Assignment 8

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

1) Which of the following need to be specified while formulating a planning problem?

- A set of propositions or predicates to define a state of the world
- A set of operators or actions to generate successor states of a given state
- Goal conditions to be achieved
- Complete description of the initial state
- Either goal conditions or an initial state, but not both.

No, the answer is incorrect.
Score: 0
Accepted Answers:
- A set of propositions or predicates to define a state of the world
- A set of operators or actions to generate successor states of a given state
- Goal conditions to be achieved
- Complete description of the initial state

2) In the Blocks World domain, actions are

- Deterministic
- Stochastic
- Instantaneous
- Durative

No, the answer is incorrect.
Score: 0
Accepted Answers:
- Deterministic
- Instantaneous

3) In the Blocks World domain, as discussed in the lectures, the domain is

- Static
- Multi-agent
- Finite
- Completely observable
- Dynamic

No, the answer is incorrect.
Score: 0
Accepted Answers:
- Static
- Finite
- Completely observable

4) Which of the following statements is/are true about State Space planning?

- Forward Search Space Planning has a lower branching factor than Backward Search Space Planning
- Forward Search Space Planning starts from an Initial state description whereas Backward Search Space Planning starts from the Goal conditions
- Forward Search Space Planning explores the state space with the help of applicable actions whereas Backward Search Space Planning explores the state space with the help of relevant actions
- Forward Search Space Planning may return an invalid plan but Backward Search Space Planning always returns a valid plan
- Progression is closed over the state space but regression is not closed over the state space

No, the answer is incorrect.
Score: 0
Accepted Answers:
Forward Search Space Planning starts from an initial state description whereas Backward Search Space Planning starts from the goal conditions.
Forward Search Space Planning explores the state space with the help of applicable actions whereas Backward Search Space Planning explores the state space with the help of relevant actions.
Progression is closed over the state space but regression is not closed over the state space.

5) Which of the following statements is/are true about Goal Stack Planning?

- It suffers from the curse of high branching factor
- It constructs plans in a forward manner
- It searches in a goal-directed backward manner
- It solves one subgoal completely before attempting another subgoal
- It terminates as soon as the last unit subgoal in the stack is solved
- It always generates linear plans.

No, the answer is incorrect.
Score: 0
Accepted Answers:
- It constructs plans in a forward manner
- It searches in a goal-directed backward manner
- It solves one subgoal completely before attempting another subgoal
- It always generates linear plans.

BEGIN GROUP

Four operators are defined over the Blocks World domain.

**Pickup(X)**
Preconditions: \(\text{armEmpty} \land \text{clear}(X) \land \text{onTable}(X)\)
Add effects: \(\text{holding}(X)\)
Delete effects: \(\text{armEmpty} \land \text{onTable}(X)\)

**Putdown(X)**
Preconditions: \(\text{holding}(X)\)
Add effects: \(\text{armEmpty} \land \text{onTable}(X)\)
Delete effects: \(\text{holding}(X)\)

**Unstack(X,Y)**
Preconditions: \(\text{armEmpty} \land \text{clear}(X) \land \text{on}(X,Y)\)
Add effects: \(\text{holding}(X) \land \text{clear}(Y)\)
Delete effects: \(\text{armEmpty} \land \text{on}(X,Y)\)

**Stack(X,Y)**
Preconditions: \(\text{holding}(X) \land \text{clear}(Y)\)
Add effects: \(\text{armEmpty} \land \text{on}(X,Y)\)
Delete effects: \(\text{holding}(X) \land \text{clear}(Y)\)

A set of grounded-actions and grounded-predicates are listed here. Each item in the list is identified by a unique item number, use the item number in your answer.

<table>
<thead>
<tr>
<th>GROUNDED ACTIONS</th>
<th>GROUNDED PREDICATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Stack(A,B)</td>
<td>10. Putdown(A)</td>
</tr>
<tr>
<td>2. Stack(A,C)</td>
<td>11. Putdown(B)</td>
</tr>
<tr>
<td>3. Stack(B,A)</td>
<td>12. Putdown(C)</td>
</tr>
<tr>
<td>4. Stack(B,C)</td>
<td>13. Unstack(A,B)</td>
</tr>
<tr>
<td>5. Stack(C,A)</td>
<td>14. Unstack(A,C)</td>
</tr>
<tr>
<td>6. Stack(C,B)</td>
<td>15. Unstack(B,A)</td>
</tr>
<tr>
<td>7. Pickup(A)</td>
<td>16. Unstack(B,C)</td>
</tr>
<tr>
<td>8. Pickup(B)</td>
<td>17. Unstack(C,A)</td>
</tr>
<tr>
<td>9. Pickup(C)</td>
<td>18. Unstack(C,B)</td>
</tr>
</tbody>
</table>

The figure describes a planning problem whose start state and goal states conditions are:

Start: \(\text{armEmpty} \land \text{on}(A,B) \land \text{on}(B,C) \land \text{onTable}(C) \land \text{clear}(A)\)
Goal: \(\text{onTable}(A) \land \text{onTable}(B) \land \text{onTable}(C)\)

Note: the start state is represented by the sequence 21,24,29,33,36 (item numbers are in ascending order) and the goal state is represented by 27,28,29.

Now, answer the planning questions based on this information. Wherever applicable, your answer must be a list of comma separated item numbers, and DO NOT enter any characters other than digits and comma. When more than one action or predicate is applicable then ALWAYS choose the one that has
6) What is the optimal plan for the problem? Your answer must be a comma separated list of item numbers.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 13, 10, 16, 11
(Type: String) 13, 10, 16, 11

1 point

7) Is the optimal plan unique?

Yes

No, the answer is incorrect.
Score: 0
Accepted Answers:
Yes

1 point

8) Enter the list of applicable actions in the Initial state. Your answer must be a comma separated list of item numbers in the ascending order.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 13

1 point

9) What are the first five actions selected by Forward State Space Planning and added to the plan? Remember the TIE-BREAKING policy. Your answer must be a comma separated list of item numbers.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 13, 1, 13, 1, 13
(Type: String) 13, 1, 13, 1, 13

1 point

10) Does Forward State Space Planning eventually find the optimal plan?

Yes

No, the answer is incorrect.
Score: 0
Accepted Answers:
No

1 point

11) Enter the list of relevant actions with respect to the goal conditions? Your answer must be a comma separated list of item numbers in the ascending order.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 10, 11, 12
(Type: String) 10, 11, 12

1 point

12) Let us add the conditions: \((\text{clear}(A) \land \text{clear}(B) \land \text{clear}(C))\) to the given set of goal conditions. Now the new goal (just for this question) becomes

\[\text{Goal}: \text{onTable}(A) \land \text{onTable}(B) \land \text{onTable}(C) \land \text{clear}(A) \land \text{clear}(B) \land \text{clear}(C)\]

Does the list of relevant actions change? Enter the list of relevant actions with respect to the goal conditions?

Your answer must be a comma separated list of item numbers in the ascending order.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 10, 11, 12, 13, 14, 15, 16, 17, 18
(Type: String) 10, 11, 12, 13, 14, 15, 16, 17, 18

1 point

13) What would be the first action selected by Backward State Space Planning for the original goal \(G: \text{onTable}(A) \land \text{onTable}(B) \land \text{onTable}(C)\)? Remember the TIE-BREAKING policy.

Your answer must be a natural number.
1 point

14) After choosing the action (the answer to the above question), BSSP regresses the goal G to a new goal G'. Enter the list of predicates that are present in G'.

Your answer must be a comma separated list of item numbers in the ascending order.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 10

1 point

15) What are the first five unit predicates pushed on the stack by Goal Stack Planning? Ignore the goal conjuncts pushed onto the stack.

Your answer must be a comma separated list of item numbers

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 28, 29, 30
(Type: String) 28, 29, 30

1 point

16) What are the first five unit predicates popped from the stack by Goal Stack Planning? Ignore the goal conjuncts pushed to the stack.

Your answer must be a comma separated list of item numbers

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 27, 28, 29, 31, 28
(Type: String) 27, 28, 29, 31, 28

1 point

17) What are the first two actions pushed to the stack by Goal Stack Planning?

Your answer must be a comma separated list of item numbers

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 11, 8
(Type: String) 11, 8

END GROUP

1 point

18) Suppose we are working with three blocks A, B and C in the Blocks World domain. Which of the following could be a valid goal description?

- on(A,B) ∧ holding(C) ∧ clear(B)
- clear(A) ∧ clear(B) ∧ clear(C)
- on(A,B) ∧ on(A,C) ∧ clear(A)
- on(A,B) ∧ clear(A) ∧ Pickup(C)
- on(A,B) ∧ holding(C)
- on(A,B) ∧ clear(C)

No, the answer is incorrect.
Score: 0
Accepted Answers:
clear(A) ∧ clear(B) ∧ clear(C)
on(A,B) ∧ holding(C)
on(A,B) ∧ clear(C)

1 point

19) Which of the following can be constituents of a partial plan?

- Initial state description
- Goal state description
Partially instantiated actions
Ordering and causal links that together impose an ordering on the actions
Binding constraints on variable assignments.

No, the answer is incorrect.
Score: 0
Accepted Answers:
- Partially instantiated actions
- Ordering and causal links that together impose an ordering on the actions
- Binding constraints on variable assignments.

20) Which of the following statements is/are true about Plan Space Planning?

- It searches in the space of partial plans.
- The search begins with an empty plan that stands for all possible plans for a given problem.
- The initial plan constitutes exactly two actions and no binding constraints.
- The initial plan has no open goals.
- The initial plan has no threats.
- It finds a solution plan only when the subgoals are serializable.

No, the answer is incorrect.
Score: 0
Accepted Answers:
- It searches in the space of partial plans.
- The search begins with an empty plan that stands for all possible plans for a given problem.
- The initial plan constitutes exactly two actions and no binding constraints.
- The initial plan has no threats.

21) Consider the partial order plan, where A1, A2, A3 and A4 are actions, illustrated in the figure below.

What will be the makespan of the above plan in the following cases: (i) one arm robot, (ii) two arm robot and (iii) four arm robot?

Your answer should be a list of 3 natural numbers separated by commas.

Enter 1,2,3 if makespans for the cases (i),(ii) and (iii) are 1, 2 and 3, respectively.

No, the answer is incorrect.
Score: 0
Accepted Answers:
- (Type: String) 4,2,2
- (Type: String) 4, 2, 2

1 point