Assignment 5

CMSC 471 (03/01) — Artificial Intelligence

Item	**Summary**
Assigned	Wednesday May 5th
Due	Wednesday May 12th, 11:59 PM Baltimore time
Topic	Planning and α-β pruning
Points	50

In this assignment you will gain experience with probability and some machine learning inference techniques.

You are to *complete* this assignment on your own: that is, the writeup you submit must be entirely your own. However, you may discuss the assignment at a high level with other students or on the discussion board. Note at the top of your assignment who you discussed this with or what resources you used (beyond course staff, any course materials, or public Piazza discussions).

The following table gives the overall point breakdown for this assignment.

Question	1	2
Points	25	25

What To Turn In You must turn in **one** item:

1. A writeup in PDF format that answer the questions.

Answers to the following questions should be long-form.

How To Submit Submit the assignment on the submission site:

https://www.csee.umbc.edu/courses/undergraduate/471/spring21/01_03/submit.

Be sure to select "`Assignment 5`."

Questions

1. (**25 points**) Answer subparts a-d of Question 6 from Section 6.8 in the book, replicated (with minor clarifications) below for ease:

   Suppose you have a STRIPS representation for actions a_1 and a_2, and you want to define the STRIPS representation for the composite action of a_2 immediately following a_1 (represented as $a_1; a_2$).

   (a) Describe, in prose, what are the effects for this composite action?

   (b) When is the composite action impossible? (That is, when is it impossible for a_2 to be immediately after a_1?)

   (c) Assuming the action is not impossible, describe in prose what the preconditions for this composite action are.

   (d) Using the delivery robot domain of Example 6.1, give the STRIPS representation for the composite action puc; mc.

2. (**25 points**) Consider the min-max tree given in Fig. 1, where pointy-up triangles represent max nodes and pointy-down triangles represent min nodes (the root is a max node). Values of the evaluation function are given under each terminal (leaf).

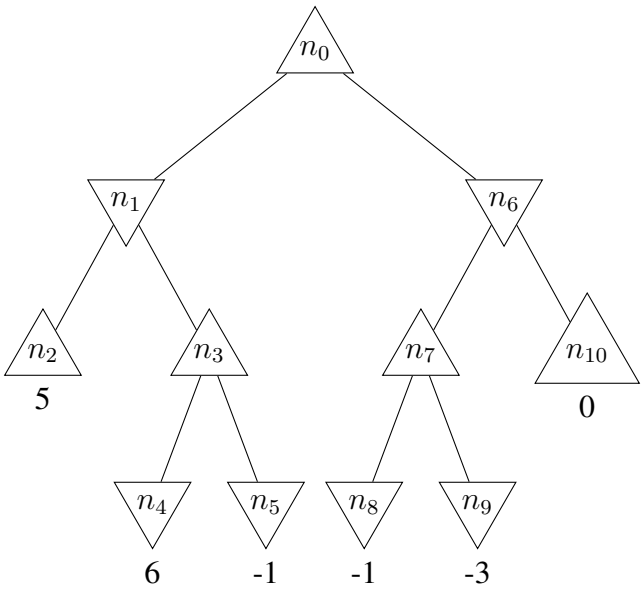

Figure 1: Tree for item 2.

   (a) Fill in the min-max node values for all non-terminal (non-leaf) nodes. You can simply provide your answers as n_i : value (e.g., if n_1 has a value of 200 (it doesn't), then $n_1 : 200$).

   (b) Run α-β pruning on the above tree, assuming a standard left-to-right DFS order. List out the nodes that are pruned and why. As you do, *show each step*. You can do this by

- listing out the initial α and β values for each node, and then providing new values next to/underneath those previous values. E.g., next to n_1, list the initial β value, then the next, then the next, and so on.
- Striking out an edge if that node is pruned.

(c) Identify a node that was not pruned, and propose *one* change that you could make to the tree that would result in that node being pruned. Clearly describe your proposed change and explain your answer.

For this question, you are allowed to consider the following types of changes: changing a value of a leaf node, or reordering the iteration order of nodes (e.g., n_i before n_j), or the introduction of new nodes. You are not allowed to consider node deletion.