United International University

Department of Computer Science and Engineering

CSI 341 Artificial Intelligence,

Mid Exam, Summer 2018

Total Marks: 30, Time: 2 hours

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1. (a) Write down the PEAS specification for an Automated Taxi Driver Agent navigating a city. [1]

   (b) Suppose you are designing an intelligent agent for playing the game of Pacman. Your objective is to eat all the dots and empty the board. You can only see what is immediately next to you but you cannot see the whole board. Blocks can appear anywhere randomly. There are no ghosts on the board. Determine if the agent's environment is fully or partially observable, single or multi agent, deterministic or stochastic, episodic or sequential. [2]

2. Suppose there is a vacuum cleaner agent that cleans four rooms (Shown in Figure 1). The agent can move left, right, up, down and can suck dirt. The goal is to clean all four rooms. [4]

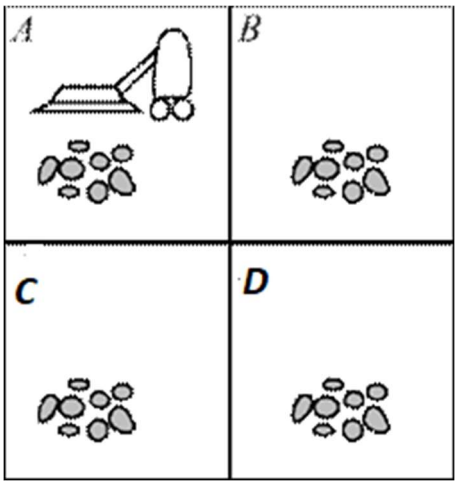

Figure 1

   (a) What are the variables required to represent a state?
   (b) What are the possible actions?
   (c) How many successors does a state have? Explain your calculation.
   (d) What is the size of the state space? Explain your calculation.

3. (a) What is Depth Limited Search? Is it complete? Explain your answer. [2]

(b) Consider the state space graph in Figure 2. Find out the solution paths and costs returned by the following Tree Search algorithms. In case of ties while picking nodes from the fringe follow the alphabetical order. S is the initial state, while G is the goal state. [4]

i. IDS
ii. UCS
iii. Greedy Search
iv. A* Search

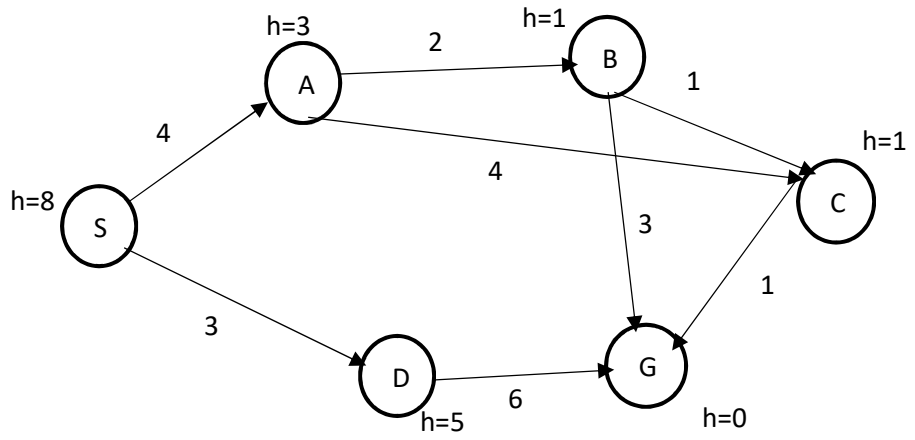

Figure 2

4. (a) Will A* Graph Search be optimal for the graph in Figure 2? Explain your answer. [1.5]

(b) You are given the following two heuristic functions for a problem. Both heuristics are admissible. Which one will you choose and why? [1.5]

Node	h1	h2
S	8	6
A	5	3
B	4	2
C	2	1
G	0	0

5. Answer any two of the following: [2x2=4]

(a) Suppose, you are solving graph coloring problem for a graph with 50 nodes and 100 edges. You are allowed to use 4 colors only. You are trying to implement simulated annealing algorithm. Now, you have two options for initial temperature T. They are T=1000 or T=10000. Which one will you prefer to use and why? Also, you are using the following, simple mechanism to update T within the epochs of your program.

$T = \alpha T$

You have two values to select for α too. One is α=0.99 and another is α=0.95. Which you prefer to use and why?

(b) What are the advantages of population-based algorithms over single point search algorithms? What necessary steps can be taken when a search algorithm faces stagnation?

(c) For each of the following statements state if they are true or false and provide some single sentence justification for each one.

i) Hill climbing with random restarts is guaranteed to find the global optimum if it runs long enough on a finite state space

ii) There can be more than one global optimum.

iii) It is possible that every state is a local optimum. (A local optimum is defined to be a state that is NO BETTER than its neighbors)

iv) Hill Climbing algorithm is a special case of Simulated Annealing algorithm.

6. (a) Practically, it is not possible to run down the depth of the game tree when depth and branching factor both are large. How is it possible to improve the performance of Min-Max Algorithm in such cases? [1]

(b) For the game tree in Figure 3 show which branches will be pruned using α-β pruning with Min-Max Algorithm. Mark the values each node expects to receive. [3]

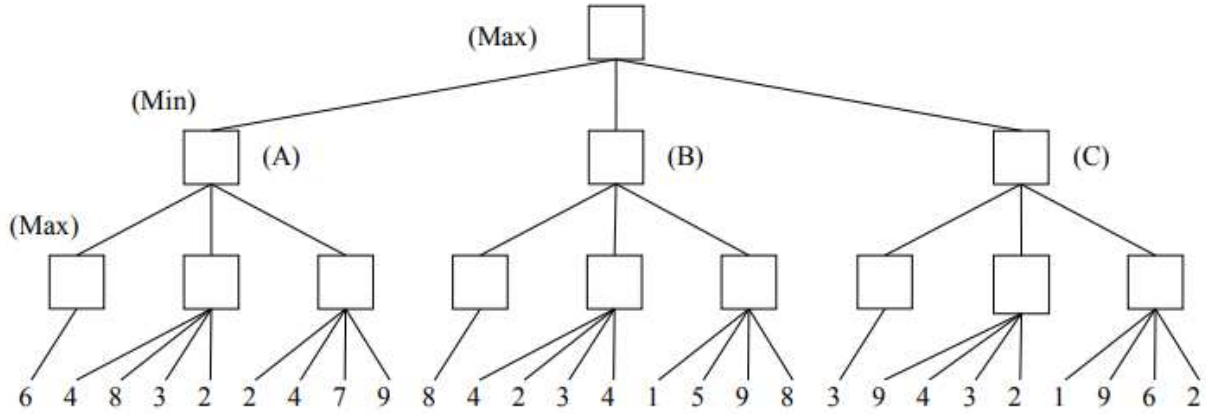

Figure 3

7. (a) In an orientation program of United International University your friend was given the duty to sample data from the incoming students. In total he collected data of 100 students only, based on which you have to build a probabilistic model. He narrates to you the following account: Among the sampled students, there were 45 girls among them 20 were carrying bags. There were 30 boys who did not carry any bag. Among the girls who carried bags 15 were wearing sporting keds. Among the girls who did not carry bags, only 10 were wearing sporting keds. The statistics among the boys is different. Among the 25 who carried bags, 20 were wearing sporting keds. There were 10 boys who neither wear sporting keds nor carry bags.

i. Your first task is to find three variables, S (sex of the student), B (carries a bag), W (wears sporting keds). Are these variables discrete or continuous? Find the joint distribution table P(S,B,W) [0.5+2]

ii. Find the conditional distribution table P(B|S). [1.5]

(b) Urn 1 has five white and seven black balls. Urn 2 has three white and twelve black balls. We flip a fair coin. If the outcome is heads, then a ball from urn 1 is selected, while if the outcome is tails, then a ball from urn 2 is selected. Suppose that a white ball is selected. What is the probability that the coin landed tails? [2]