ECE4010 Homework 4

Q1. [5 pts] For which of the following will you always find the same solution, even if you re-run the algorithm multiple times?
Assume a problem where the goal is to minimize a cost function, and every state in the state space has a different cost.

- ☐ Steepest-ascent hill-climbing, each time starting from a different starting state
- ☐ Steepest-ascent hill-climbing, each time starting from the same starting state
- ☐ Stochastic hill-climbing, each time starting from a different starting state
- ☐ Stochastic hill-climbing, each time starting from the same starting state
- ☐ Both steepest-ascent and stochastic hill climbing, so long as you always start from the same starting state
- ☐ Both steepest-ascent and stochastic hill climbing, each time starting from a different starting state
- ☐ No version of hill-climbing will guarantee the same solution every time

Q2. [30 pts] A farmer is trying to plant two crops, Crop 1 and Crop 2, and wants to maximize his profits. The farmer will make $500 in profit from each acre of Crop 1 planted, and will make $400 in profit from each acre of Crop 2 planted.

However, the farmer needs to do all of his planting today, during the 12 hours between 7am and 7pm. Planting an acre of Crop 1 takes 3 hours, and planting an acre of Crop 2 takes 2 hours.

The farmer is also limited in terms of supplies: he has enough supplies to plant 10 acres of Crop 1 and enough supplies to plant 4 acres of Crop 2.

Assume the variable C1 represents the number of acres of Crop 1 to plant, and the variable C2 represents the number of acres of Crop 2 to plant.

(a) [10 pts] Write this problem as an LP in a form that is defined in lecture. Be sure to change the goal as minimizing a cost function and the constraints should follow the inequality form (proper use of less than or equal).

(b) [15 pts] Accurately plot the graphical representation of this linear program. Specifically: Plot the boundary of each half space as a line and shade the feasible region.
Plot:

(c) [5 pts] Find the optimal solution to this LP problem.
C1: C2: Total Profit:

Q3. [30 pts] You are in charge of scheduling for computer science classes that meet Mondays, Wednesdays and Fridays. There are 5 classes that meet on these days and 3 professors who will be teaching these classes. You are constrained by the fact that each professor can only teach one class at a time.

The classes are:
1. Class 1 - Intro to Programming: meets from 8:00-9:00am
2. Class 2 - Intro to Artificial Intelligence: meets from 8:30-9:30am
3. Class 3 - Natural Language Processing: meets from 9:00-10:00am
4. Class 4 - Computer Vision: meets from 9:00-10:00am
5. Class 5 - Machine Learning: meets from 10:30-11:30am

The professors are:
1. Professor A, who is qualified to teach Classes 1, 2, and 5.
2. Professor B, who is qualified to teach Classes 3, 4, and 5.
3. Professor C, who is qualified to teach Classes 1, 3, and 4.

(a)[10 pts] Formulate this problem as a CSP problem in which there is one variable per class, stating the domains, and constraints. Constraints should be specified formally and precisely, but may be implicit rather than explicit.

(b)[10 pts] Draw the constraint graph associated with your CSP.

(c)[10 pts] List all possible solutions.