Homework 2
Computer Science
B551 Spring 2018
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Introduction

The aim of this homework is to get you acquianted with problem solving and the steps (Real World → Concept → Logic → Implementation). You will turn-in four files

- A *pdf with the written answers called `hw2.pdf`
- A Python script called `rv1.py`
- A Python script called `rv2.py`
- A Python script called `rpsg.py` for rock-paper-scissors.

I am providing this LaTeX document for you to freely use as well. Please enjoy this homework and ask yourself what interests you and then how can you add that interest to it! Finally, questions 4 and 5 are worth 50 points each whereas questions 1,2 and 3 are 20 worth points each.

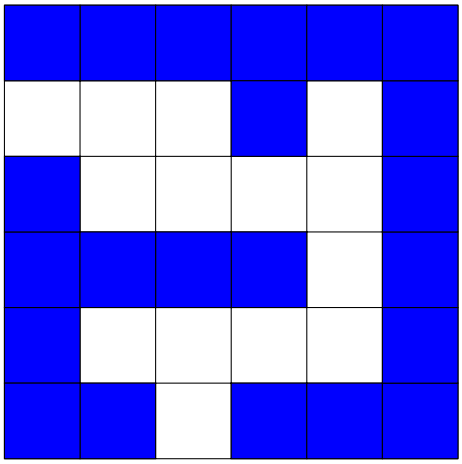
Homework Questions

1. Problem 3.10 (p. 115) in the text.
2. Problem 3.18 (p. 117) in the text.
3. The text (page 95) describes consistency as:

$$h(n) \quad \leq c(n, a, n') + h(n')$$

for state n, its successor n' and action a. For $G = (\{A, B, C\}, \{(A, B), (A, C), (B, C)\})$, $Cost = \{((A, B), 2), ((A, C), 5), ((B, C), 1)\}$, and $h(A) = 1, h(B) = 4, h(C) = 3$. Is this consistent?

4. Assume you're programming a robot named R to navigate a 2D surface. The robot can only move forward a single step to an adjacent square (not diagonally), but can also rotate $\pm$ 90 degrees. R has a single sensor on its front that determines if there is an obstruction, perhaps a wall, is in its path. Your task is to read in a 2D plan and starting at location from the southmost (bottom) side, navigate to another side. The plan below has an opening at (3,1). *One* path is: (3,1), (3,2), ..., (3,5), (2,5), (1,5). If R is at (4,2) facing north, then its sensor would return 1. If R is at (4,2) and facing east, its sensor would return 0. If R is at (2,2) facing west, to move to (3,2), rotate(90), rotate(90), step. You can *start* R on any available open square on the bottom – you'll have to decide what direction R is facing. The plan is encoded as an array of ones and zeros. The plan below:



would be encoded as:

```
111111
000100
100001
111101
100001
110111
```

   (a) Given a floor plan `f.txt` (read in the file), return True and the series of instructions needed to navigate R if there is a path and False otherwise. Name this program `rv1.py`.

   (b) Improve R's programming by returning the *shortest* path if it exists. Name this program `rv2.py`.

   (c) Discuss your search techniques in both solutions. State explicitly your $\hat{h}, \hat{g}, \hat{f}$.

5. Extend Rock/Paper/Scissors from the last assignment that has the computer playing a human. You'll additionally have $100 dollars worth of $1 chips. *Before* you show your selection, you must place a

wager (at least \$1). Keep the computer's strategy uniform and independent for both how it plays and how it bets. The maximum amount of chips that can be wagered is $\min\{c, h\}$ where c, h are the counts of computer and human chips respectively. Compare this R/P/S with your earlier version and discuss. Name this program `rpsg.py`.