Intelligent Systems – Test Block 1 (type A)
ETSINF, Universitat Politècnica de València
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Name:
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In each question, mark only one of the given options. A correct answer weighs 1, and an incorrect answer has a penalty of 1/3 (unanswered questions do not affect the score).

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1) Given the WMinitial={(lista1 b a a a c c a c b b c)(lista2 a c)} and the following rule, indicate the final WM that will be reached among the given options.

```
(defrule  R1
  ?f <- (lista1  $?x ?a ?a $?y)
        (lista2  $? ?a $?)
 =>
   (retract ?f)
   (assert (lista1 $?x ?a $?y)))
```

A. {(lista1 b b b c) (lista2 a c)}
B. {(lista1 b a c a c b b c) (lista2 a c)}
C. {(lista1 b b b c)}
D. {(lista1 b a c a c b c) (lista2 a c)}

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2) Given the LHS of the rule:

```
(defrule R2
   ?f <- (lista  $? ?b $?x ?b $?x)
    =>
   ...
```

and the fact (lista c c d c c d c c d), how many rule instances will be inserted in the Agenda?

A. 1
B. 2
C. 3
D. 4

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3) Let be the WMinitial={(lista 5 7 3 1 6 4) (maximo 0)} and the following rule to calculate the maximum value of a list of numbers

```
(defrule R4
    ?f1 <- (lista $?a ?b $?c)
    ?f2 <- (maximo ?x)
    (test (>  ?b ?x))
=>
    (assert (lista $?a $?c))
    (assert (maximo ?b)))
```

Assuming we wish to obtain a final WM (after successively executing the rule R4) in which a fact of type (maximo …) appears only once with the maximum value of the list of numbers, which of the following assertions is **TRUE**?

A. The rule is correct
B. It is necessary to add (retract ?f1)
C. It is necessary to add (retract ?f2)
D. The modification of answer C is not sufficient and it is also necessary to add (retract ?f1)

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4) Given the fact (problem tower a b c name A tower a name B tower name C), which of the following patterns is suitable to retrieve the name of a tower that contains only one element?

A. (problem $?x tower ?a $?y name ? $?z)
B. (problem $?x tower ?a name ?z $?x)
C. (problem $?x tower ?a name ?z $?)
D. (problem $? tower ?a name ?)

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5) Let be a RBS to calculate the Fibonacci number of an integer $n>0$, for example, $n=5$ (the Fibonacci number is stored in fib-1), which of the following assertions is **TRUE**?

```
(defrule Fibonacci_number
  ?f1 <- (number ?n1)
  ?f2 <- (fib-1 ?n2)
  ?f3 <- (fib-2 ?n3)
=>
  (retract ?f1 ?f2 ?f3)
  (assert (number (- ?n1 1)))
  (assert (fib-1 (+?n2 ?n3)))
  (assert (fib-2 ?n2 )))

(deffacts fibonacci (number 5) (fib-1 1) (fib-2 0)
```

NOTE: The Fibonnaci number is calculated as: $f(n)=f(n-1)+f(n-2)$ with $f(0)=0$ and $f(1)=1$.

A. The RBS works correctly
B. The above assertion is not true because a test condition (test (> ?n1 1)) is needed in the LHS of the rule to work properly
C. The above modification is not sufficient and it is also necessary to add a halt rule: (defrule stop (declare (salience 100)) (number 1) => (halt)).
D. None of the above assertions is true

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6) Given the fact:

(market street 1 fruit 20 fish 0 street 2 fruit 10 fish 10 street 3 fruit 16 fish 4)

, where the numeric value after the symbol 'street' is the street identifier and the numeric values after the symbols 'fish' and 'fruit' indicate the number of stalls of fish and fruit in the respective street. Indicate the correct pattern to obtain **ONLY** the identifier of any of the streets and the number of fish stalls in such street.

A. (market $? street ? fruit $? fish ?n $?)
B. (market $? street ?c $? fish ?n $?)
C. (market street ?c fruit ? fish ?n)
D. (market $? street ?c fruit ? fish ?n $?)

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7) Let be a RBS composed of WMinitial={(lista 2 1 6 2 3)}, and the following rules:

```
(defrule R1
  ?f <- (lista $?x ?z ?y $?w)
        (test (< ?z ?y))
=>
 (assert (lista $?x ?z ?y $?w)))
```

```
(defrule R2
   ?f <- (lista $?x ?z ?y $?w)
      (test (> ?z ?y))
=>
   (assert (lista $?x ?z ?y $?w)))
```

What are the contents of the Agenda after the first pattern-matching?

A. An instance of R1 and two instances of R2
B. Two instances of R1 and one instance of R2
C. Two instances of R1 and two instances of R2
D. No rule instance is generated

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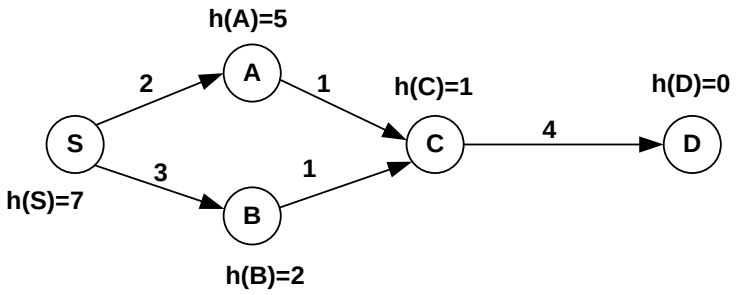
8) Assuming that all of the nodes in a search space have more than one child, in which of the following search strategies the order of generation of the nodes is **never** the same as the order of expansion of the nodes?

A. Breadth-first search
B. Uniform cost search
C. Depth-first search
D. Greedy search

9) In the state space of the figure, S is the initial state, D is the goal state, h(n) is the heuristic estimation for each node and the numeric values on the edges are the costs of the arcs. Indicate the **CORRECT** statement.



A. An A algorithm (TREE SEARCH with control of repeated states in the OPEN list) does not return the optimal solution.
B. An A algorithm (GRAPH SEARCH with control of repeated states in the CLOSED list such that a newly generated node is discarded if it exists in CLOSED) returns the optimal solution
C. The answer A is not TRUE since h(n) is not admissible
D. The answer B is not TRUE since h(n) is not consistent

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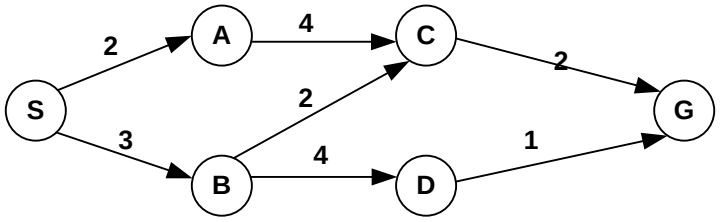
10) Given the state space of the figure, the number of nodes generated by a Uniform Cost search (TREE SEARCH) is (in case of two nodes with the same f-value, expand first the node that comes alphabetically before):



A. Higher than the number of nodes of a BFS
B. Lower than the number of nodes of a BFS
C. Lower than the number of nodes of a DFS
D. None of the above answers is TRUE

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11) Given a consistent heuristic function h(n) in a search of type f(n)=g(n)+h(n), which of the following assertions is CORRECT?

A. It does not return the optimal solution
B. The heuristic value of the parent can be the same as the heuristic value of the child
C. It never generates a new node n1, equal to another already generated node n2, such that f(n1) < f(n2).
D. It never generates a new node which is the same as one already in the CLOSED list

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12) Let be a search $f(n)=g(n)+h(n)$, where $h(n)$ is admissible, and two solution nodes $G1$ and $G2$. $G1$ is an optimal solution and $G2$ is not. Let $n1$ be a node that belongs to the solution path to $G1$. Mark the CORRECT statement:

A. $g(G1) \leq f(G2)$
B. $f(n1) \leq g(G2)$
C. $h^*(n1)+g(n1)=f(G1)$
D. None of the above

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13) Regarding the number of nodes in the worst-case scenario for an Iterative Deepening search that finds the solution at level d and a limited Depth-first search with $m=d$ for one same problem, which of the following assertions is CORRECT?

A. DFS generates more nodes than ID
B. ID generates more nodes than DFS
C. DFS and ID generate the same number of nodes
D. None of the above

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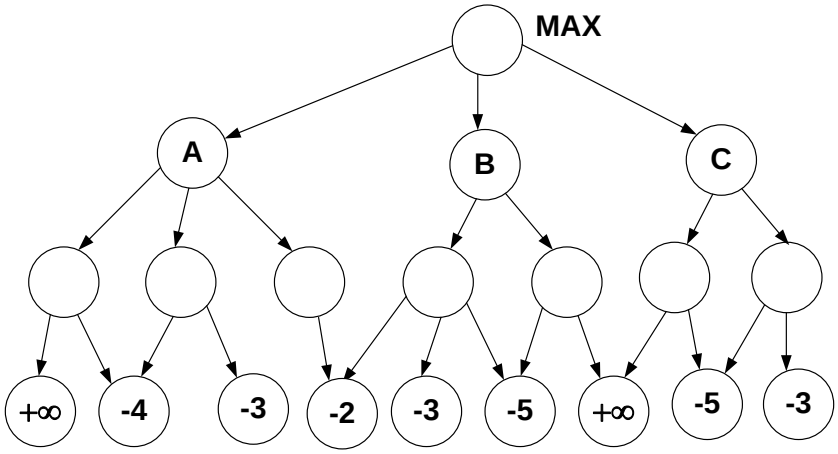
14) Given the game tree of the figure, where MAX is the initial player and assuming we apply an alpha-beta procedure, mark the CORRECT statement:



A. MAX will choose any of the three branches because all of them lead to a winning position for MAX
B. MAX will choose the branch A
C. MAX will choose the branch B
D. MAX will choose the branch C

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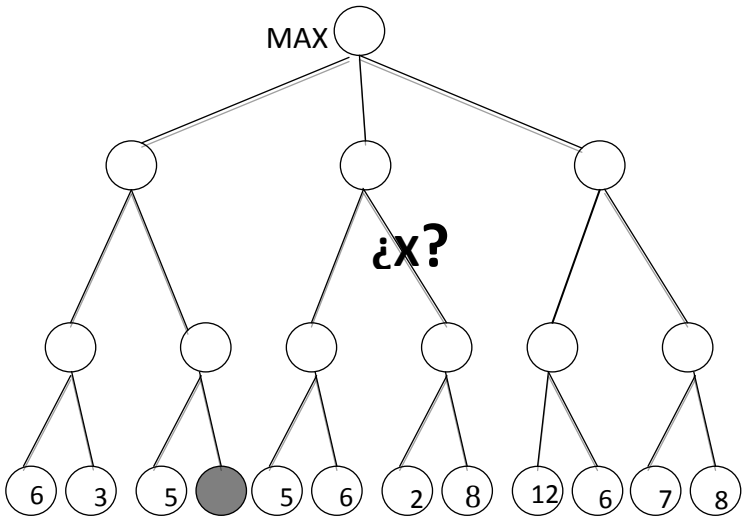
15) Assuming we apply an alpha-beta procedure to the game tree of the figure, which is the value that the shadowed node should have in order to get the cut-off of the figure?



A. Any value
B. A value lower than 6
C. A value higher or equal than 6
D. The cut-off would never be produced (none of the above answers)