



Saifullah SP21-BSE-104

14.75

COMSATS University, Islamabad
Department of Computer Sciences
Mid Term Examination Fall-2023

Subject: CSC-462 Artificial Intelligence
Semester: BCS-V (A&B), DS-5 E
Instructor: Syed M Muslim, Waqas Ali, Umar Nauman

Dated: 11-23
Marks: 25
Time (mins): 90

Instructions: Solve all questions on Question Paper only. Use of pencil, cutting, over-writing, use of fluid in Question 01(c), 01(d), and Question 02(a, b, c) will result in zero credit. Nothing will be graded out side the provided space. Be precise and to the point in all questions.

CLO 1:

Articulate how artificial intelligence enables the capabilities of a computer, machine, or system to mimic human Brain

Question 01: (10 marks)

- a) Can Virtual Personal Assistants like Apple's Siri and Google Assistant be considered as examples of **strong AI**? Please comment with brief explanation (1 + 2 = 03 marks)

Yes, virtual personal assistants like Apple's Siri etc are considered as examples of strong AI because they provide the best possible solution to a problem using best AI algorithms, that are efficient in case of time and space complexity.

Also they consider the current knowledge as well as past history to generate a optimal solution to a problem and also learn from past experiences to enhance their result which is quality of strong AI.

- b) Imagine a city with a mix of autonomous and human-driven vehicles. A pedestrian suddenly jaywalks in front of an autonomous car. How can strong AI address this situation better than weak AI? What are the potential risks associated with each? (01 marks)

In case of strong AI if pedestrian came in front of strong AI autonomous car then car will apply brake because in this case sensor can sense the object with less time taking ability. In this risk will be handled already by strong AI autonomous car. while in weak AI this case (risk) cannot may not be handled by software of car. Risk in strong AI would be back car can hit autonomous car if suddenly apply brake while pedestrian can die if weak AI.

- c) Clearly Identify the PEAS in scenario. A smart home security system is being developed to monitor and secure a residence. It should detect intruders, control access, and provide alerts to homeowners. (1 + 1 + 1 + 1 = 04 marks)

	Performance	Environment	Actuators	Sensors
Smart Home Security System	detect intruders	Home	notification message or mobile phone etc	Camera

- d) Consider the example of "image analysis" select the right option for each of the environment types amongst the following. Encircle the correct option. (0.5 x 4 = 02 marks)

Agent	Observable	Deterministic	Discrete
i. Single	i. Fully	i. Deterministic	i. Continuous
ii. Multi	ii. Partially	ii. Stochastic	ii. Discrete

CLO 2:

Apply various AI problem solving and searching techniques to a real-world problem.

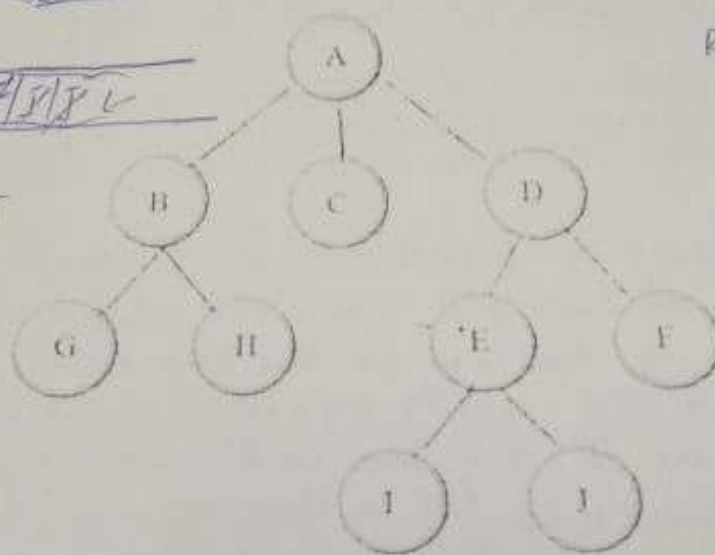
Question 02: (10 marks)

- a) Perform DFS and BFS on the given tree and give output and answer which of these techniques is better and why? (1 + 1 + 1 = 03 marks)

BFS

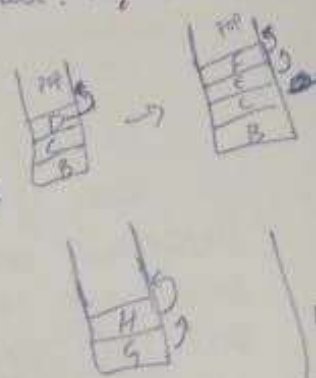
Result = A B C D G H E F I J L

Result = A B C D G H E F I J



DFS

Result: A D F E J I C B



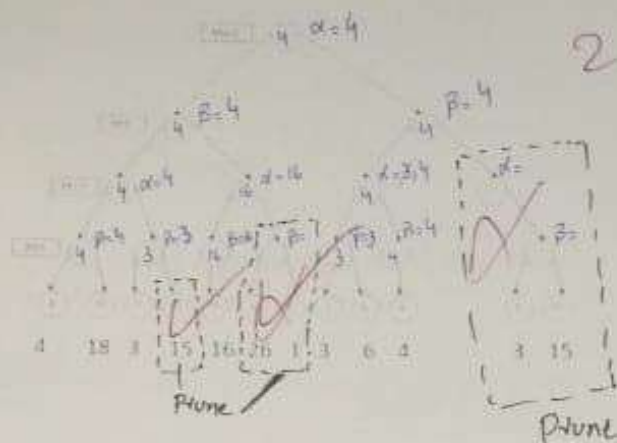
BFS would be better because it is:

Output BFS: ADFEJICBHJ

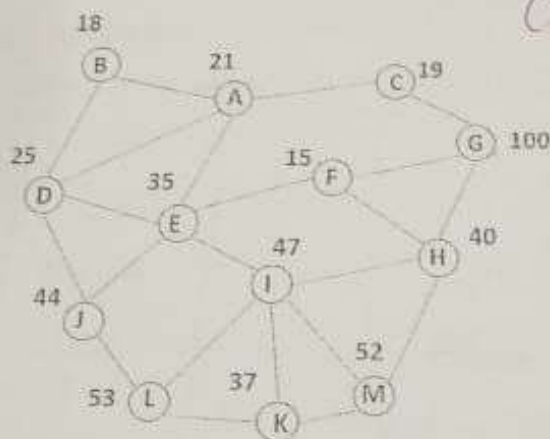
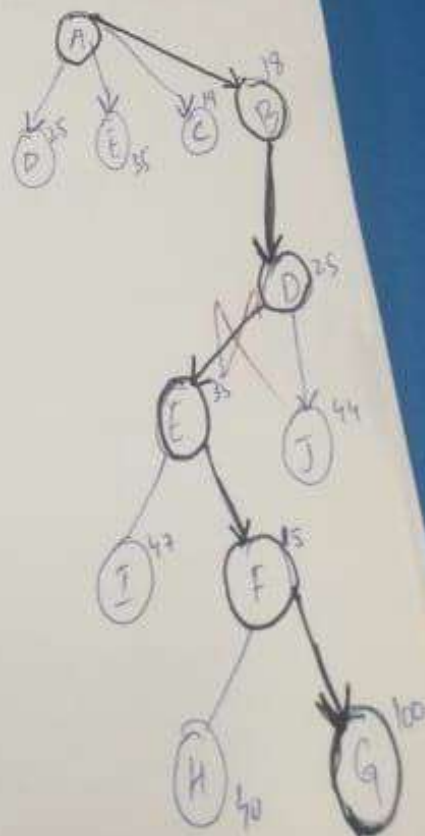
Output BFS: ABCDGHEFII

- complete (always give result).
- give optimal solution (best possible solution out of all).
- $O(b^d)$ time and space complexity.
- covers whole state space.

b) Consider a game tree scenario in which children nodes are visited from left to right. Apply the Alpha-Beta pruning technique to this game tree mentioned below. In the solution, you have to draw the tree by applying Alpha-Beta pruning algorithm and write down the proper values of all the empty nodes, also mention the values of Alpha and Beta with their nodes and highlight the pruned branches by red arrows. (1 + 2 = 03 marks)



c) Apply hill climbing to the following tree. Node 'A' is your initial node and your goal is to reach global maximum, which in this case is node 'G'. The values of cost/heuristic function are also mentioned. Show the final path and any intermediate state that is necessary. (3 + 1 = 04 marks)



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Final Path = A-B-D-E-~~F~~-G

Intermediate State = ~~A~~ mentioned with blue arrow

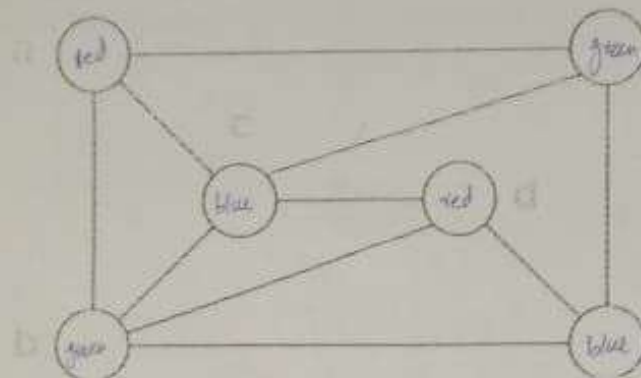


— CLO 3: —

Formulate a problem specified in natural language as a constraint satisfaction problem. —

Question 03: (5 marks)

- a) Solve the following graph coloring problem using CSP listing all the variables, domains, constraints and final values (02 marks)



$V = \{a, b, c, d, e, f\}$
 $D = \{Red, Green, Blue\}$
 $C = \{(scope), red\}$

1.5

- b) Solve the following cryptarithmic problem, mention all variables, domains, and constraints. (03 marks)

$$AB * CD = DACB$$

Variables

$V = \{A, B, C, D\}$

Domain

$D = \{*, \times\}$

0.78

constraints

$C = \{(scope), red\}$

$C = \{AB, CD, AB * CD, DA, CB, DACB, DA * CB\}$

$C = \{(AB, A * B), (CD, C * D), (DACB, DA * CB), (AB * CD - DACB)\}$

	A	B	C	D
Initial node	ABCD	ABCD	ABCD	ABCD
C1	AB		CB	DA
C2	AB * CD		CB, CD	DA * CD
C3	AB * CD - DACB			

----- **CLO 1:**
Articulate how artificial intelligence enables the capabilities of a computer, machine, or system to mimic human Brain -----

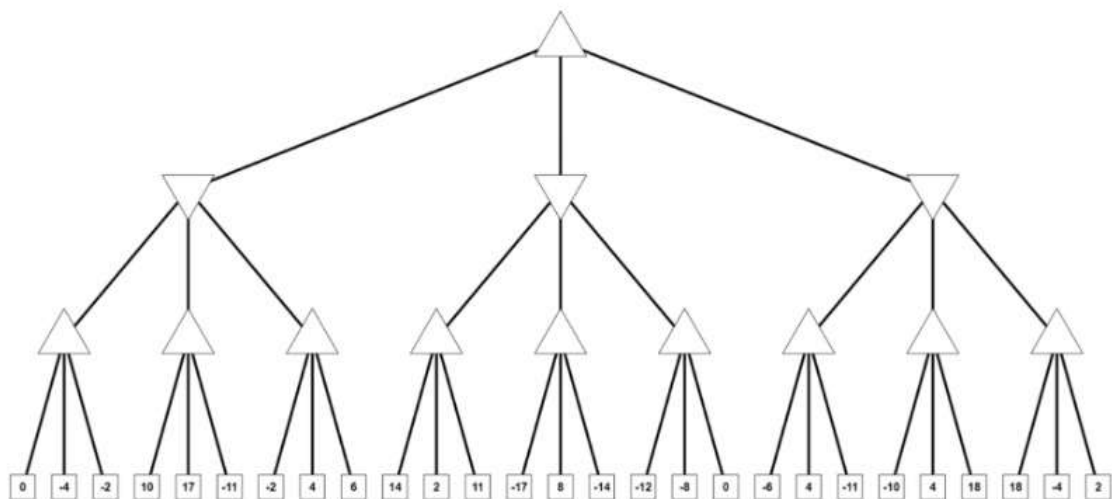
Question 01: **(5 marks)**

- a) What is the difference between a rational and an intelligent agent. Properly define and differentiate between the two agent types. **(2.5 + 2.5 = 05 marks)**

----- **CLO 2:**
Apply various AI problem solving and searching techniques to a real-world problem. -----

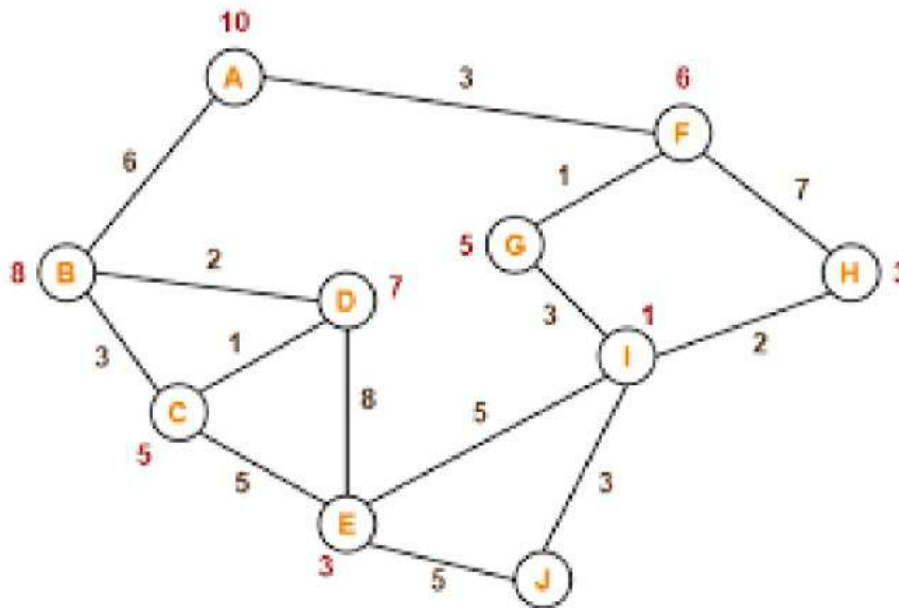
Question 02: **(10 marks)**

- a) Perform min-max along with alpha-beta pruning on the given tree (assuming MAX on top) **(1 + 4 = 05 marks)**



NOTE: The values in sequence from Left-to-Right are: 0, -4, -2, 10, 17, -11, -2, 4, 6, 14, 2, 11, -17, 8, -14, -12, -8, 0, -6, 4, -11, -10, 4, 18, 18, -4, 2

- b) Apply A* Search to the following graph. Node 'A' is your initial node and your goal is to reach node 'J'. The values of cost/heuristic function are also mentioned for the edges as well as the nodes. Show the final path and cost **(5 marks)**.

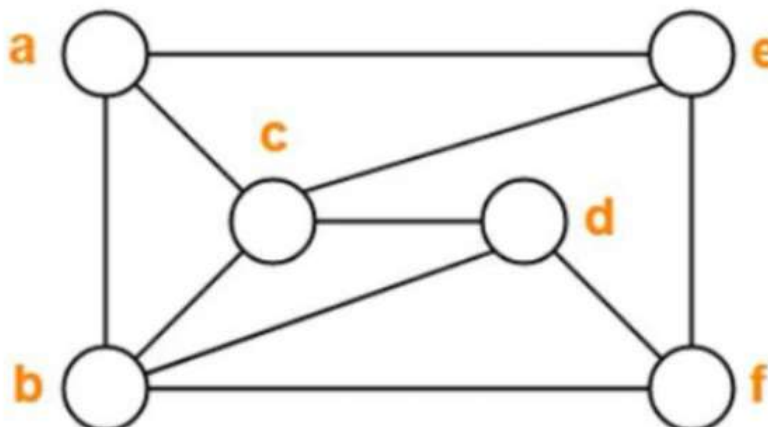


----- CLO 3:

Formulate a problem specified in natural language as a constraint satisfaction problem. -----

Question 03: (9 marks)

- Solve the given graph using CSP (graph coloring). Listing the variables, domains, constraints, total number of colors needed to solve this problem, and the final solution (05 marks)



- Consider the timetable problem of your university. While making the timetable of **one section**, some considerations needs to be catered for such as instructor availability, room capacity, no-time-conflicts. Identify the variables, their domains, and list the constraints as they map with the variables. (04 marks)

----- CLO 4:

Apply resolution to a set of logic statements to answer a query. -----

Question 04: (10 marks)

- a) Convert the following statements to their equivalent FOL (First Order Logic) (05 marks)
- a. Everyone knows that there are people who don't respect their elder
 - b. Not all students like both Mathematics and Science.
 - c. All birds fly.
 - d. Some boys play cricket
 - e. Lilly is tall
- b) Respond to the following (2.5 + 2.5 = 05 marks)
- a. What does CNF and DNF stands for? Define the usage of CNF and DNF along with a valid example (one or two statements)

----- CLO 5:

Compare different planning strategies for different applications under uncertainty -----

Question 05: (16 marks)

- a) Considering the given data set, **predict if the given fruit is a “banana”, “orange” or “other” when only three features (long, sweet and yellow) are known.** HINT: Given a fruit that is long, sweet and yellow: Can you predict which fruit it is? (10 marks)

Type	Long	Not Long	Sweet	Not Sweet	Yellow	Not Yellow	Total
Banana	400	100	350	150	450	50	500
Orange	0	300	150	150	300	0	300
Other	100	100	150	50	50	150	200
Total	500	500	650	350	800	200	1000

- b) Considering the given conditions, write at least **Three** classical Planning paths: (2 + 2 + 2 = 06 marks)

Initial State (I) = 5

Goal State (G) = 11

Operators (O) = {Increment, Decrement, Double, Half}