Recheck

National University of Computer and Emerging Sciences, Lahore Campus

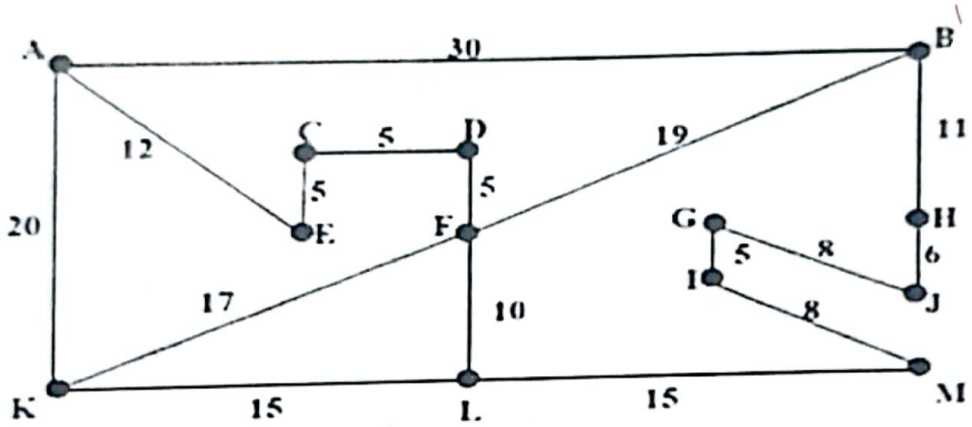
Course Name:	Applied Artificial Intelligence	Course Code:	AI4007
Program:	BS (Software Engineering)	Semester:	Fall 2023
Duration:	60 Minutes	Total Marks:	100
Paper Date:	30-09-2023	Weight	15
Section:	BSE-7A	Page(s):	7
Exam Type:	Mid I		

Student Name:

Registration #:

Q1. A* Search Algorithm: (50 marks)

Consider the following map (not drawn to scale). (Last page for rough work)



Part a) Use A* algorithm to work out a route from town A to town M. Use the following cost functions

g(n) = Total cost of reaching from town A to town n (step cost of each move is given on the map)

h(n) = Straight line distance between town n and town M These costs are given in the table below.

h(n) can be used as an estimated distance to M

Town	Distance
A	56
B	22
C	30
D	29
E	29
F	30
G	14

Town	Distance
H	10
I	8
J	5
K	30
L	15
M	0

i) Showing the order of nodes expanded by A* (Show complete working on the next page along with the tree)

ii) What path/route would be found by A* using this heuristic function?

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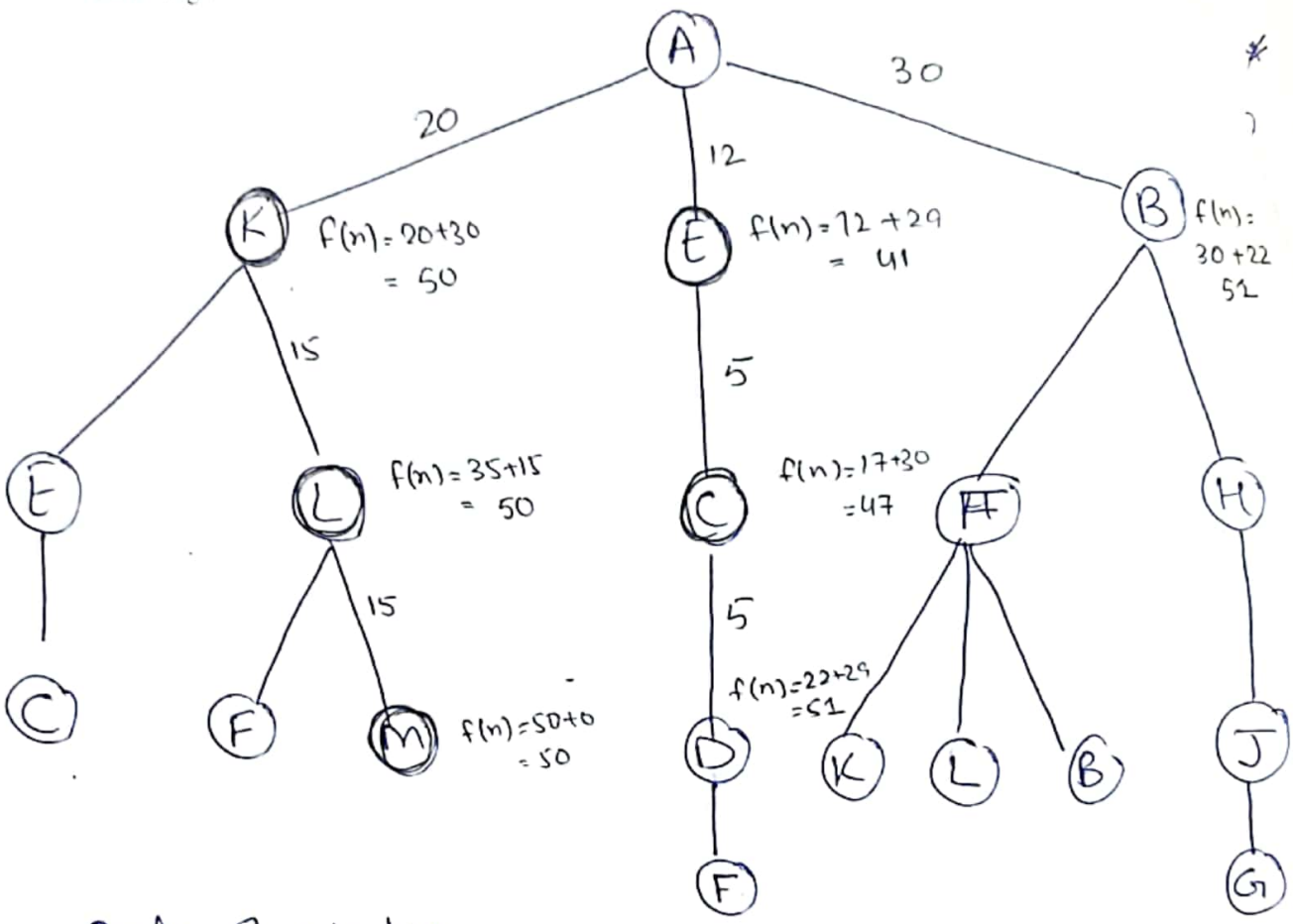

Order of Nodes

A → E → C → K → L → M

BackTrack from D

Path Using Heuristic function (AKLM

A → K → L → M ✓

Total cost = ~~30~~ 50

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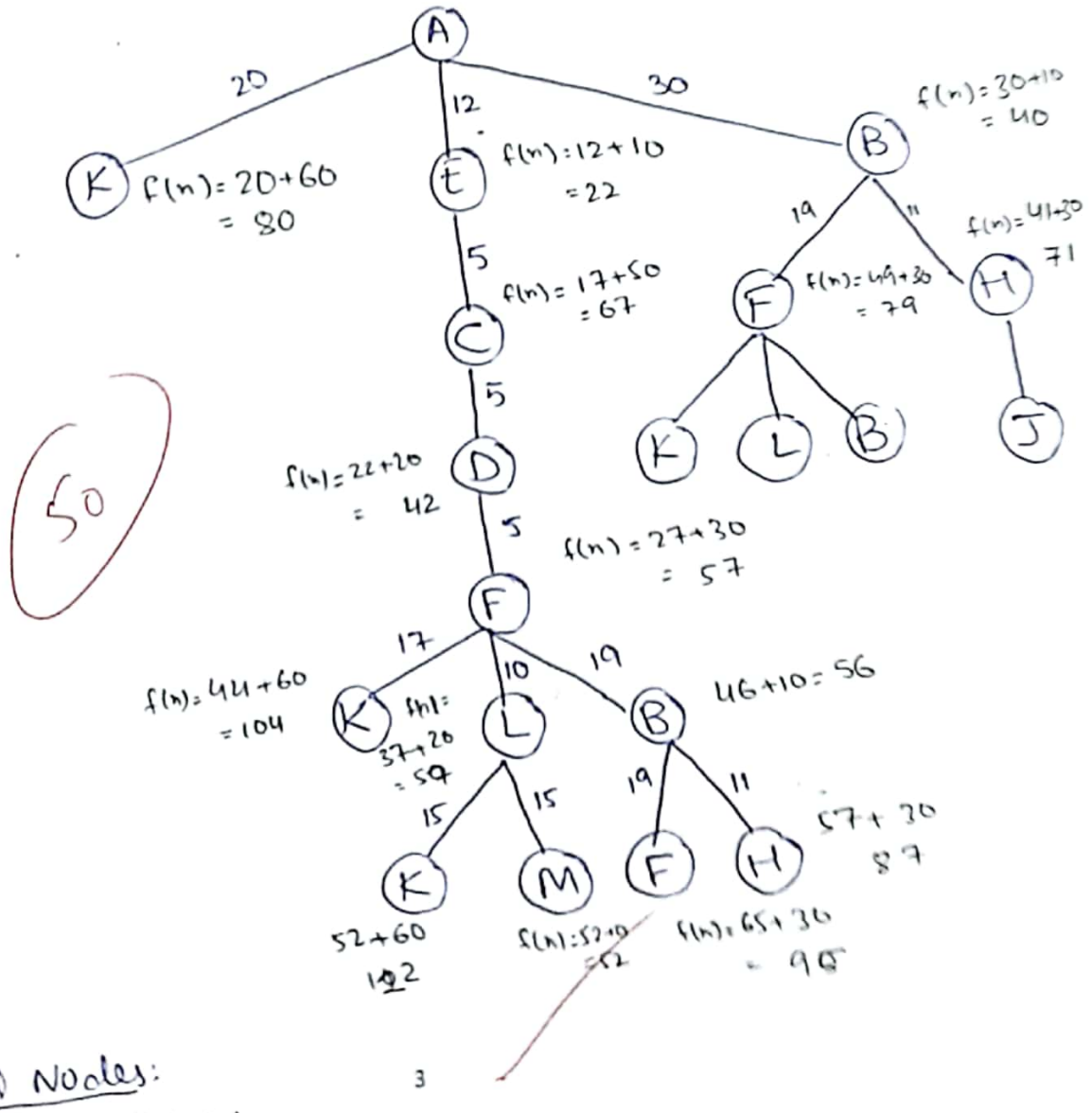
(b) Repeat the above question for the following heuristic function

Town	Distance
A	80
B	10
C	50
D	20
E	10
F	30
G	60

Town	Distance
H	30
I	20
J	50
K	60
L	20
M	0



50

Expanded Nodes:
AEBCDFBLM

Path:
AECDFLM

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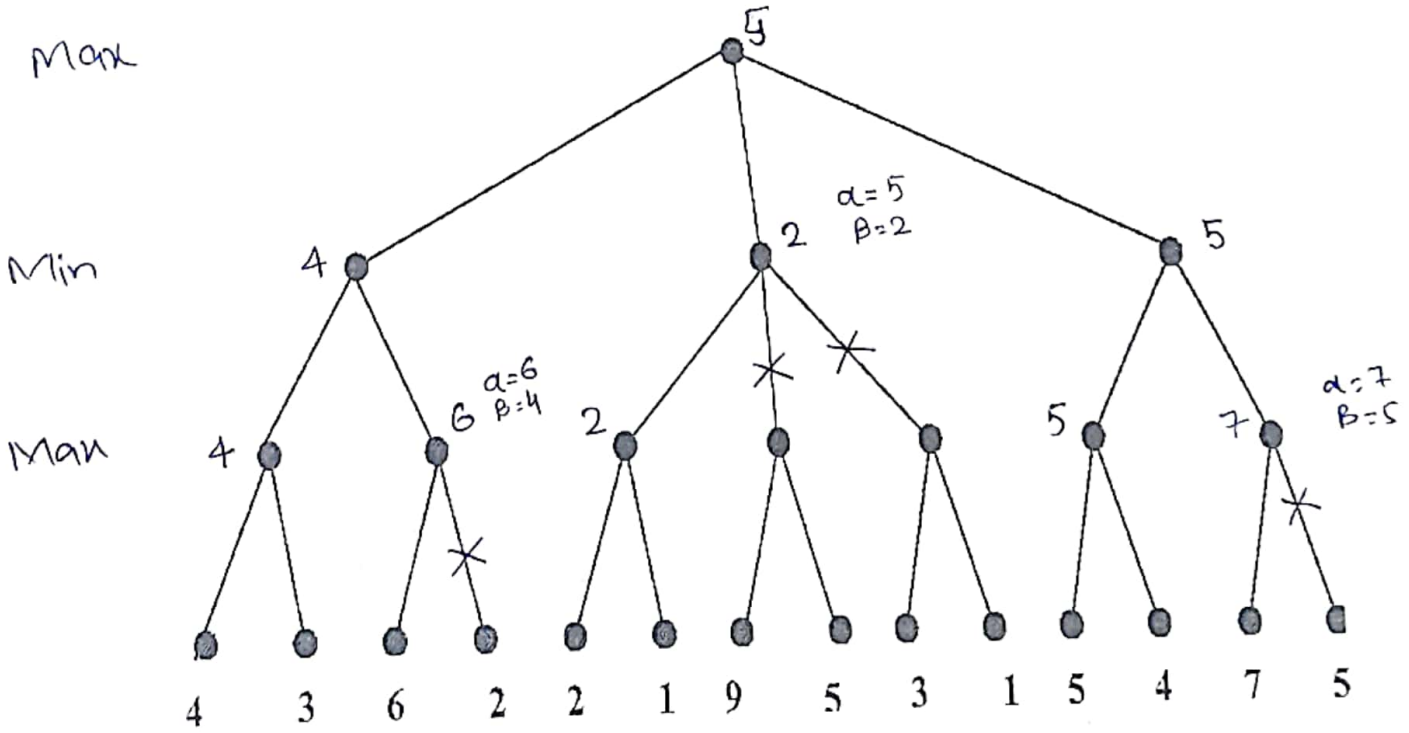
Part c) Comment on the optimality of the two runs of A* algorithm in the first two parts. How would you account for the different routes returned by the two runs?

- The first approach is no doubt more optimal as we are considering the right heuristic approach.
- The heuristic for second approach is not accurate and thus giving us not accurate results. But there might be some kind of blockage we don't know on roads.
- The second algorithm also does not seem admissible.

Q2. a. Run MINIMAX algorithm with Alpha-Beta pruning on the given game tree. Start state is for MAX and the values given at the bottom are the values of corresponding states for max player. (30 marks).

On the figure clearly show

- value of each node as found by the minimax algorithm
- the branches that will be pruned by the algorithm and the values of alpha and beta at the time of pruning



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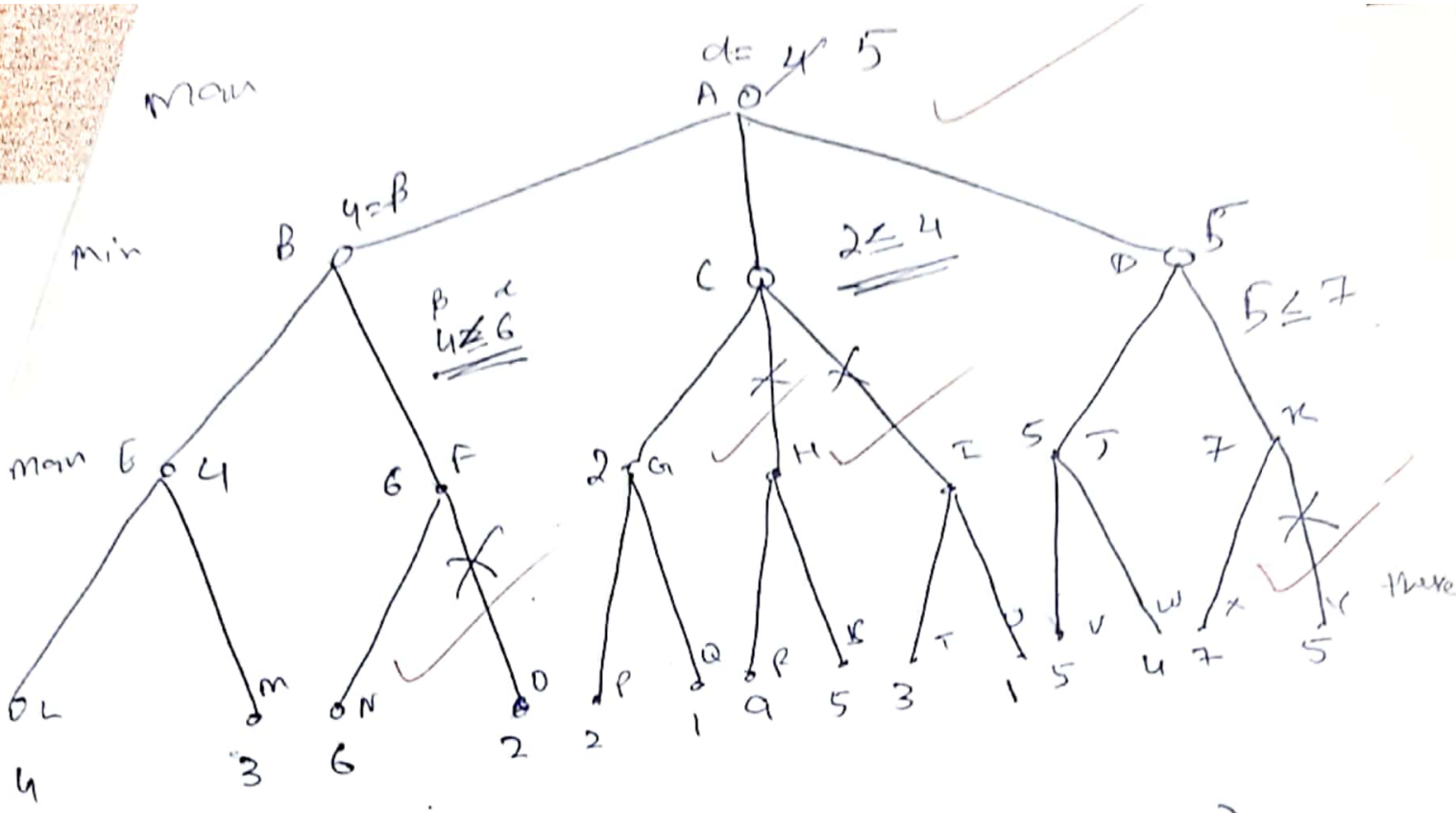

Node F is pruned $4 \leq 6$ $(\beta \leq \alpha)$

H and I is pruned $2 \leq 4$ $(\beta \leq \alpha)$

Node K is pruned $5 \leq 7 (\beta \leq \alpha)$

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b. Provide short answers (1-2 sentences) for each of the following questions.

a) In what way is iterative deepening better than depth-first search? (3 marks)

Solution: Iterative deepening give two advantages: Require less memory and find optimal solution. It is mixture of DFS or BFS. It does not stuck in loop like DFS.

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b) Define in detail the specific condition that a heuristic must satisfy in order for A* to be guaranteed to return an optimal solution. (3 marks)

Solution: heuristic must be admissible $h(n) \leq h'(n)$

heuristic must be consistent. That is to go to one node from A and then from B, C, D the distance would increase.

3

c) Clearly define the terms *soundness* and *completeness* for search Strategies? (3 marks)

Solution: Completness means does the algorithm find the optimal solution if there is one?

Soundness: if the soulution is optimal found by our algorithm.

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d) Write whether each statement is true (T) or false (F), and provide a short explanation:

1) Uniform-cost search is a special case of Breadth- first search. (4 marks)

Solution:

2

2) Breadth-first search, depth- first search and uniform-cost search are special cases of Best- first search. (4 marks)

Solution:

3) A* is a special case of uniform-cost search. (3 marks)

Solution: