Intelligent Systems – Exam Block 1, February 1, 2024
Test A (1.75 points) score: max (0, (corrects – incorrects/ 3)* 1.75/6)

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

1) Let be an algorithm of type A ($f(n)=g(n)+h(n)$) where we know that the function $h(n)$ is consistent. Indicate the **INCORRECT** answer:

   A. The algorithm returns the optimal solution.
   B. Let n be a parent node and n' be a child node. It is always true that $h(n) > h(n')$.
   C. $n2$ can be generated equal to an existing node $n1$ such that $n1$ is in OPEN and $f(n2) < f(n1)$
   D. $n2$ can be generated equal to an existing node $n1$ such that $n1$ is in CLOSED and $f(n1) < f(n2)$

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2) The CLIPS fact (transport bus 1 Plaza-Ayuntamiento Malvarrosa bus 2 Benimaclet San-Marcelino bus 3 Torrefiel Hospital-La-Fe) represents the origin and destination of the routes of three buses. Determine what would be the correct pattern to find out the bus number I have to take if I want to get to San-Marcelino:

   A. (transport $?x bus ?numbus San-Marcelino $?y)
   B. (transport $?x bus ?numbus San-Marcelino ?y)
   C. (transport $?x bus ?numbus ? San-Marcelino $?y)
   D. (transport $?x bus ?numbus ? San- Marcelino ?y)

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3) Let be the following set of facts and rule in CLIPS

```
(deffacts data
   (string B C  A)
   (string A C A B)
   (union))
```

```
(defrule R1
  (string $?x ?letter $?y)
  (union $?lis)
  (test (not (member ?letter $?lis)))
=>
(assert (union ?letter $?lis)))
```

After executing the RBS, indicate the **CORRECT** answer:

   A. A single fact ‘union’ is generated containing the three letters A, B and C without repetitions
   B. Six facts ‘union' are generated, each containing the three letters A, B and C in a different order
   C. Six facts ‘union' are generated, each of which contains the three letters A, B and C in a different order, and six facts 'union', each of which contains a combination of two letters in a different order.
   D. Fifteen facts ‘union’ are generated

4) Indicate the **CORRECT** statement :

A. An IDA* algorithm expands nodes following an evaluation function f(n)=g(n)+h(n).
B. An IDA* algorithm maintains a single f-value for the entire tree in each iteration.
C. An RBFS algorithm expands nodes following depth expansion.
D. A DFS algorithm without control of repeated nodes always guarantees that a solution will be found.

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5) In an Alpha-Beta algorithm, indicate the **CORRECT** statement **:**

A. The provisional α values of a MAX node are lower bounds of the node and can never decrease when developing the search.
B. The β value of a non-terminal MIN node is the largest value among the values of its successor nodes
C. The provisional β values of a MIN node are lower bounds of the node and can never decrease as the search proceeds.
D. None of the above is correct.

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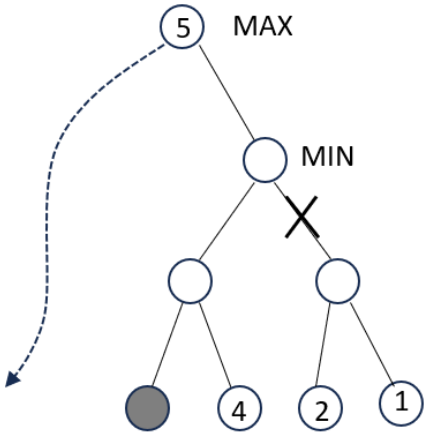
6) What value should the shaded node have for the indicated cut to occur?



A. Greater than or equal to 4
B. Less than or equal to 5
C. Between 2 and 6
D. Cutting is not possible

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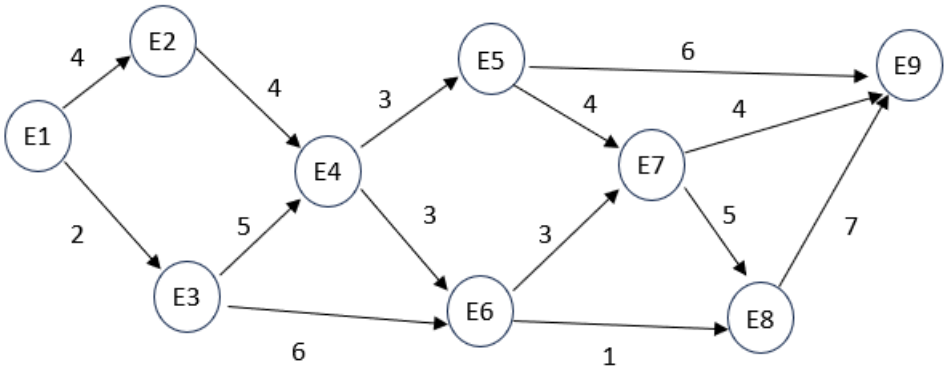
Problem: 2 points

There is a weighted graph that represents a system of **urban public transport routes** . Each node in the graph represents a public transportation station, such as a bus stop, subway station, or tram, and each edge represents direct connections between stations. The weight of each edge represents the travel time between stations. The goal of a traveler is to get from station E1 to station E9.



The following table shows the heuristic value of each node, an estimate of the time that has been obtained from user data.

n	E1	E2	E3	E4	E5	E6	E7	E8	E9
h(n)	15	11	14	8	6	6	3	5	0

1) (0.7 points) Show the search tree that would result from the application of an A algorithm (f(n)=g(n)+h(n)). Apply the graph version of the algorithm avoiding repeated nodes. Indicate at the end the number of nodes generated and expanded. Please indicate clearly the value of the evaluation function (f(n)) at each node and the order of expansion of the nodes. If the value of the evaluation function is the same between two nodes, expand the numerically previous node first.

   E1, E3, E6, E7, E9. Coste 15

2) (0.3 points) According to the problem data and the tree developed in the previous section: Does the algorithm return the optimal solution? Is the heuristic function admissible? And consistent (monotonous)? Justify all the answers.

   It finds the optimal solution, but it is not admissible

   h(E3) = 14 and actual cost is 13 → E3, E6, E7, E9

   Therefore, it is not consistent.

3) (0.5 points) If we apply a greedy search algorithm to this problem, what solution would it find? Show the tree that is generated, indicate the nodes of the solution path, as well as the total number of nodes generated. If the value of the evaluation function is the same between two nodes, expand the numerically previous node first.

E1, E2, E4, E5, E9 cost 17

4) (0.5 points) If we apply the IDA* algorithm to this problem, how many iterations would it take to find the solution? Justify the answer and show the tree of the first iteration.

Two iterations, in the second iteration the bound is 16 and is not exceeded.