University of Toronto at Scarborough
CSCC73 - Algorithm Design and Analysis

Assignment #7 Linear Programming

Due: November 24, 2018 at 11.59pm This exercise is worth 5% of your final grade.

Warning: Your electronic submission on MarkUs affirms that this exercise is your own work and no one else's, and is in accordance with the University of Toronto Code of Behaviour on Academic Matters, the Code of Student Conduct, and the guidelines for avoiding plagiarism in CSCC73. Late assignments will not be accepted. If you are working with a partner your partners' name must be listed on your assignment and you must sign up as a "group" on MarkUs. Recall you must not consult **any outside sources except your partner, textbook, TAs and instructor**.

1. (15 marks) Your favourite natural food company sells two types of trail mix each of which are made from a blend of dried fruits and nuts. Trail mix A contains $1lb$ of dried fruits and $1.5lbs$ of nuts and retails for \$7. A package of trail mix B contains $2lbs$ of dried fruit and $1lb$ of nuts and retails for \$6. Dried fruits when bought in bulk cost $\$1/lb$ and bulk nuts cost $\$2/lb$. The packaging for trail mix A is a nice metal tin and costs $\$1.40$ to package whereas type B tail mix is packaged in a resealable bag and costs $\$0.60$ to for the packaging. **A total of 240,000lbs of dried fruits and 180,000lbs of nuts are available each month – Added Nov. 16**. Due to the nature of the packaging, the bottleneck in the production is for type A in that the factory can only produce 110,000 tins of trail mix A per month.

   (a) Formulate the problem as a linear program in two variables where the objective function maximizes profit.

   (b) Graph the feasible region, give the coordinates of the vertices and state the vertex maximizing the profit and the value of the maximum profit.

   (c) Confirm the maximizing vertex by applying the Simplex method to the problem.

2. (10 marks) Suppose you are given the following points in the plane:

$$(10, 19), (8, 15), (7, 14), (5, 11), (3, 7), (2, 5), (1, 3)$$

   and you would like to fit a line $ax + by = c$ that approximately passes through these points (note that it will not be a perfect fit). Give a linear program to find the line that minimizes the *maximum absolute error*,

$$\max_{1 \le i \le 7} |ax_i + by_i - c|.$$

   You do not need to solve your LP.