MAC175 Operational Research COURSEWORK 2018

There are two parts to the coursework; first to implement the *revised Simplex method in matrix form* in Maple, Matlab or C and second to use the method to solve the problem that is given below. The main objective is to find the optimal solution to the given problem but in implementing the method, marks will be given if the code is written for a general LP problem in canonical form so that it could be used for other problems with different numbers of variables and a different objective function. It is not absolutely necessary to write code to pre-process the constraints to obtain the initial canonical form, however the process should be discussed and bonus marks will be awarded if the initial basic feasible solution can be determined automatically through the use of slack, surplus and artificial variables. Do not generate the initial starting solution by a systematic search through all possible basis matrices. Check your answer by using Matlab or Maple's in-built linear programming packages or by hand (long). Marks will be awarded for a good cross check.

Once the solution to the problem has been determined, see how the optimum value changes as the right hand sides of the constraints (resources) change independently. This might affect the feasibilty of determining a solution or the optimality of the solution and these points should be discussed. Matlab or Maple's (or some other) graphing capability can be used to plot relationships between optimal values and the changes in the constraints. If the constraints are thought of as available resources, calculate their worth. Try also your algorithm on another problem that you construct yourself to see if it works. Discuss what you find. Will your code handle special cases such as unbounded or infeasible solutions ? When you write the report please include a print out of the main code as an appendix. Make sure the diagrams are readable and label all graphs and axes and provide proper figure captions. The report should be less than 15 sides excluding the code. Email the final version of the code to R.Smith@lboro.ac.uk.

PROBLEM 15

Maximise $z = 2x_1 + 3x_2 + 4x_3 + x_4 + 8x_5 + x_6$ subject to

$$x_1 - x_2 + 2x_3 + x_5 + x_6 = 18$$

$$x_2 - x_3 + x_4 + 3x_6 \leq 8$$

$$x_1 + x_2 - 3x_3 + x_4 + x_5 \leq 36$$

$$x_1 - x_2 + x_5 + x_6 \leq 23$$

with all variables non-negative.