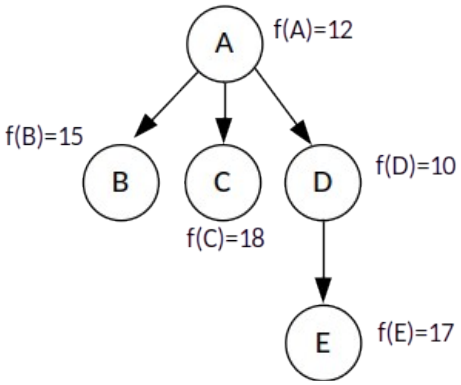
Intelligent Systems – Exam Block 1, 24th January 2025 (Type A)
Test A (1,75 points) score: max (0, (corrects – incorrects/3)*1,75/6)

Surname:	**Name:**
Group: A B C D E F G 4IA	

1) The tree in the figure shows the result of a **partial exploration** of an RBFS algorithm when node D is being processed and where only the f-value of the nodes is indicated. Indicate the **CORRECT** answer:



A. In the next step, the F-value of D would be updated to 17.
B. In the next step, the node E would be expanded and its value b would be b(E) = 15.
C. The b value of node D is b(D) = 18
D. The b value of node C is b(C) = 15

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2) The following fact represents two zones of a building, east zone and west zone, and for each zone the floor number and the number of offices on each floor are indicated; for example, in the east zone the first floor has 4 offices, the second floor has 6 offices and the third floor has 5 offices.

(building east zone floor 1 4 floor 2 6 floor 3 5 west zone floor 1 7 floor 2 10)

Indicate which of the following patterns is valid to store the floor number in the variable ?p and the number of offices on that floor in the variable ?num of any floor in the east zone.

A. (building $?x floor ?p ?num west zone $?y)
B. (building $?x floor ?p ?num $?y west zone $?z)
C. (building east zone $?x floor ?p ?num $?y)
D. (building $?x east zone $?y floor ?p ?num $?z)

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3) Given the Facts F={(list 17 8 43 26 2 9)}, how many instantiations of this rule are produced after the pattern-matching process

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(defrule R1
   (list $?x ?e1 $?y ?e2 $?z)
   (test (<= ?e1 ?e2))
=>
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A. 3
B. 4
C. 5
D. 6

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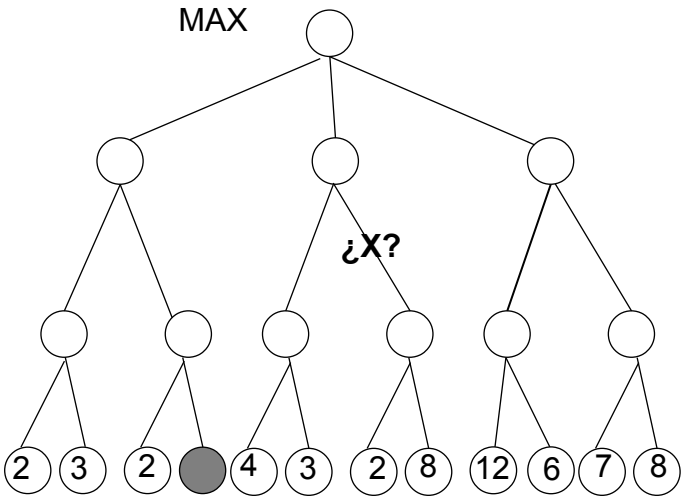
4) Given the game tree in the figure and applying the alpha-beta procedure (left expansion), what value should the shaded terminal node have for the cut indicated in the figure to occur?



A. Any value of the shaded node would produce a cut
B. Less than 2
C. Greater than or equal to 4
D. The indicated cut could never occur (or none of the previous answers is correct)

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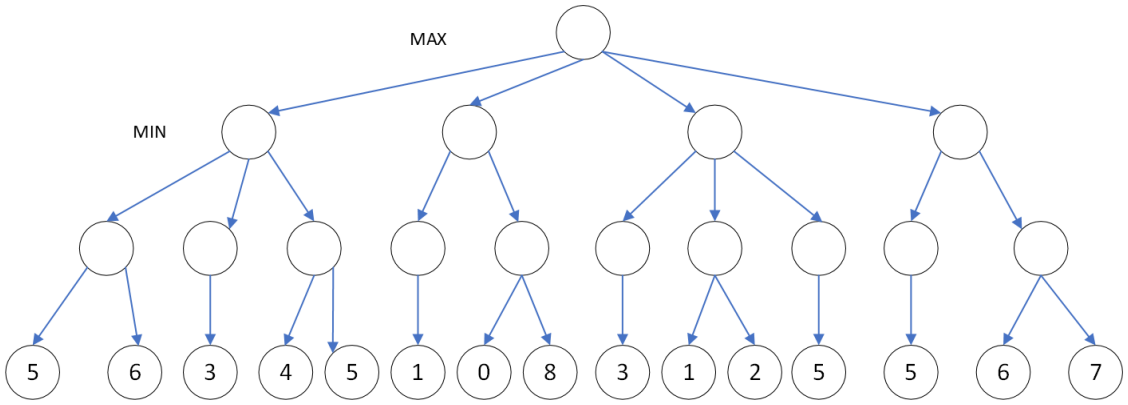
5) How many terminal nodes are not generated using the alpha-beta algorithm compared to the minimax algorithm in the following tree (left expansion)?



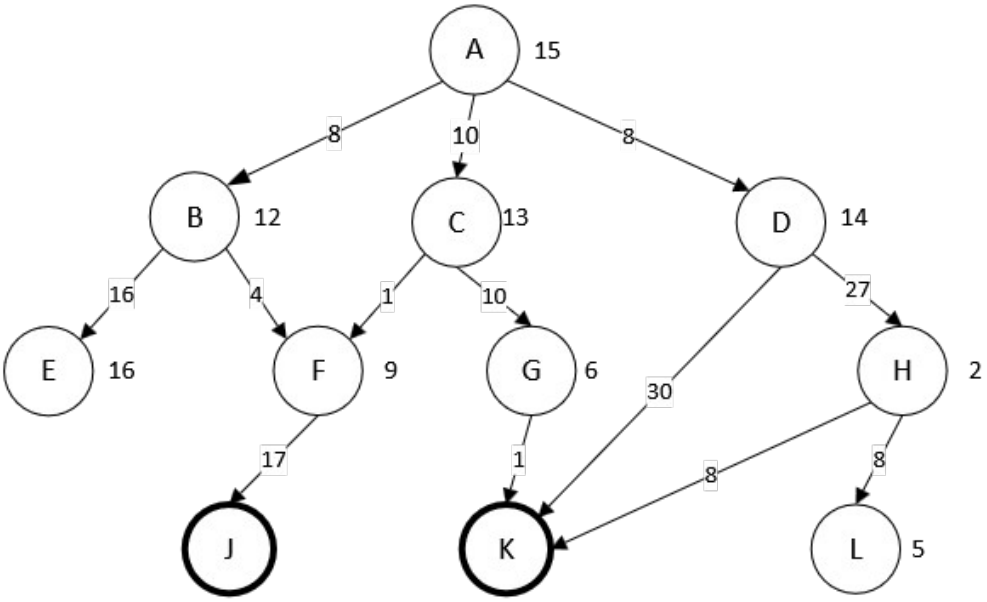
A. 6
B. 7
C. 8
D. 9

6) Given a search problem in which all its operators have the same cost, indicate which of the following statements is INCORRECT:

A. A TREE-SEARCH search algorithm with admissible heuristics will return the shortest solution
B. A GRAPH-SEARCH search algorithm with admissible heuristics will return the solution with the lowest cost
C. The uniform-cost strategy will return the solution of the lowest cost but not the shortest solution
D. An Iterative Deepening (ID) search algorithm would find the same solution as a breadth-first algorithm

Intelligent Systems – Exam Block 1, 24th January 2025
Problem: 2 points

The following graph represents the state space of a problem. The nodes of the graph are the states of the problem, the edges connect each state to its successors, and the numerical value of each edge represents the cost of moving from one state to the corresponding successor. The value next to each node represents the value of the heuristic function h(n) for that node. The initial state of the problem is node A, and the final states are J and K.



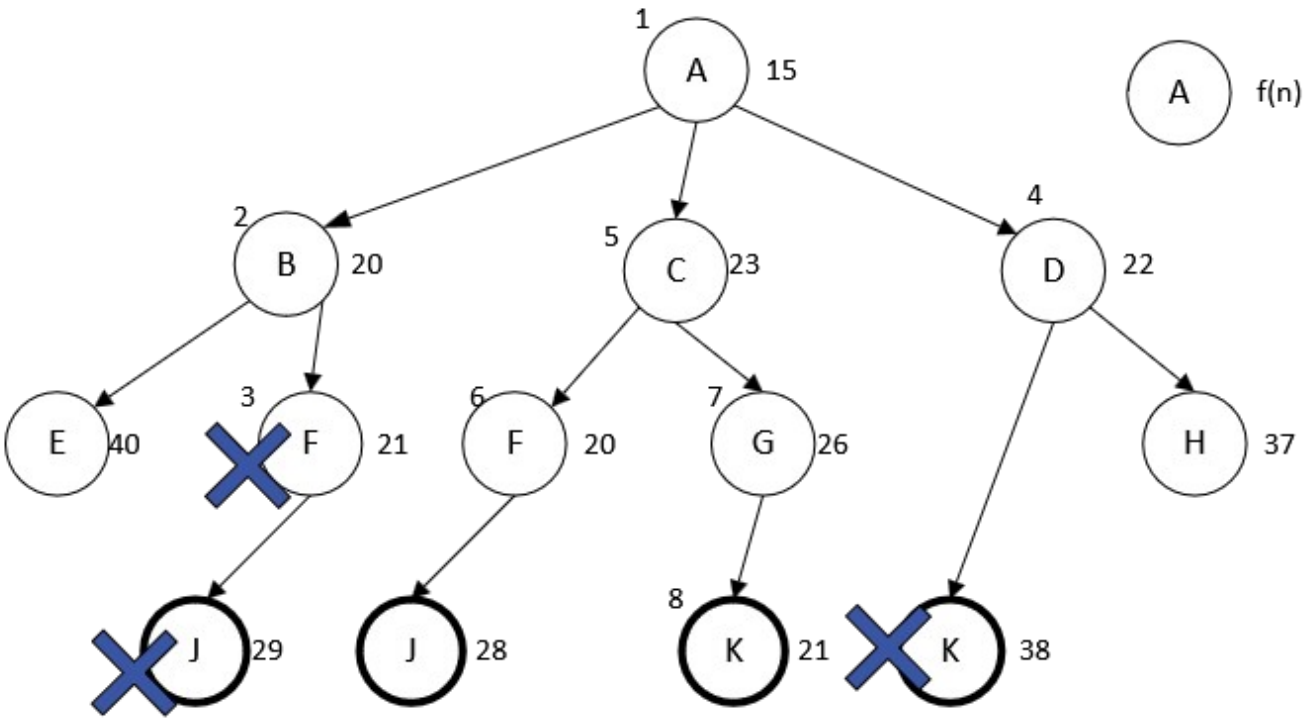
1) (1 point) Draw the TREE generated by performing a search with an A algorithm with control of repeated nodes in OPEN and CLOSED with re-expansion, indicating next to each node the order of expansion of this node (if it is expanded). Mark the eliminated nodes with an **X**. Indicate the status of the list of OPEN and CLOSED nodes at each moment, the solution path obtained and its cost. If two nodes have the same score, choose the alphabetically previous node.

2) (0.3 points) Is the answer found in section 1) the optimal solution? Is the heuristic admissible? And consistent? Justify your answers.

3) (0.7 points) Draw the trees generated by the application of an iterative deepening algorithm with backtracking (with control of repeated nodes with re-expansion and choosing the alphabetically previous node in case of two nodes with the same score). Indicate the order of expansion for each node and mark the deleted nodes with an **X**. What solution would you find? How many iterations would you perform? What is the maximum number of nodes stored in memory (including those in PATH) and what are they? Justify your answers.

SOLUTION:

1)

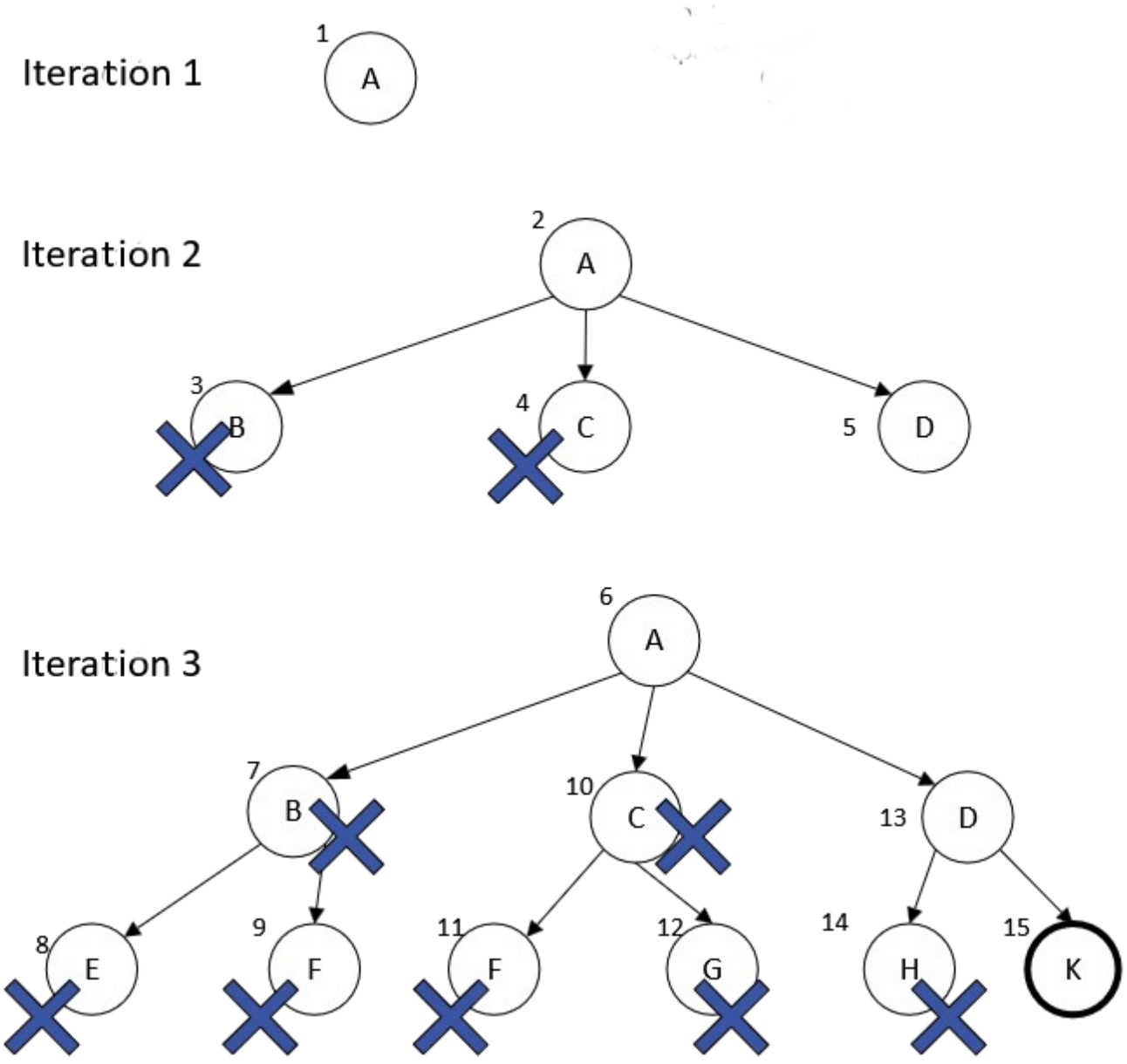


OPEN	CLOSED
A(15)	
B(20) D(22) C(23)	A(15)
F(21) D(22) C(23) E(40)	A(15) B(20)
D(22) C(23) J(29) E(40)	A(15) B(20) F(21)
C(23) J(29) H(37) E(40) K(38)	A(15) B(20) F(21) D(22)
F(20) G(26) J(29) H(37) E(40) K(38)	A(15) B(20) D(22) C(23)
G(26) J(28) H(37) E(40) K(38)	A(15) B(20) D(22) C(23) F(20)
K(21) J(28) H(37) E(40)	A(15) B(20) D(22) C(23) F(20) J(28)
J(28) H(37) E(40)	A(15) B(20) D(22) C(23) F(20) J(28) K(21)

Solution: A-C-G-K cost 21

2) The solution found is the optimal one. It is not admissible because h(C)=13 and h*(C)=11, and h(G)=6, h*(G)=1. Therefore, it is not consistent, as can be seen from the fact that h(G)<=h(K)+c(G,K) is not fulfilled (6 <= 0 +1 is not fulfilled); or from the fact that h(C)<=h(F)+c(C,F) is not fulfilled (13 <= 9+1 is not fulfilled).

3)



Solution: A-D-K. 3 iterations. Maximum number of nodes in memory: 3+3 (ADK).