

Student's Name:

Student's ID:

Question 1. [4 Marks: CLO (a)] Select ONLY ONE ANSWER (the best answer).

Copy your answer for question 1-1 to 1-16 in the table on page2. ONLY THAT TABLE WILL BE GRADED.

1.	In which of the following situations might a blind search be acceptable?
A.	real-life situation
B.	complex game
<input checked="" type="radio"/> C.	small search space
D.	all of the mentioned above.

2.	Strong Artificial Intelligence is:
<input checked="" type="radio"/> A.	the manifestation of human intellectual capabilities within a computer
B.	a set of computer programs that produce output that would be considered to reflect intelligence if it were generated by humans
<input checked="" type="radio"/> C.	the study of mental faculties through the use of mental models implemented on a computer
D.	all of the mentioned above.

3.	Which search method takes less memory?
<input checked="" type="radio"/> A.	Depth-First Search
B.	Breadth-First search
C.	Uniform-cost search
D.	Bidirectional search

4.	A heuristic is a way of trying:
A.	To discover something or an idea embedded in a program
<input checked="" type="radio"/> B.	To search and measure how far a node in a search tree seems to be from a goal
C.	To compare two nodes in a search tree to see if one is better than the other is
<input checked="" type="radio"/> D.	All of the mentioned

5.	Which instruments are used for perceiving and acting upon the environment?
<input checked="" type="radio"/> A.	Sensors and Actuators
B.	Sensors
C.	Perceiver
D.	None of the mentioned

6.	A robot's "arm" is also known as its:
A.	end effector
<input checked="" type="radio"/> B.	actuator
C.	manipulator
D.	servomechanism

7.	Which search is implemented with an empty first-in-first-out queue?
A.	Depth-first search
<input checked="" type="radio"/> B.	Breadth-first search
C.	Bidirectional search
D.	None of the mentioned

8.	Which search implements stack operation for searching the states?
<input checked="" type="radio"/> A.	Depth-first search
B.	Breadth-first search
C.	Bidirectional search
D.	None of the mentioned

Please copy your answer for question 1-1 to 1-8 in the following table:

1.	2.	3.	4.	5.	6.	7.	8.
C	A	A	D	A	B	B	A

✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

Q2:

1- State Space: A way of representing in a computer the states of the real problem.

2- Actions or State Space Transitions: Formulate actions that allow one to move between different states.

3- Initial or Start State and Goal: Identify the initial state that best represents the starting conditions and the goal or condition one wants to achieve.

4- Heuristics: Formulate various heuristics to help guide the search process.

Question 3. (4 Marks)

Answer by "T" for true statements and by "F" for false statements.

Decription	Answer
Informed search strategies use problem specific knowledge beyond the definition of the problem itself.	T ✓
Evaluation function generally consists of two parts: - The path cost from the initial state to a node n , $g(n)$ (optional) - The estimated cost of the cheapest path from a node n to a goal node, the heuristic function, $h(n)$. If the node n is a goal state $\rightarrow h(n)=0$;	F ✗
uninformed search: select nodes for expansion on basis of distance from start and uses only information contained in the graph.	F ✗
Informed search: select nodes on basis of some estimate of distance to goal. It requires additional information — evaluation function, or heuristic rules to choose the "best" (most promising) alternative \Rightarrow best-first search.	T ✓
Greedy search means at each search step the algorithm always tries to get close to the goal as it can	T ✓
A^* is a special case of uniform-cost search.	F ✓
A heuristic function h is optimistic or admissible if $h(n) \leq h^*(n)$ for all nodes n . (h never overestimates the cost of reaching the goal.)	T ✓
In an Informed Search a node is selected for expansion based on an evaluation function that estimates cost to goal.	T ✓

3

Student's Name: Student's ID:

Question 4. (8 Marks)

In BFS and DFS, when we are at a node, we can consider any of the adjacent as next node. So both BFS and DFS blindly explore paths without considering any cost function. The idea of **Best First Search** is to use an **evaluation function** to decide which adjacent is most promising and then explore. Best First Search falls under the category of **Heuristic Search** or **Informed Search**.

We use a priority queue to store costs of nodes. So the implementation is a variation of BFS, we just need to change Queue to PriorityQueue.

The pseudocode of the BFS is as follows:

Best-First-Search(Grah g, Node start)

1) Create an empty PriorityQueue

PriorityQueue pq;

2) Insert "start" in pq.

pq.insert(start)

3) Until PriorityQueue is empty

u = PriorityQueue.DeleteMin

If u is the goal

Exit

Else

Foreach neighbor v of u

If v "Unvisited"

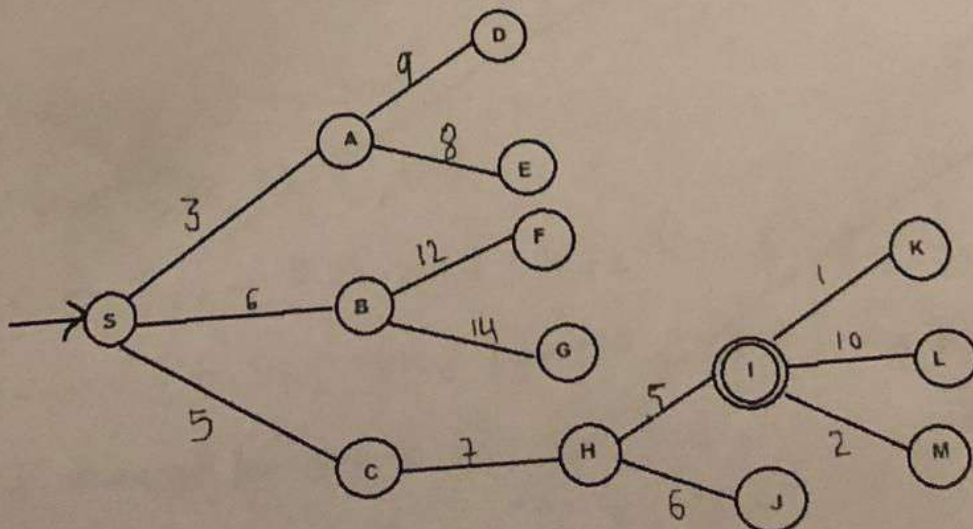
Mark v "Visited"

pq.insert(v)

Mark v "Examined"

End procedure

Considering the following graph, trace the above Best-First-Search algorithm:



Student's Name:

Student's ID:

Answer: Complete the tracing as it starts below:

We start from source "S" and search for goal "I" using given costs and Best First search.

- 1 - pq initially contains S
We remove s from and process unvisited neighbors of S to pq.
pq now contains {A, C, B} (C is put before B because C has lesser cost)
- 2 - we remove A from ~~app~~ and check if it's the goal (because it has the least cost) and process unvisited neighbors of A to pq
pq now contains {C, B, E, D}
(E, D were put last because they have higher cost).
- 3 - we remove C from pq and check if it's the goal (because it has the least cost) and process unvisited ~~neats~~ neighbors of C to pq
pq now contains {B, H, E, D}
- 4 - we remove B from pq and check if it's the goal if not (because it has the least cost) and process unvisited neighbors of B to pq
pq now contains {H, E, D, F, G}

Student's Name:.....

Student's ID:.....

5- we remove H from PQ (because it has the least cost), AND check if it's the goal state if not (it's not) then process unvisited ~~neighbors~~ neighbors to PQ
PQ now contains [I, J, E, D, F, G] ^{DSH}

6- we remove I from PQ (because it has the least cost) AND we check if it's the Goal and it is!
since we found I we exit the Program.

Path = ~~S~~ → A → C → B → H → I

8

Student's Name:

Student's ID:

Question 1. [8 Marks: CLO (a)]

Select ONLY ONE ANSWER (the best answer).

Copy your answer for question 1-1 to 1-16 in the table on page1. ONLY THAT TABLE WILL BE GRADED.

Student

Student

Student

Instruct

Tick the Relevant

X

X

X

X

1. Strong Artificial Intelligence is:
- A. the materialization of human intellectual capabilities within a computer
 - B. a set of computer programs that produce output that would be considered to reflect intelligence if it were generated by humans
 - C. the study of mental faculties through the use of mental models implemented on a computer
 - D. all of the above mentioned

2. What is Artificial intelligence?
- A. Putting your intelligence into Computer
 - B. Programming with your own intelligence
 - C. Making a Machine intelligent
 - D. Playing a Game

3. Which search method takes less memory?
- A. Depth-First Search
 - B. Breadth-First search
 - C. Uniform-cost search
 - D. Bidirectional search

4. A heuristic is a way of trying:
- A. To discover something or an idea embedded in a program
 - B. To search and measure how far a node in a search tree seems to be from a goal
 - C. To compare two nodes in a search tree to see if one is better than the other is
 - D. All of the mentioned

5. Which instruments are used for perceiving and acting upon the environment?
- A. Sensors and Actuators
 - B. Sensors
 - C. Perceiver
 - D. None of the mentioned

6. Used to perceive the environment
- A. Used to perceive the environment
 - B. Complete history of actuator
 - C. Complete history of perceived things
 - D. None of the above mentioned

7. How many types of agents are there in artificial intelligence
- A. 1
 - B. 2
 - C. 3
 - D. 4

8. What is the rule of simple reflex agent?
- A. Simple-action rule
 - B. Condition-action rule
 - C. Simple & Condition-action rule
 - D. None of the mentioned

Please copy your answer for question 1-1 to 1-8 in the following table:

1.	2.	3.	4.	5.	6.	7.	8.
D	C	A	D	B		D	B

Student's Name: Student's ID:

Question 2. (7 Marks)

2.1 Give the names of the different type of agents in artificial intelligence? (2 Mark)

1	Simple Reflex agent ✓
2	agent that keeps track of states ✓
3	Goal based agent ✓
4	Utility based agent ✓

2.2 An agent perceives environment through sensors and acts on the environment through effectors. Give some example of the following: (3 Marks)

Percepts	Sounds, colors ✓	
Sensors	Human	ears, eyes .. ✓
	Robot	camera, microphone, IR ✓
Effectors	Human	hands, legs ✓
	Robot	Speakers, robot arms and legs ✓
Actions	Speak, Movement, ✓	

2.3 An agent can be completely specified by an agent function mapping percept sequences to actions, and an agent program implements an agent function: takes a single percept as input, keeps internal state, returns an action. Give the pseudocode of the function Skeleton-Agent: (2 Marks).

skeleton agent (Percept p)

accept Percept (Percept p)

Combine data in internal memory (action a)

take an action (internal memory m)

Question 3, (5 Marks)

3.1 Give the names of the different available types in uninformed search method in artificial intelligence? (2 Mark)

Breadth first Search	✓
Depth first Search	✓
Uniformed cost Search	✓
Iterative deeping	✓
Bidirectional Search	✓

3.2 Which search is implemented with an empty first-in-first-out queue and why? (1 Mark)

BFS, because it traverse by levels

3.3 Which uninformed search method represents the following code? (2 Marks)

Your answer:

BFS

```
import java.io.*;
import java.util.*;
```

```
class Graph
```

```
{
    private int V; // No. of vertices
    private LinkedList<Integer> adj[]; //Adjacency Lists
```

```
// Constructor
    Graph(int v)
```

Student's Name: Student's ID:

Question 1. [4 Marks: CLO (a)] Select ONLY ONE ANSWER (the best answer).

Copy your answer for question 1-1 to 1-16 in the table on page2. ONLY THAT TABLE WILL BE GRADED.

1.	How many successors are generated in backtracking search?
<input checked="" type="radio"/> A.	1
B.	2
C.	3
D.	4

2.	Which algorithm is used to solve any kind of problem?
A.	Breath-first algorithm
B.	Tree algorithm
C.	Bidirectional search algorithm
<input checked="" type="radio"/> D.	None of the mentioned

3.	Which of the Following problems can be modeled as CSP?
A.	8-Puzzle problem
B.	Queen problem
C.	Map coloring problem
<input checked="" type="radio"/> D.	All of the above mentioned

4.	The BACKTRACKING-SEARCH algorithm has a very simple policy for what to do when a branch of the search fails: back up to the preceding variable and try a different value for it. This is called chronological-backtracking. It is also possible to go all the way to set of variable that caused failure. State whether True or False.
<input checked="" type="radio"/> A.	Always True
B.	Always False
C.	Not always True
D.	Not always False

5.	Consider a problem of preparing a schedule for a class of student. This problem is a type of:
A.	Search Problem
B.	Backtrack Problem
<input checked="" type="radio"/> C.	CSP
D.	Planning Problem

6.	Flexible CSPs relax on _____
<input checked="" type="radio"/> A.	Constraints
B.	Current State
C.	Initial State
D.	Goal State

7.	A solution to a CSP is an assignment of a value to all of the variables such that every constraint is satisfied.
<input checked="" type="radio"/> A.	Always True
B.	Always False
C.	Not always True
D.	Not always False

8.	A CSP is unsatisfiable if an assignment of a value to all of the variables such that every constraint is satisfied <u>does not exist.</u>
<input checked="" type="radio"/> A.	Always True
B.	Always False
C.	Not always True
D.	Not always False

Please copy your answer for question 1-1 to 1-8 in the following table:

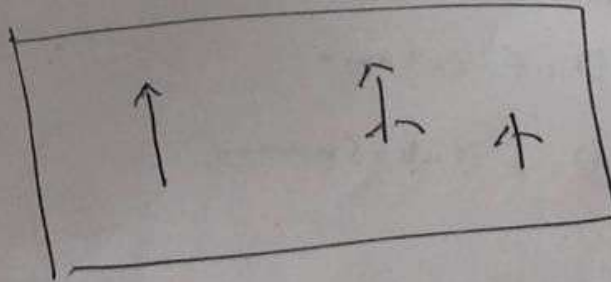
1.	2.	3.	4.	5.	6.	7.	8.
A	D	D	A	C	A	A	A

A constraint satisfaction problem (CSP) consists of:

1	a set of variables $\{x_1, x_2, \dots, x_i\}$;
2	a finite set of domain D
3	a set of constraints C
4	CSP is to assign values to variables so that all constraints are satisfied.

2.1 Describe the elements in the definition

1	<p>Variables represent:</p> <p>a variable is an empty space eg, (A node, an element in a array) that can have many different values</p> <p>(1 mark)</p>
2	<p>The domain of a variable is:</p> <p>a (finite) number of different values is the set of possible values for each variable</p> <p>(1 marks)</p>
3	<p>Constraint is a condition that returns true if satisfied or returns false if not satisfied</p> <p>(2 marks)</p>



A variable is an entity of the problem

3.1 Give the variables, Domains and Constraints of the SUDOKU problem.

Variables:

each cell in the Problem
is a variable

in the case of SUDOKU is 81 variables

Domains:

the Domain of the variables are all
the same: $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

Constraints:

- 1) ALL Diff constraint on ROW
- 2) ALL Diff constraint on column
- 3) ALL Diff constraint on sub-square

ALL Diff means that every value
on the scope has to be different
than the others

6

at's Name:.....

Student's ID:.....

Exercise 4. (6 marks).

4.1 Describe the CSP as a traditional search problem: (2 Marks)

- 1- Initial state: empty assignments
- 2- Successor function: Assigning a ~~value~~ ^{value} to all unassigned variables which doesn't make the constraint return false
- 3- goal test: All assignment complete

4.2 Write the Algorithm of the Backtracking Search: (4 Marks)

```

BS (level) {
    if all variables are assigned
        Print value of each variable
        return or exit

    Assign
    v = Pick unassigned variable ()
    Assigned[v] = true

    for d = each member of Dom[x] {
        value[v] = d
        track = true

        for each constraint C over v such that {
            a) if we found a value that Doesn't satisfy
                any constraint C
                then
                    track = false
                    break
        }
        if (track)
            BS (level + 1)
    }
    Assigned[v] = false
    return;
}
    
```

END OF THE EXAM