HITEC University Taxila

Admit Card of Mid Term Semester Examinations - Fall Semester 2025

Bachelors of Cyber Security (Entry Fall - 2024)

Name: ALI ABBAS QAZI Registration #: 24-CyS-050

Course Title: CS-213. : Artificial Intelligence : 2-0-2

Note: 1. Attach this slip with Answer Book 2. Mobile phones are NOT allowed inside Exam Hall

3		6	

Invigilator's Signature

HITEC UNIVERSITY TAXILA

In Truth | Triumph

Invigilator's Signature

IMPORTANT

This Answer Book should not be used for any purpose other than writing the anser to question in the Examination Hall. Illegal use of answer book or any part of it will lead to action as per rules.

Reg No: 24-CyS-050 Name: Ali Abbas Qazi

Program: BS Cyber Security Semester: 3rd

Subject : Artificial intelligence Section: A Date: 2-12-25

INSTRUCTIONS FOR CANDIDATE

1. Before writing answers, please FILL correctly all the particulars mentioned above.
2. This answer book has 1- 6 leaves.
3. Paper to be solved with blue ball point / ink pen.
4. Answer only the require number of questions, Attempting more number of questions(s) will result in discarding the best answer.
5. Write on both sides and on each line of the leaf and cross unused portion.
6. No Answer Book or paper of any kind is to be taken in or removed from the Examination Hall/Room except the Question Paper
7. No leaf from Answer Book will be torn out.
8. This Answer Book must be handed over to the Superintendent/Invigilator, even if no question has been answered.
9. Candidates are not permitted to leave the Examination Hall/Room until the expiry of one third of the allowed time after the distribution of Question paper.
10. Candidates guilty of making appeals to the Examiner in Answer Book will entail the penalty of cancellation of the Answer Book through which such appeal is made.
11. Candidates found using unfair means shall be liable to disciplinary action.
12. Cellular/Mobile Phones, Smart Watches and Programable Calculators are not allowed inside the Examination Hall/Rooms.

Q No	1	2	3	4	5	6	7	Total Marks
Marks Obtained	10	9	9	18				46/50
Q No	8	9	10	11	12	13	14	
Marks Obtained								

Marks Obtained in Words:_____ Signature of the Examiner:_____

Examiner Name:_____ Examiner Name:_____

PLEASE START WRITING ANSWER ON REVERSE OF THIS SHEET

Question 1

10

a) Fintelligence & Artificial intelligence.

⇒ Intelligence:

Intelligence is the ability to think, solve problems and evaluate things. This involves reasoning and solving problems to get the optimal answer.

eg:- Solving puzzles (ie Jigsaw)

⇒ Artificial Intelligence:

Artificial Intelligence is the Ability for a machine to think for itself, use reasoning, problem solving, evaluation, deduction. Similar to a human.

eg:- Google Maps

b) Evolutionary AI & Artificial super Intelligence.

⇒ Artificial Super Intelligence (ASI):

ASI is a hypothetical model of an AI that surpasses humans in terms of knowledge and emotional understanding. This model does not exist yet.

⇒ Evolutionary AI:

Evolutionary AI is a type of AI models that evolves overtime by learning new patterns, information, data as it is fed more data overtime.

eg:- ChatGPT, Gemini image creation.

---

c) Simple reflex agent and goal-based Agent.

⇒ Simple reflex Agent:

This agent does not have a percept, it does not have a memory and is condition-Action based. It only performs Actions based on current inputs/values.

eg:- Room cleaner, only cleans when room is dirty. (binary input).

⇒ Goal based Agent:

A Goal-based Agent works when it has a goal to achieve, it thinks in the future (makes future decisions) to ensure that the desired goal is achieved by making a series of choices (A sequence).

eg:- Paint mixer, when given multiple colors to mix into a specified colour, it will pre-plan what colours need to be mixed to achieve desired colour.

---

d) Stack and queue.

⇒ Stack:

Stack is a linear data structure that works on a LIFO (last in, first out) order, last element added is the first element to be removed.

functions:
- Push() : Adds
- Pop() : removes.

eg:- A stack of plates.

⇒ Queue:

Queue is a linear data structure based on the FIFO (first in ~~first~~, first out), first element added is the element that will be removed first.

Functions: • Enqueue(): Adds
• ~~Re~~ Dequeue(): Removes.

Good

eg:- A line At the bank/Atm/restaurant.

---

e) Optimal & near-optimal.

⇒ Optimal:

An Optimal solution is the best possible solution that can be made from a set of possible solutions, that is the shortest & most efficient.

eg:- A* Search gives an optimal solution. (shortest and cost efficient).

⇒ Near Optimal:

A Near-optimal solution is a good solution from a set of possible solutions but it is not the best, longer and less efficient.

good

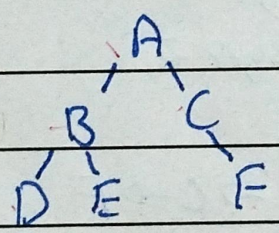
Question 2

1) Breadth first Search, advantages and disadvantages.

:) Breadth first Search (BFS):

BFS is a type of searching Algorithm that uses the Queue (FIFO) structure, it searches ~~through~~ through the graph layer by layer (level by level) until the goal node is found. with a time complexity of $O(b^d)$

eg:-



Layer 0
Layer 1
Layer 2

Result:- A → B → C → D → E → F

Advantage: easy to perform and understand

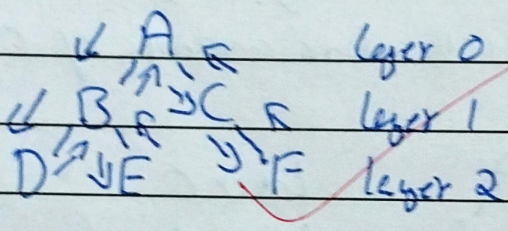
disadvantage: ~~Highly~~ inefficient and High memory usage as it goes through every node and stores it in the memory.

b) Depth first Search, what is backtracking.

⇒ Depth first Search (DFS):

DFS uses the stack structure (LIFO), It travels down a Branch until it reaches the final node within that branch, then Backtracks and moves to the neighboring Branch. Can get stuck in an Infinite loop ⇒ $O(b^d)$

Ex



Result: A → B → D → E → C → F

Backtracking:

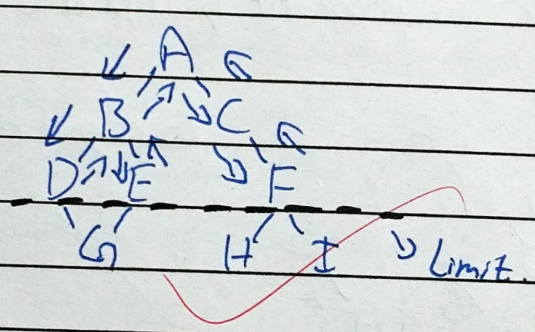
Once traversal reaches the last node in a Branch, it moves backwards (Backtracks) to the node that has a new Branch connected to it, and moves through that. Continues until all branches are explored.

) Depth Limited search, why we use it.

> Depth - Limited Search (DLS):

It is exactly the same as Depth first search, with the only difference being that it only moves to a certain layer (level) before backtracking. as it gets limited to a specific point (layer). $O(b^L)$

es:-



Result: A → B → D → E → C → F

Why we use it:

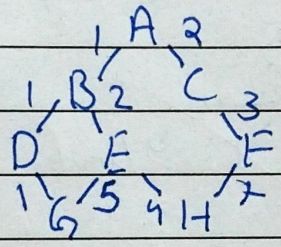
we use DLS to avoid the infinite loop Problem in DFS. allows the program to always end at one point.

d) Uniform cost search, Difference b/w UCS & BFS.

=> Uniform cost Search:

UCS is very similar to BFS as it moves layer by layer until it finds a goal node. but it only works/uses a weighted graph using the concept of priority queue. finds the path with the least cost to reach the goal node. Its a variant of dijkstra's Algorithm.

eg:-



G is goal node

Result:- A → B → D → G (shortest path)

Difference b/w UCS & BFS:

UCS and BFS are different as UCS uses a weighted graph and priority queue, where as BFS blindly searches until it finds the goal node.

Question 4

a) Heuristic Based:

18

) What is a Heuristic function, compare with uninformed search.

=) Heuristic function:

h(n)

A Heuristic function allows you to find the ~~sort~~ shortest and most optimized path from start node to root node by giving values/costs to each node.

=) How it guides:

Heuristic function allows the use of costs to ensure that the shortest, efficient and ~~optimal~~ optimized path is chosen, saving time and memory.

Uninformed search is a blind search where all nodes are explored to find the goal node.

ii) Characteristics:

⇒ Admissibility:

Estimated cost is always ≤ True cost.

⇒ Efficiency:

Allows us to choose the shortest path which reduces time taken, memory used, and finds shortest distance.

iii) Real-world Examples:

⇒ GPS routing (Google Maps):

GPS routing like Google maps uses Heuristics like the A* Algorithm to ensure that the route that takes the least time is chosen.

⇒ Playing games (like chess):

Uses Heuristics to ensure that the shortest and efficient moves are made and an optimal Path is chosen to solve a Problem.

ator's Signature _____ S - 173509

HITEC UNIVERSITY TAXILA

Reg No: 24-CyS-050 Name: Ali Abbas Qazi

Program: BS Cyber Security Subject: AI. Date: 2-12-25.

(b) Apply A* Algorithm

Formula Used: $f(n) = g(n) + h(n)$ where $f(n)$ = cumulative cost

$g(n)$ = step cost

$h(n)$ = heuristic cost.

Route 1: A → B → E → G

$\underbrace{\text{Cost}}_{f(n)} = \underbrace{2+3+4}_{g(n)} + \underbrace{0}_{h(n)} = 9$

Route 2: A → B → D → G

Cost = 2+5+6 +0 = 13

Route 3: A → C → D → G

Cost = 4+2+6 +0 = 12

Route 4: A → C → F → G

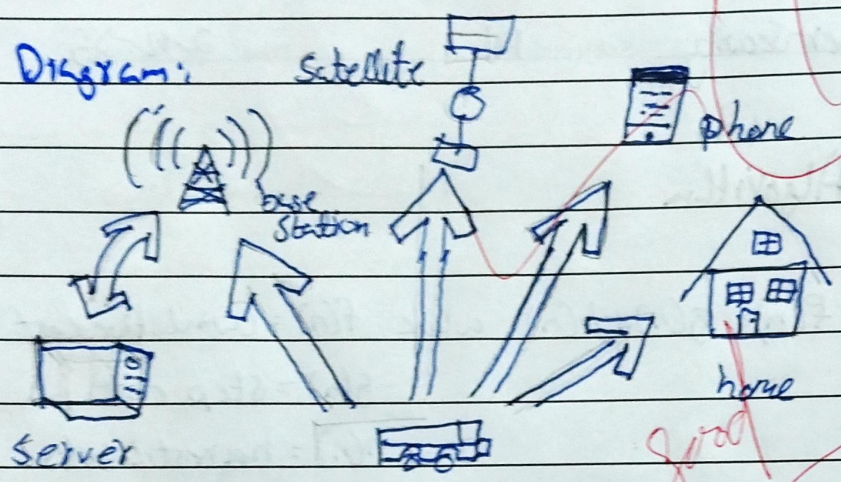
Cost = 4+4+3 +0 = 11

⇒ Shortest/optimal path: Route 1 ⇒ cost = 9

Reason: Route has the most optimal path as it has the lowest cumulative cost value = 9.

Question 3

=> Diagram:



Smart Bus Management System

=> PEAS Framework:

i) Performance measure:

- Safety: Ensure that the driver is not speeding or sudden braking.
- Maintainance: Ensure that the bus is not overcrowded.
- Management: Ensure that the bus schedules are adjusted dynamically according to traffic.

Invigilator's Signature _____ S - 149013

HITEC UNIVERSITY TAXILA

Reg No: 24-CyS-060 Name: Ali Abbas Qazi

Program: BS Cyber Security Subject: AI Date: 2-12-25

ii) Environment:

- buses are maintained.
- even roads are taken by the driver (avoid uneven roads).
- Buses dont go off track.
- avoid traffic / time delays.
- Bus stop are neat and clean.

iii) Actuators:

- Notify drivers about speed limits if crossed or sudden braking.
- Notify drivers about fuel level
- alert drivers if bus is malfunctioning.
- Alert drivers of no. of passengers at next stop.

iv) Sensors:

- Detect passenger flow at different stops using live feeds.
- provide real-time updates to passengers at bus stops.
- Accelerometer to detect speed.

- Thermostat to measure temperatures within the bus so ensure appropriate cooling or heating.
- GPS for navigation.