National University of Computer and Emerging Sciences

Islamabad Campus

Artificial Intelligence (AI2002)

Sessional-I Exam

Course Instructor(s):

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Section(s): CS-A,B,C,D,E,F,G,H,J,K

Total Time (Hrs): 1

Total Marks: 45

Total Questions: 3

Date: Feb 26, 2025

Roll No **Course Section** **Student Signature**

Do not write below this line.

Attempt all the questions.

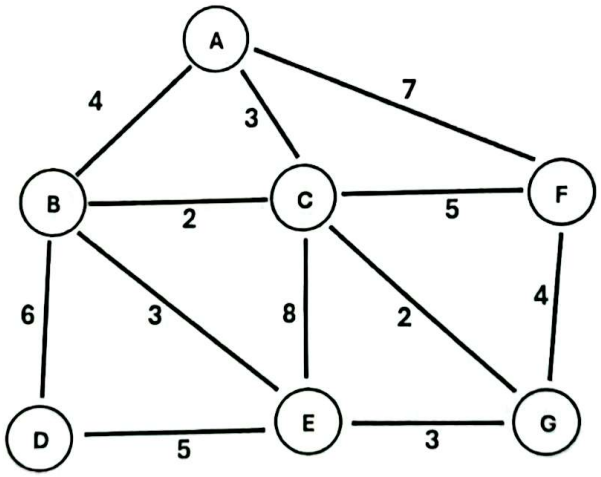
Instructions:

1. **Only put final answers on this question paper. Use answer books for showing complete working.**
2. **Calculator and other resource sharing is not allowed.**

Q #	Q1	Q2	Q3	Total
Obt Marks				
Max Marks	16	16	13	45

Q1: Given a graph, identify which of following heuristic function is Admissible/Non-Admissible and Consistent/ Non- Consistent. No marks will be awarded without valid/correct justification

Starting point: A **End Point: G** **[16 Marks]**



$H_1(n)$	$H_2(n)$	$H_3(n)$	$H_4(n)$
h(A) = 12	h(A) = 5	h(A) = 4	h(A) = 6
h(B) = 9	h(B) = 3	h(B) = 3	h(B) = 5
h(C) = 8	h(C) = 1	h(C) = 2	h(C) = 3
h(D) = 7	h(D) = 6	h(D) = 5	h(D) = 9
h(E) = 6	h(E) = 2	h(E) = 1	h(E) = 4
h(F) = 5	h(F) = 3	h(F) = 4	h(F) = 5
h(G) = 0	h(G) =0	h(G) =0	h(G) =1

H1(n)

Is h1 Admissible? No

If no, reason why? _____

Is h1 consistent? No

If no, reason why? _____

H2(n)

Is h2 Admissible? Yes

If no, reason why? _____

Is h2 consistent? No

If no, reason why? _____

H3(n)

Is h3 Admissible? Yes

If no, reason why? _____

Is h3 consistent? Yes

If no, reason why? _____

H4(n)

Is h4 Admissible? No

If no, reason why? _____

Is h4 consistent? Yes

If no, reason why? _____

Rubrics * 2 Marks Each Regardless of the explanation.

Use answer book for working. Write final answers here only.

Q2: Given the graph and Hill climbing algorithm given below,

a. **analyze the pseudo code and identify any anomaly in the steps. If there is any, explain and rectify the mistake. Else apply the given algorithm on given graph. Solve on answer book and write the final goal state here:** NA **Mention number of visited nodes here:** NA

In case of mistake in the pseudocode. Write down the identified mistake in no more than 2 lines

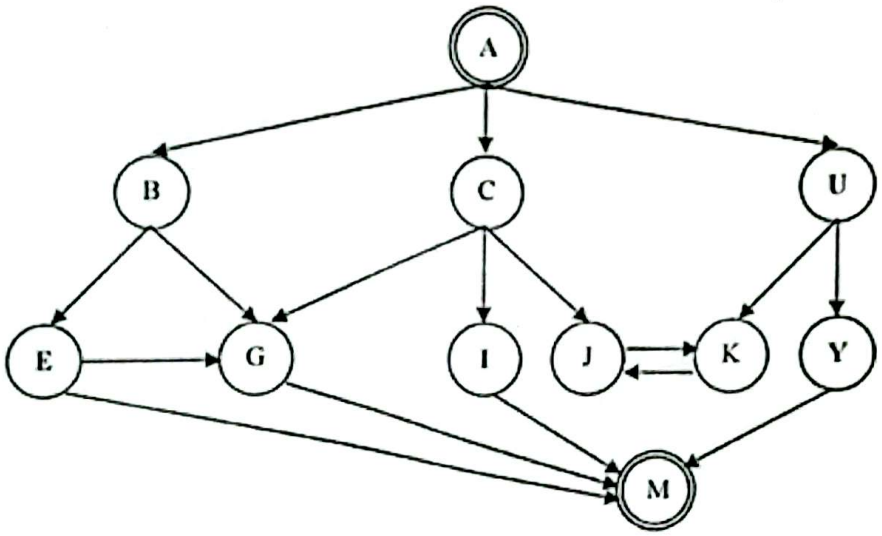
No goal state in local Search. 10 Marks

The highlited line in the Pseudo code shold be removed.

[10+6=16 Marks]

Pseudo Code:

```
function HILL-CLIMBING(problem) returns a state that is a local maximum
  inputs: problem, a problem
  local variables: current, a node
                   neighbor, a node
  current ← MAKE-NODE(INITIAL-STATE[problem])
  loop do
    neighbor ← a highest-valued successor of current
    if VALUE[neighbor] ≤ VALUE[current] then
      if Goal-Test[problem] applied to State(node) succeeds return STATE[current]
    current ← neighbor
  end
```



h(n):

h(A) = 7
h(B) = 5
h(C) = 3
h(U) = 4
h(E) = 2
h(G) = 3
h(I) = 1
h(J) = 2
h(K) = 6
h(Y) = 2
h(M) = 0

b. Suppose we found the solution M using hill climbing but after finding M, cost of node C is increased to 8. Will it affect the solution. (Yes/No) → 6 marks

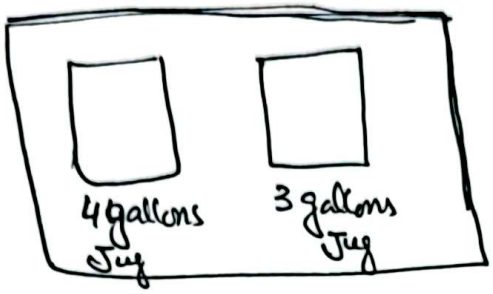
If Yes, explain how we can fix it without running Hill climbing again. Explain in two lines.

Rubrics → No explination was required. If explained with no then explination should be correct otherwise -3

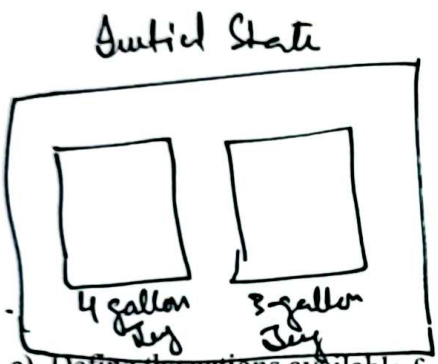
Q3: State space search techniques are often illustrated by showing how they can be used in solving puzzles of the sort you find in intelligence tests. One such puzzle is the water jug problem: "You are given two jugs, a 4-gallon one and a 3-gallon one. Neither has any measuring markers on it.

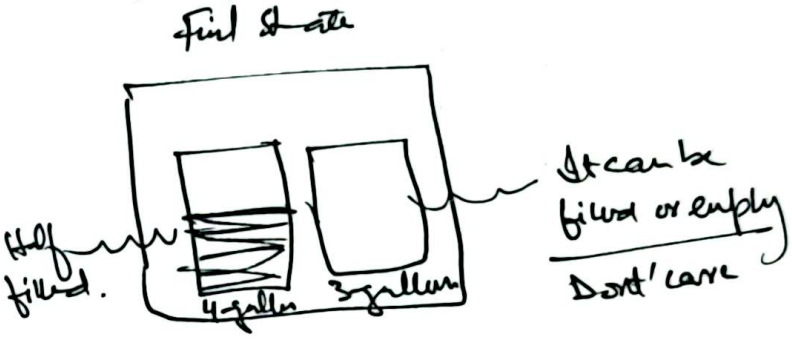
There is a tap that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into the 4-gallon jug". Given such a problem, decide the following. Remember this is an incremental question and each part is dependent on the previous part [2+2+4+5=13 Marks]

a). How can we represent state for this problem?



b). What the initial and final states for this problem using the representation defined in part a?





c). Define the actions available for this problem. Clearly mention the pre- requisites for the application of the actions. For example, pouring of water from 4-gallons into 3-gallons jug is not possible if the former is full. The representation of part a must be used for mentioning the starting and ending states along with the the pre-requisites.

Fill 4 gallon Jug from Tap
" 3 " " " "
Fill 3 " " " 4 gallon Jug
" 4 " " " 3 " "
Empty 3 gallon Jug.
" 4 " " .

d) Starting from the initial state, try to reach the goal state by applying the actions.