Midterm (9pm-11pm)

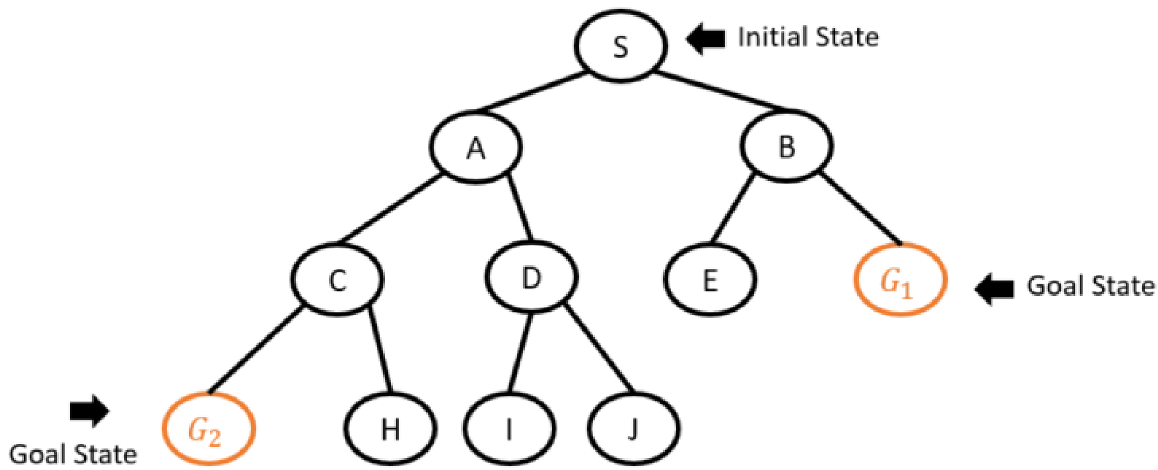
Started: Feb 15 at 9pm

Quiz Instructions

Question 1 10 pts

You are given a search tree as below. Number the nodes in the tree according to the order in which they will be **generated(** not visited! **)**. The goal test is applied **immediately after the node is generated**. When the order is arbitrary, follow the alphabetical order. If a node is never generated, choose "not generated".

Breadth First Search



A	[Choose]
B	[Choose]
C	[Choose]
D	[Choose]
E	[Choose]
G1	[Choose]
G2	[Choose]

H [Choose]

I [Choose]

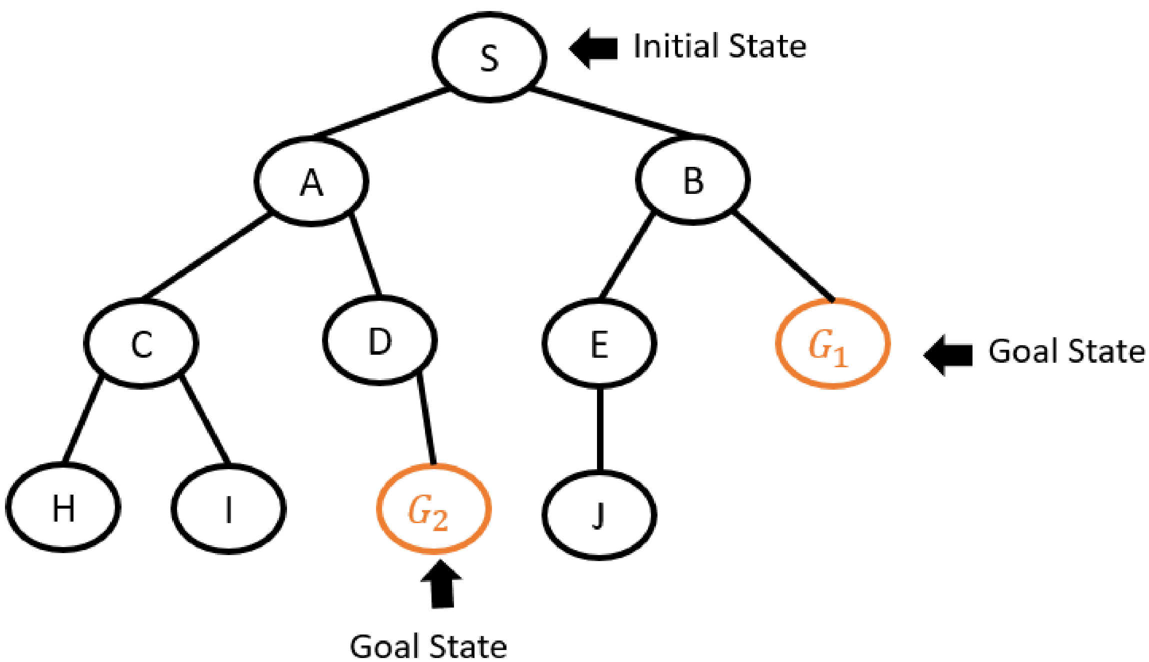
J [Choose]

Question 2

10 pts

You are given a search tree as below. Number the nodes in the tree according to the order in which they will be **generated(** not visited! **)**. The goal test is applied **immediately after the node is generated**. When the order is arbitrary, follow the alphabetical order. If a node is never generated, choose "not generated".

Depth First Search



A [Choose]

B [Choose]

C [Choose]

D [Choose]

E

[Choose]

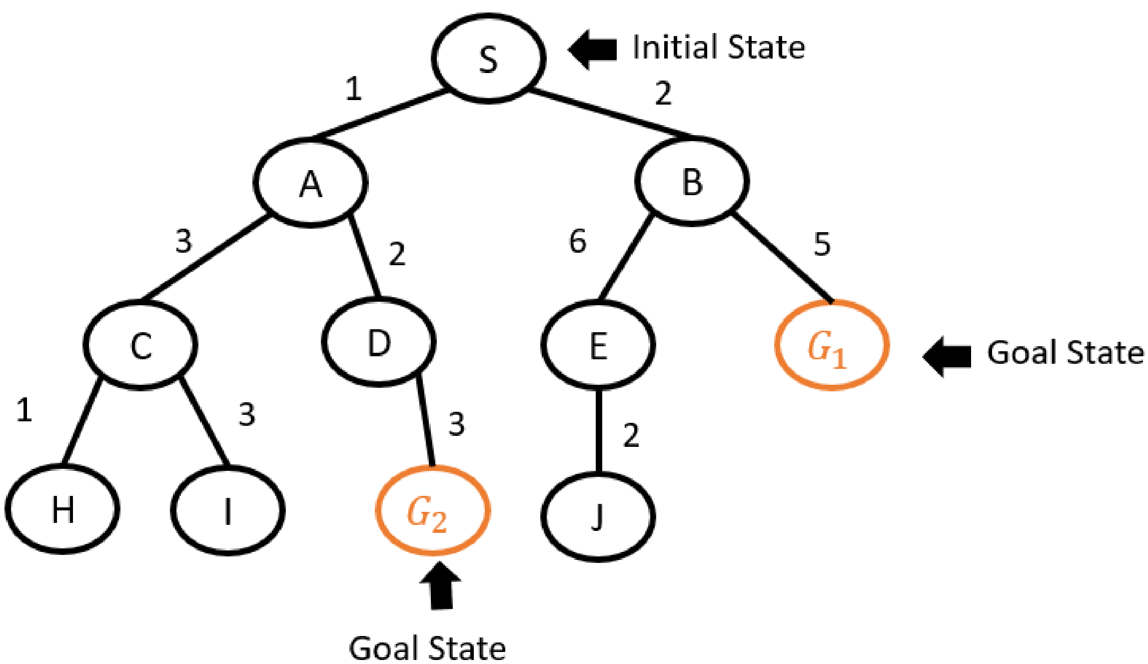
G1	[Choose]
H	[Choose]
I	[Choose]
G2	[Choose]
J	[Choose]

Question 3

10 pts

You are given a search tree with one node labeled as a start state and nodes labeled as a goal state. The goal test is performed at node expansion. Assuming S has been expanded, number the rest of the nodes in the tree according to the order in which they will be **expanded** (not the order in which they are generated). When there is a tie, follow the alphabetical order. If a node has never been expanded, choose "not expanded".

Uniform-cost Search



A

[Choose]

B	[Choose]
C	[Choose]
D	[Choose]
E	[Choose]
G1	[Choose]
H	[Choose]
I	[Choose]
G2	[Choose]
J	[Choose]

Question 4

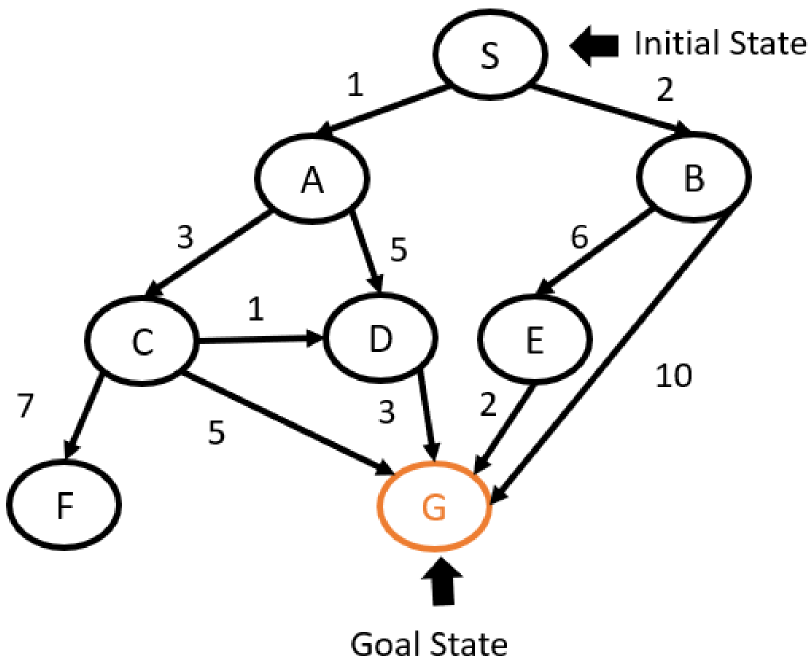
10 pts

The graph below shows the state space of a search problem. States are represented by nodes in the graph, and each edge represents an action. The cost of an action is indicated as a number on the edge. S is the initial state and G is the goal state. The goal test is applied when a node is selected for expansion. The table below the graph shows the values of an admissible heuristic function.

Choose **the first 5 expanded states** (not the order they are generated) by **A* Search** based on the heuristic function shown in the table. *One state may be expanded multiple times and thus be chosen multiple times.*

When there is a tie, follow the alphabetical order.

A* Search:



Heuristic:

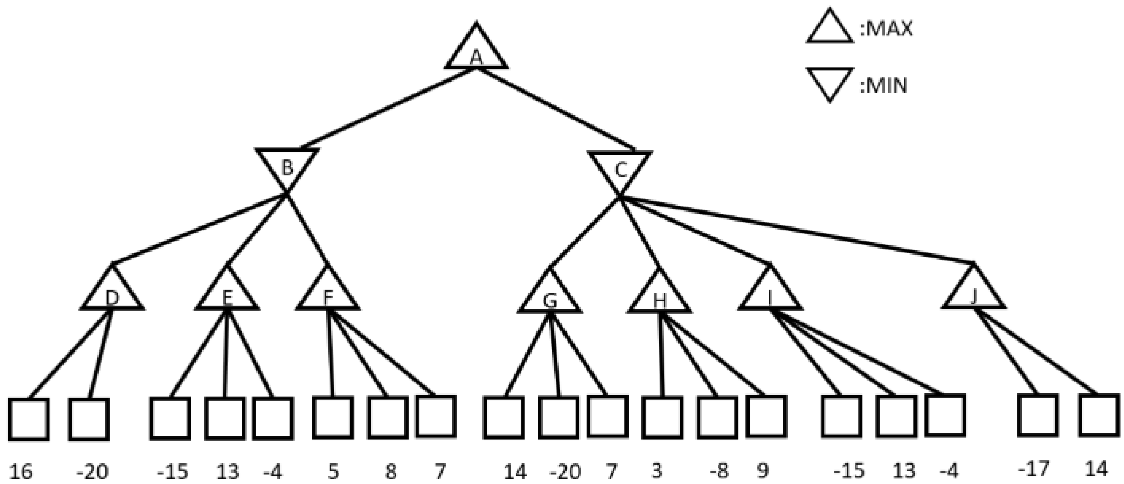
A	B	C	D	E	F	G
5	3	3	3	1	5	0

1st expanded state	[Choose]
2nd expanded state	[Choose]
3rd expanded state	[Choose]
4th expanded state	[Choose]
5th expanded state	[Choose]

Question 5

10 pts

Show the minimax value of each node in the following game tree as computed by the minimax algorithm. You should input integers such as the following: 1, 11, -10 and 0



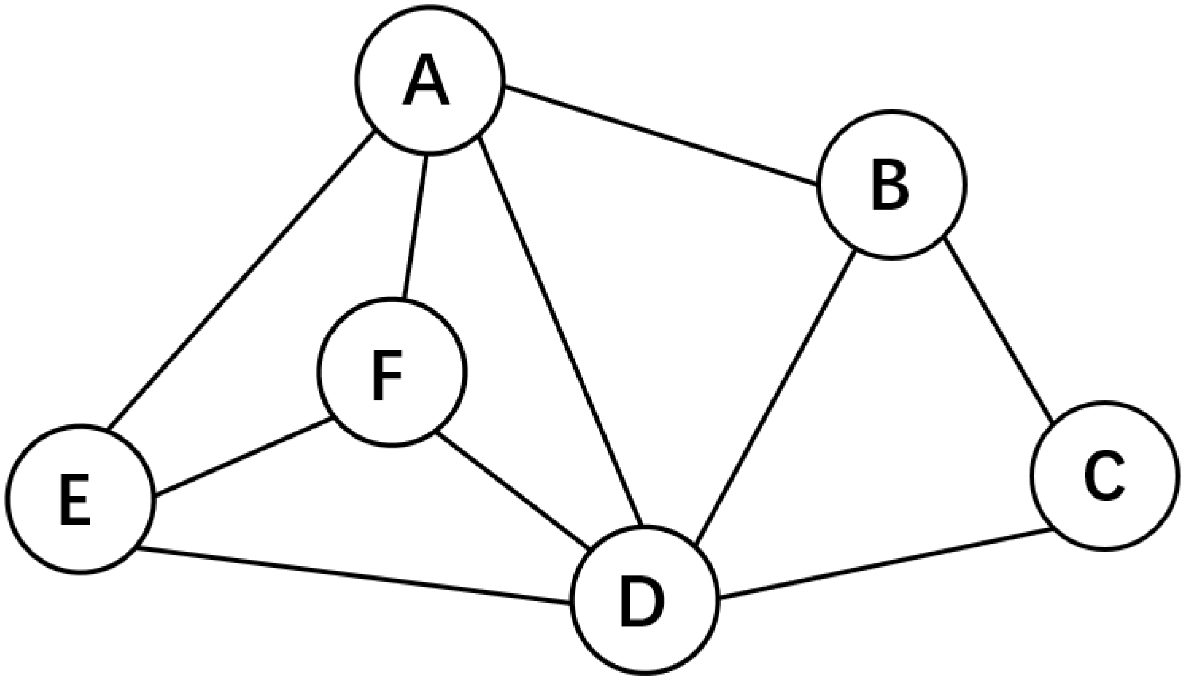
Minimax Value: A ______ , B ______ , C ______ , D ______ , E ______ , F ______ , G ______ , H ______ , I ______ , J ______

Question 6

2.5 pts

We consider the following Constraint Satisfaction Problem: We have 6 variables {A,B,C,D,E,F}. The domain of each variable is {1,2,3,4}. The constraints, as shown in the graph, require any connected variables must not have the same value.

This image illustrates the constraint graph.



Suppose we assigned A=1 and C=2 and performed forward checking. According to the Minimum Remaining Values strategy, which of the following variables will be first considered? Choose all that applies.

- [ ] E
- [ ] B
- [ ] F
- [ ] D

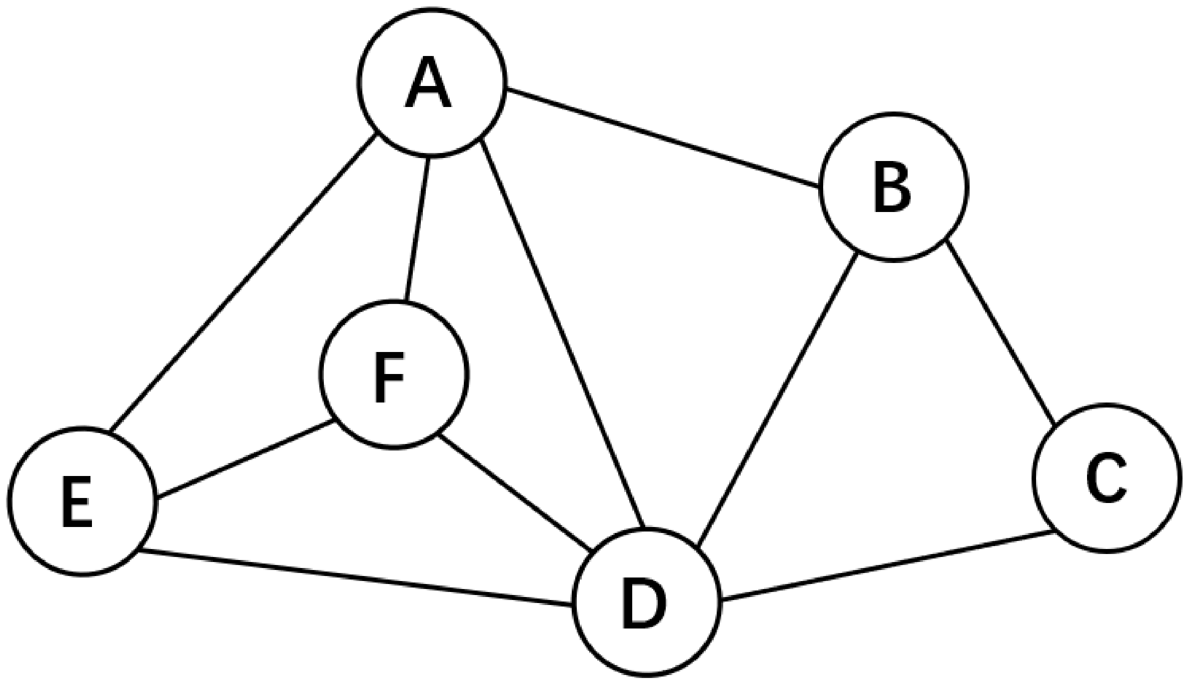
Question 7

2.5 pts

We consider the following Constraint Satisfaction Problem: We have 6 variables {A,B,C,D,E,F}. The domain of each variable is {1,2,3,4}. The constraints, as shown in the graph, require any connected variables must not have the same value.

This image illustrates the constraint graph.

Suppose we assigned A=1 and C=2 and performed forward checking. Suppose instead, we choose variables according to the Degree Heuristic (choose the variable with the most constraints on remaining variables). Which of the following variable we should choose? (choose all that applies)



- [ ] B
- [ ] D
- [ ] E
- [ ] F

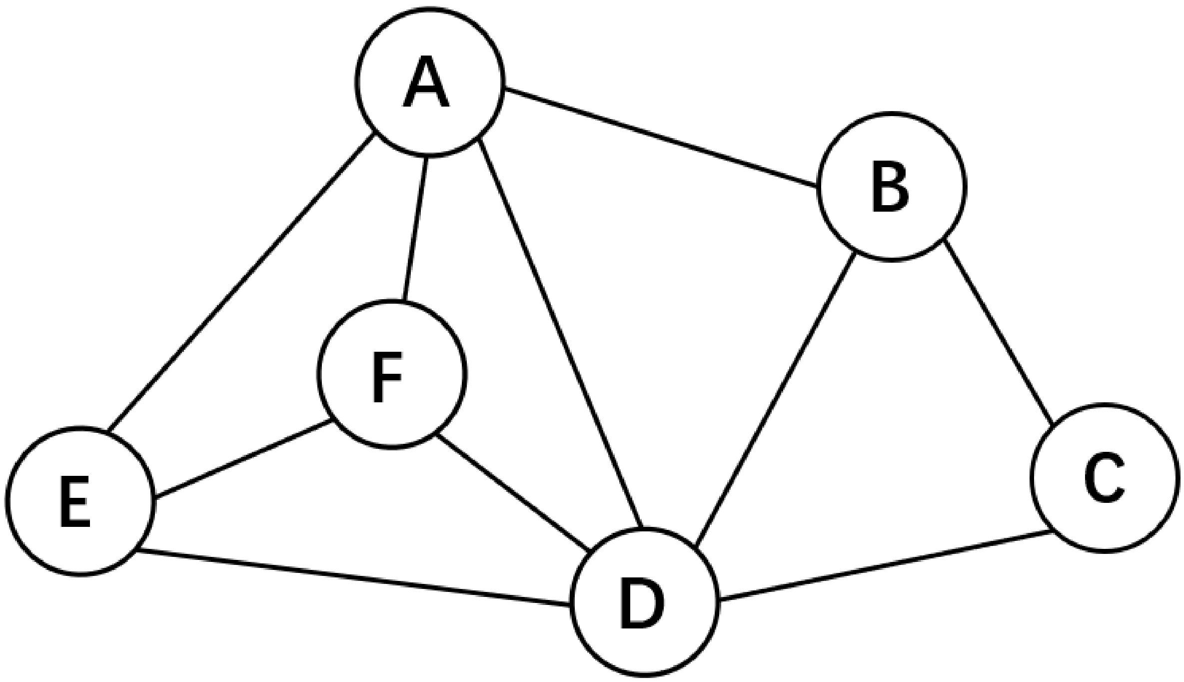
Question 8

2.5 pts

We consider the following Constraint Satisfaction Problem: We have 6 variables {A,B,C,D,E,F}. The domain of each variable is {1,2,3,4}. The constraints, as shown in the graph, require any connected variables must not have the same value.

This image illustrates the constraint graph.

Suppose we assigned A=1 and C=2 and performed forward checking. Suppose by some criterion, we decide to first explore the variable E. According to the Least Constraining Value strategy, which value to E should we choose first? (choose all that applies)



- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4

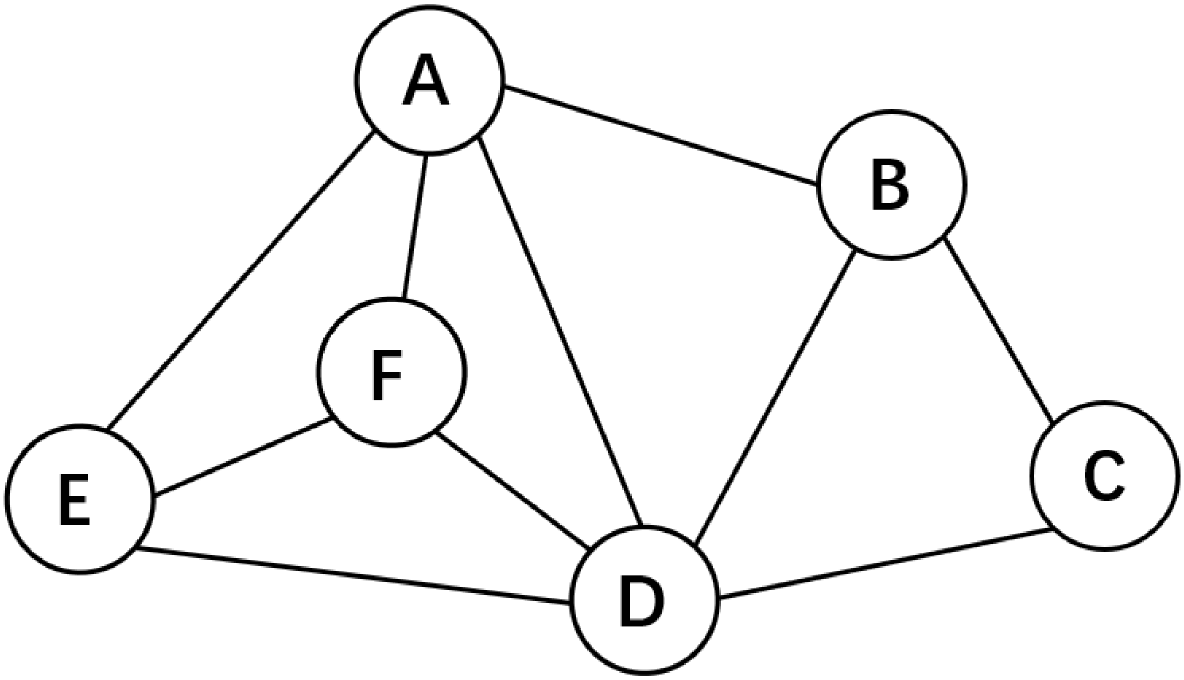
Question 9

2.5 pts

We consider the following Constraint Satisfaction Problem: We have 6 variables {A,B,C,D,E,F}. The domain of each variable is {1,2,3,4}. The constraints, as shown in the graph, require any connected variables must not have the same value.

This image illustrates the constraint graph.

Suppose we've already assigned A=1, C=2, B=3. Perform the AC-3 algorithm on the graph, what values are contained in the updated domain of variable D?



- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4

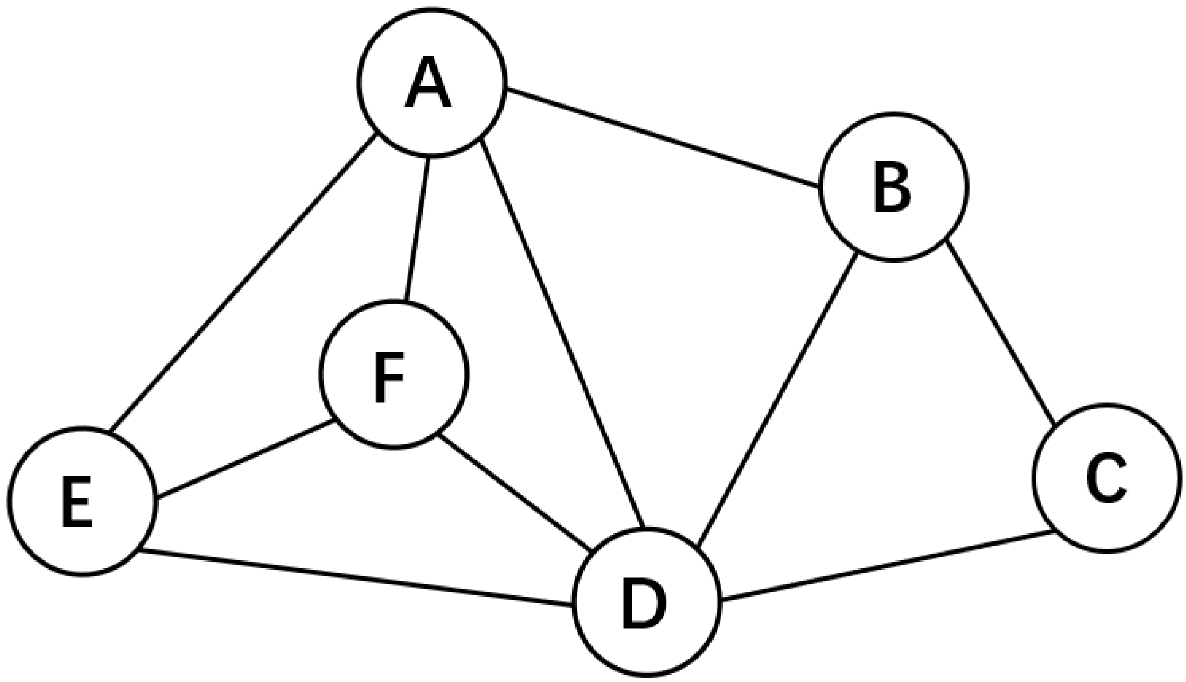
Question 10

2.5 pts

We consider the following Constraint Satisfaction Problem: We have 6 variables {A,B,C,D,E,F}. The domain of each variable is {1,2,3,4}. The constraints, as shown in the graph, require any connected variables must not have the same value.

This image illustrates the constraint graph.

Suppose we've already assigned A=1, C=2, B=3. Perform the AC-3 algorithm on the graph, what values are contained in the updated domain of variable F?



- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4

Question 11

2.5 pts

A search problem with a finite branching factor and a solution of finite depth must have a finite search tree.

- ○ True
- ○ False

Question 12

2.5 pts

In general, Depth First Search (DFS) is complete.

- ○ True

◯ False

Question 13

2.5 pts

In general, Uniform-Cost Search is optimal.

◯ True

◯ False

Question 14

2.5 pts

Suppose the branching factor b is finite, the shallowest solution is of depth d, and the maximum depth of the problem is m. The Iterative Deepening algorithm takes the space complexity of:

◯ O(b^d)

◯ O(b^m)

◯ O(bd)

◯ O(bm)

◯ O(d)

◯ O(m)

◯ O(1)

Question 15

2.5 pts

In Breadth-First Search (BFS), suppose we perform the goal test after **expanding** the node. In the worst case, how many nodes we will **generate**? Assume the branching factor b = 2, and the shallowest solution is of depth d. (A tree of depth 0 only contains the root node; a tree of depth 1 contains the root and its children. Initially, we only have the root node and generate 0 nodes.)

◯ 2^(d+1) - 2

◯ 2^(d+2) - 2

◯ 2(d+2) - 2

◯ 2(d+1) - 2

Question 16 — 2.5 pts

The key advantages of local search algorithms include:

- ☐ It usually takes less memory than global search
- ☐ It takes less time than global search
- ☐ It can find a solution in large infinite space
- ☐ It always finds global optimum

Question 17 — 2.5 pts

Which of the following is used to improve the performance of heuristic search?

- ○ Quality of nodes
- ○ Quality of heuristic function
- ○ Simple form of nodes
- ○ None of the mentioned

Question 18 — 2.5 pts

Suppose you were using a genetic algorithm and try to perform the crossover step on the following two individuals, represented as strings of integers: 1324421 and 2751421, which of the following could be the result of performing crossover?

- ☐ 1324421 and 2751421
- ☐ 1321421 and 2754421
- ☐ 1324421 and 2754421
- ☐ None

Question 19 — 2.5 pts

A local search algorithm that is complete and optimal means it will find a global minimum/maximum if one exists.

- ○ True

◯ False

Question 20

2.5 pts

Assume that we have a video game in which a player is trying to reach one of the goal points in a maze. The maze is basically a grid with walls at different locations and the player moves are limited to up, down, left, and right (no diagonal moves). The player wins as soon as it reaches a goal position no matter which goal is it

Assume that we know: the initial location of the player, wall locations, and goal positions.

Indicate whether the following heuristics are admissible. Just mark each with either “True” (admissible) or “False” (not admissible).

Euclidean distance between the player position and the closest goal (closest according to Euclidean distance).

◯ True

◯ False

Question 21

2.5 pts

Indicate whether the following heuristics are admissible. Just mark each with either “True” (admissible) or “False” (not admissible).

Manhattan distance between the player position and the closest goal (closest according to Manhattan distance).

◯ True

◯ False

Question 22

2.5 pts

Indicate whether the following heuristics are admissible. Just mark each with either “True” (admissible) or “False” (not admissible).

(Value of Euclidean distance between the player position and the closest goal) + (minimum number of walls in all rows) + (minimum number of walls in all columns).

◯ True

◯ False

Question 23 2.5 pts

Indicate whether the following heuristics are admissible. Just mark each with either “True” (admissible) or “False” (not admissible).

Average Manhattan distance between the player position and all goals.

- ○ True
- ○ False

Question 24 2.5 pts

Evaluating the expression (cons ’(A B) (rest (cons ’B ’(C)))) gives:

- ○ ’(A B (C))
- ○ ’((A B) C)
- ○ ’(A B C)
- ○ ’((A B) (B C))
- ○ None of the others

Question 25 2.5 pts

Consider the function:

```
(defun foo (L I)
  (cond ((null (rest L)) I)
    (t (+ 2 (foo (rest L) (+ 1 I))))))
```

The result of evaluating (foo ’(A B C) 2) is:

- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ None of the others

No new data to save. Last checked at 9:04pm

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