**Assignment 6:**

**Installation**

1. Open a command prompt in the folder, and type ‘pip install –r requirements.txt’ to make sure that all the dependencies are installed.
2. Download GLPK from <http://sourceforge.net/projects/winglpk/files/latest/download>
3. Unzip it into (for example) : C:\glpk\_is\_here\
4. Add GLPK binaries to your system path before running python C:\>set PATH=%PATH%;C:\glpk\_is\_here\glpk-4.55\w64 (Depends on system architecture)
5. To run the file, on a command prompt type ‘python lp\_solve.py’

**Explanation**

1. **Write the LP relaxation (P1) of (IP) and explain why the objective value of an optimal solution to (P1) is an upper bound on the value of an optimal solution to (IP)**

The LP relaxation is obtained by dropping the integrality constraint:

Maximize: 3x1 − x2 + 2x3

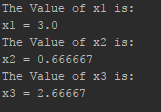
Subject to: x1 − x2 + x3 ≤ 5

2x2 + x3 ≤ 4

x1 ≤ 3

x1, x2, x3 ≥ 0

As this increases the region of feasible solutions and we are dealing with a maximization problem, the value of an optimal solution to (P1) is an upper bound on the value of an optimal solution to (IP).



**2. Convert the problem (P1) to equational form by adding slack variables x4, x5, x6 corresponding to the three in-equalities in the order from top to bottom. Next write the first simplex tableau with x4, x5, x6 as the basic solution**

Maximize: 3x1 − x2 + 2x3

Subject to: x1 − x2 + x3 + x4 = 5

2x2 + x3 + x5 = 4

x1 + x6 = 3

x1, x2, x3, x4, x5, x6 ≥ 0

The first simplex tableau with x4, x5, x6 as basic solution is given by

x4 = 5 − x1 + x2 − x3

x5 = 4 − 2x2 − x3

x6 = 3 − x1

z = 0 + 3x1 − x2 + 2x3