	: Dr. Jora M. Gonda
Weight	: 4.7%	Submission Deadline	: 20-01-2020 05:00 PM

Given the Reddy-Mikks problem is model as follows:

$$\max \qquad z = c_E \cdot x_E + c_I \cdot x_I$$

subjected to the constraints:

$$\begin{aligned} x_E + 2x_I &\leq 6 && (1)\\ 2x_E + x_I &\leq 8 && (2)\\ -x_E + x_I &\leq 1 && (3)\\ x_I &\leq 2 && (4)\\ x_E &\geq 0 && (5)\\ x_I &\geq 0 && (6) \end{aligned}$$

Obtain solutions to the bits of questions as detailed below, by graphical approach and by using LibreOffice Solver.

1. (15 Marks) Obtain the static Solution to the problem
   (a) Determine the optimal solution ($\underset{\sim}{\overset{*}{x}}$)
   (b) Calculate the optimal value, of the gross income.
   (c) Calculate the Lagranges multipliers/shadow/pseudo prices for each of the constraints.
   (d) Classify the resources into scarce and abundant; binding or non-binding constraints.
   (e) Calculate the slack or surplus value of the resources/constraints.
   (f) Given that the cost of resources per unit quantity is the same, which resource will you consider to allocate extra money, to improve the gross income ?
2. Conduct sensitivity Analysis:
   (a) (08 Marks) Change in the Objective function coefficients:
      i. Determine the range of values for the cost of x_E and x_I over which the optimal **solution** does not change.

ii. Determine the range of optimal solutions to the problem, when each of the constraints (binding/active) have their gradients aligning with that of the objective function.

(b) (08 Marks) Change in the limits of coefficients:

i. Determine the level by which each of the resource/constraints' limits be changed to render it redundant or binding, as applicable.

ii. Referring to (1f), by how much level of that resource may be changed to get maximum return?

iii. What is the new solution for (1f), and the return thereof, in gross income?

(c) (04 Marks) Change in the coefficients of the Constraints.

3. (18 Marks) Draw few insights in relation to the model, and write clearly in few sentences, for each bits of the questions above.

4. (Not for evaluation) Also model and solve the Optimal Skill Mix problem, given the statements as follows:

An electronics firm manufactures printed circuit boards and specialized electronics devices. Final assembly operations are completed by a small group of trained workers who labor simultaneously on the products. Because of limited space available in the plant, no more than ten assemblers can be employed. The standard operating budget in this functional department allows a maximum of $9000 per month as salaries for the workers. The existing wage structure in the community requires that workers with two or more years of experience receive $1100 per month, while recent trade-school graduates will work for only $800. There are also the following government in force – a limit on veteran-drop and that on an accommodate-neophyte policies. The policies say that the manufacturing unit shall have at least 20% reserved for veterans as well as for neophytes. The production manager is not comfortable having more than 7 neophytes and less than 3 veterans. Previous studies have shown that experienced assemblers produce $2100 in value added" per month while new-hires add only $1800. In order to maximize the value added by the group, how many persons from each group should be employed? Solve graphically and carryout sensitivity analysis.