FIT3139: Applied questions for week 10

Question 1

Discuss your Specification Table for your Final Project with your Applied Class demonstrators.

If you do not have a Specification Table yet, try to put one together and then discuss.

Base model	One sentence description of the base model
Extension assumptions	One paragraph description on how assumptions are modified and the nature of the extension
Techniques showcased	Technique 1. Technique 2.
Modelling question 1	Questions being addressed.
Modelling question 2	

Your Specification Table should include;

- Base Model: A one sentence description of the base model
- Extension Assumptions: One paragraph description on how assumptions are modified and the nature of the extension
- Techniques Showcased: Which modelling and simulation techniques are you using
- Modelling Questions: The questions you will address in your assignment.

Keep in mind that the Specification Table you present today is not set in stone, and can still be changed. This is an iterative process and will be refined as you progress in the assignment. The point of this task is to get you started and on the right track for getting the assignment completed in time, and to make use of the advice you receive form your lab demonstrators.

Once you have set up the table, make sure to think and discuss how to answer the questions (what plots or visualisations you envision) and how your extension assumptions align well with the questions you are asking.

Question 2

Write down the pseudocode for stochastic hill climbing. [1] Explain how you can use – or modify – this algorithm, to minimise an arbitrary function $f : \mathbb{R}^n \to \mathbb{R}$.

[1] Choose randomly from all uphill moves in the vicinity. Probabilities may depend on steepness of the uphill move.

Question 3

Describe the general structure of a Simulated Annealing algorithm. Discuss how this algorithm changes for minimisation and maximisation goals.

You are given weights and values of n items, and you need choose which items to take in a knapsack of capacity W, maximising the total value in the knapsack. You cannot break an item, either pick the complete item, or don't.

Write a function to solve this problem using Simulated Annealing. Keep in mind the following:

- How would you represent a potential solution?
- How would you structure your fitness function?
- How would you evaluate the fitness of a potential solution?
- How would you perturb a potential solution?

Question 4

A match of tennis is composed of sets, games and points. Lets model a game between players A and B as an absorbing Markov chain, and compute the probability of a player of a certain skill winning a game, and the expected number of points in a game.

The following diagram shows the states and transitions in a game of tennis. The main assumption is that player A wins any single point with probability p, thus player B wins a single point with probability $q = 1 - p$ The first few points are quite straightforward, but more nuanced transitions can arise in the top 5 states, given any game needs to be won with at least a 2-point advantage.

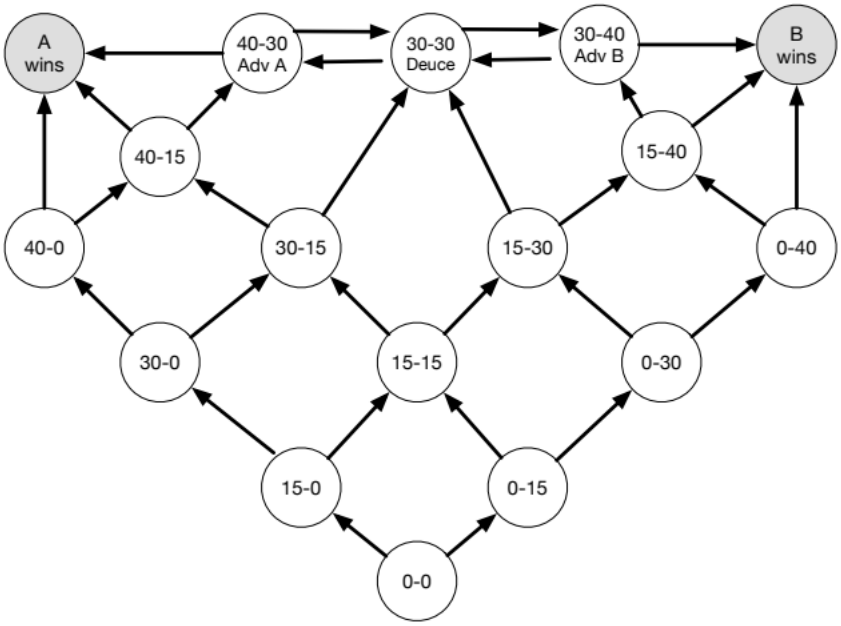

Figure 1: States and Transitions

How would you represent this game with a Markov Chain? How would you use this Markov Chain to compute which states were visited most often, and how long it takes on average for the game to end? How about simulating a game?