AY2324S2-CSxx46-MockExam

Your Name: _____ **Your ID:** _____

# of Questions: 6

Total Exam Points: 15.00

Question #: 1

[1 mark] Which of the following is the correct CNF equivalent of the formula: $\neg(A \rightarrow B) \vee (C \rightarrow A)$

A. $(A \vee \neg B) \wedge (\neg A \vee C)$

B. $(A \vee \neg C) \wedge (A \vee \neg B \vee \neg C)$

C. $(A \vee C) \wedge (A \vee \neg B \vee \neg C)$

D. $(A \vee \neg B) \wedge (\neg C \vee A)$

E. $(A \vee \neg C) \wedge (A \vee B \vee \neg C)$

Item Weight: 1.0

Question #: 2

[6 marks] Consider the blocks world problem as shown in the figure below

$$
\begin{aligned}
&Init(On(A, Table) \wedge On(B, Table) \wedge On(C, A) \\
&\quad \wedge Block(A) \wedge Block(B) \wedge Block(C) \wedge Clear(B) \wedge Clear(C)) \\
&Goal(On(A, B) \wedge On(B, C)) \\
&Action(Move(b, x, y), \\
&\quad \text{PRECOND: } On(b, x) \wedge Clear(b) \wedge Clear(y) \wedge Block(b) \wedge Block(y) \wedge \\
&\qquad (b \neq x) \wedge (b \neq y) \wedge (x \neq y), \\
&\quad \text{EFFECT: } On(b, y) \wedge Clear(x) \wedge \neg On(b, x) \wedge \neg Clear(y)) \\
&Action(MoveToTable(b, x), \\
&\quad \text{PRECOND: } On(b, x) \wedge Clear(b) \wedge Block(b) \wedge (b \neq x), \\
&\quad \text{EFFECT: } On(b, Table) \wedge Clear(x) \wedge \neg On(b, x))
\end{aligned}
$$

In the current form the action *Move(b,x,y)* moves the block *b* from *x* to *y*. Now, we introduce a robotic arm that manipulates the blocks using actions *Pickup* and *Putdown* instead of *Move*.

Q: Write the action schema for *Pickup* and *Putdown*. Clearly indicate additional pre dicates, if any, that are necessary.

Note:

- As in the Figure, you can use the inequality operator
- You can use minus (-) for negation and != for inequality in writing your answer

Item Weight: 6.0

Question #: 3

[4 marks] Assume that you are given a directed graph with *n* vertices and positive weights and would like to compute the shortest path from every vertex to a goal vertex *g*. Describe how to model the problem as a MDP so that it can be solved with an appropriately initialized value iteration algorithm. More specifically, describe the state space, action space, transition function, and reward function.

Item Weight: 4.0

Question #: 4

[2 marks] In an MCTS simulation, a state has been visited 20 times and has 2 children nodes *A* and *B*.
Node *A* has won 2 out of 4 times, whereas node *B* has won 8 out of 16 times.
The value of
π_{UCT}

for node *A* is __1__ (correct to 2 decimal places)
The value of
π_{UCT}

for node *B* is __2__ (correct to 2 decimal places)
Consider
$\log_{10}$

in the UCT bound and $c = 1$

1. _____
2. _____

Item Weight: 2.0

Question #: 5

[1 mark] Cathy prefers A to B and prefers lottery C = [0.2, A; 0.8, B] to lottery D = [0.3, A; 07, B]. Is there at least one such utility function that satisfies Cathy's preferences? Explain

_____

_____

_____

Item Weight: 1.0

Question #: 6

[1 mark] Consider the blocks world problem as shown in the figure below

$$
\begin{aligned}
&Init(On(A, Table) \wedge On(B, Table) \wedge On(C, A) \\
&\quad \wedge Block(A) \wedge Block(B) \wedge Block(C) \wedge Clear(B) \wedge Clear(C)) \\
&Goal(On(A, B) \wedge On(B, C)) \\
&Action(Move(b, x, y), \\
&\quad \text{PRECOND: } On(b, x) \wedge Clear(b) \wedge Clear(y) \wedge Block(b) \wedge Block(y) \wedge \\
&\qquad (b \neq x) \wedge (b \neq y) \wedge (x \neq y), \\
&\quad \text{EFFECT: } On(b, y) \wedge Clear(x) \wedge \neg On(b, x) \wedge \neg Clear(y)) \\
&Action(MoveToTable(b, x), \\
&\quad \text{PRECOND: } On(b, x) \wedge Clear(b) \wedge Block(b) \wedge (b \neq x), \\
&\quad \text{EFFECT: } On(b, Table) \wedge Clear(x) \wedge \neg On(b, x))
\end{aligned}
$$

In the current form the action Move(b,x,y) moves the block b from x to y. Now we introduce a robotic arm that manipulates the blocks using actions Pickup and Putdown instead of Move.

With the introduction of the new actions in lieu of Move, do you still need to treat Table differently? Why or Why not?

Item Weight: 1.0