INDU 6111 Theory of Operations Research
Homework Assignment 1
Due on Wednesday September 28 in class.
Late homeworks will not be accepted.

> Please, print out the Expectation of Originality Form
> (available from a link on our class web page),
> fill it in, sign it, and attach it to your homework.

1. [10 points out of 40] You have 700 kg of rubber, 600 kg of cereal, and 60 kg of tripe lying around. From these ingredients, you can make two kinds of sausages. Each kilogram of JUICY takes 0.2 kg of rubber, 0.4 kg of cereal, and 0.5 kg of tripe for the net profit of 50 cents. Each kilogram of FREEDOM FRANKS takes 0.5 kg of rubber, 0.3 kg of cereal, and 0.25 kg of tripe for the net profit of 70 cents. Formulate the corresponding linear program and show its optimal dictionary.

2. [10 points out of 40] Your workshop can manufacture five kinds of furniture:
    • A desk takes 1 unit of wood, 2 units of metal, and 2 hours of work;
it brings in a net profit of $30;
    • A chair takes 1 unit of wood, 1 unit of metal, and 1 hour of work;
it brings in a net profit of $20;
    • A bedframe takes 1 unit of wood, 2 units of metal, and 1 hour of work;
it brings in a net profit of $30;
    • A bookcase takes 1 unit of wood, 1 unit of metal, and 2 hours of work;
it brings in a net profit of $30;
    • A coffee table takes 2 units of wood, 2 units of metal, and 1 hour of work;
it brings in a net profit of $25.
    You have 40 units of wood, 60 units of metal, and 50 hours of time to work are at your disposal. Formulate the corresponding linear program and show its optimal dictionary.

3. [10 points out of 40] Show an optimal dictionary for the auxiliary problem arising from the problem

$$
\begin{array}{llrrrrl}
\text{maximize} & & x_1 & - & x_2 & + 2x_3 & \\
\text{subject to} & -x_1 & + x_2 & + x_3 & & \leq 1 \\
& & + x_2 & - 2x_3 & & \leq -2 \\
& x_1 & - x_2 & - 2x_3 & & \leq -3 \\
& x_1 & - 3x_2 & + 3x_3 & & \leq 2 \\
& & x_1, x_2, x_3 & \geq 0 &
\end{array}
$$

4. [10 points out of 40] Show a complete sequence of feasible dictionaries constructed by the simplex method in the process of solving the problem

$$\text{maximize} \quad 3x_1 - 3x_2$$
$$\text{subject to} \quad 2x_1 - x_2 \leq 5$$
$$x_2 \leq 3$$
$$x_1 - 2x_2 \leq 1$$
$$x_1, x_2 \geq 0$$

Draw the feasible region and point out the sequence of its vertices visited by the simplex method.