Foundation Level
Final Exam
Questions
Question 1

A* Search

Tick those statements that you believe to be true:

Marks available: 3

☐ The A* algorithm always expands the node n on the current search fringe that has the lowest heuristic value h(n).
☐ A heuristic is admissible if it never overestimates the distance to the nearest goal.
☐ In the worst case, A* graph search uses only polynomial memory.
☐ The search queue used by A* can be maintained in constant time. That is adding a node to the queue and retrieving the next node to be expanded takes constant time.
☐ If the heuristic used by A* is admissible, the tree search algorithm will always return a minimal cost solution.
Question 2

State-Space Search Planning (STRIPS)

Tick those statements that you believe to be true:

Marks available: 3

☐ For planning by state-space search (as performed by STRIPS), each state in the search space is a finite set of function-free, ground first-order atoms.

☐ To compute the state that results from applying an applicable action in a given state, we first add all the positive effects to the state and then we remove the negative effects.

☐ The node expansion step in state-space search must compute all the applicable actions for a given state. This can be done in linear time.

☐ State-space search terminates when it finds a state that contains all the goal conditions.

☐ In the STRIPS representation, an operator may have negative preconditions.
Question 3

State-Space Search Planning (STRIPS)

To answer this question, you will need to look at another random domain and an associated random problem.

Which of the following actions are relevant for the goal defined in the problem?

Marks available: 3

☐ (op2 A B B)
☐ (op2 A A B)
☐ (op1 C B B)
☐ (op1 A B B)
☐ (op2 C B B)
Question 4

Plan-Space Search Planning (UCPOP)

Tick those statements that you believe to be true:

Marks available: 3

☐ For plan-space search, the search space consists of partial plans, which consist of a set of partially instantiated operators, ordering constraints, and variable binding constraints.

☐ A threat can be resolved in two ways: by adding an ordering constraint, or by adding a variable binding constraint.

☐ The dummy action that represents the initial state in a partial plan never poses a threat.

☐ A node in plan-space search is a goal node if it contains no threats.

☐ Expanding a node in plan-space search corresponds to a plan refinement operation that adds one or more components of a partial plan to the successor nodes.
Question 5

Task Network Planning

Tick those statements that you believe to be true:

Marks available: 3

☐ Transitions between states in the search space can be applications of methods to decompose tasks in the network.

☐ A goal state in task network search is a ground, primitive task network.

☐ Practical planning system often use the task network approach because it is faster.

☐ Task network planning can also be solved by search, but here the search space consists of task networks.

☐ A method in HTN planning breaks down a task into one or more subtasks.
Question 6

Graphplan

Tick those statements that you believe to be true:

Marks available: 3

☐ The planning graph is a layered graph consisting of alternating proposition and action layers, where nodes in proposition layers correspond to state propositions and nodes in action layers correspond to action propositions.

☐ Two actions are independent if they do not delete each other's preconditions.

☐ An action that appears in one action layer must also appear in all action layers with greater index.

☐ In the Graphplan algorithm, in general it is the backward search that takes most of the time.

☐ A pair of state propositions that are mutex in one action layer must also be mutex in all proposition layers with greater index.
Question 7

Graphplan

To answer this question, you will need to look at the random domain and associated random problem from question 3 again.

Which of the following actions can be found in action layer $A_7$?

*Marks available: 3*

- [ ] (op1 A B C)
- [ ] (op1 A B B)
- [ ] (op1 C B C)
- [ ] (op2 A B B)
- [ ] (op1 C A B)
Question 8

Graphplan

To answer this question, you will need to look at the random domain and associated random problem from question 3 and 7 again.

Which of the following propositions can be found in proposition layer P_r?

Marks available: 3

☑ (R A A)
☐ (S A A)
☐ (S B B)
☐ (R A B)
☐ (S C C)
Question 9

Advanced Heuristics

Tick those statements that you believe to be true:

*Marks available: 3*

- [ ] The simple planning graph heuristic that is computed by adding the indexes of the first layer in which the goal components appear is admissible.
- [ ] Pattern database heuristics are specific to a goal. That is, if the goal changes, the pattern database must be recomputed.
- [ ] FF runs in polynomial time because both the forward chaining and the backward chaining have polynomial time complexity.
- [ ] Pattern databases and A* are a good combination.
- [ ] The heuristic used by the FF planner is admissible.
Question 10

Advanced Heuristics

To answer this question, you will need to look at the random domain and associated random problem from previous questions a final time.

What is the heuristic value computed by FF for the initial state?

Marks available: 3