Intelligent Systems – Test Block 1 (type A)
ETSINF, Universitat Politècnica de València
November 6, 2018

Last name(s):
Name:
Group: A B C D E F G 4GIA

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)

---

1) Let be the following rule that calculates the Greatest Common Divisor (GCD) of two positive integer numbers. Mark the **CORRECT** answer:

```
(defrule GCD
    ?a <- (num ?n1)
    ?b <- (num ?n2)
    (test (> ?n1 ?n2))
 =>
    (retract ?a)
    (assert (num (- ?n1 ?n2))))
```

A. The rule correctly calculates the GCD and the final WM will contain a fact 'num' with the GCD value
B. A stop rule with no salience is needed to prevent the RBS from an endless execution
C. A stop rule with salience is needed to prevent the RBS from an endless execution
D. None of the above answers is correct

---

2) Let be a RBS whose initial WM is (list b a c c a b b a rest), and contains the rule:

```
(defrule R1
    ?a <- (list $?x ?y ?y $?x $?z rest $?m)
 =>
    (retract ?a)
    (assert (list $?x $?x $?z rest $?m ?y)))
```

The contents of the final WM is:

A. (list b a a b b a rest c)
B. (list b a rest c a b)
C. (list b a b a rest c b)
D. None of the above answers

---

3) Given the fact (owners cars a b c owner P cars d owner Q cars e f owner R), which describes the cars and then the owner of these cars, which of the following patterns would be used to obtain the name of an owner who has only one car?

A. (owners $?x cars ?a owner $?z)
B. (owners $? cars ? owner ?z $?)
C. (owners $?x cars ?a owner ?z $?x)
D. (owners $? cars ? owner ?z)

---

4) Let be a RBS whose initial WM is {(list A B C A B C C B A C B A)}, and contains the single rule:

```
(defrule R1
  ?f1 <- (list $?x1 ?y $?x2 ?y $?x3)
         (test (> (length $?x2) 0))
         (test (not (member ?y $?x2)))
 =>
       (retract ?f1)
       (assert (list $?x1 ?y ?y $?x3)))
```

The contents of the final WM is:

A. A list that only contains the letter 'A'
B. A list that only contains the letter 'B'
C. A list that only contains the letter 'C'
D. It will depend on whether the used control strategy is breadth or depth

---

5) Given the fact (prueba 1 2 3 4 5 6 7 8 9 10) and the rule:

```
(defrule R1
    ?f1 <-  (prueba $?a  $?c)
=>
    (retract ?f1)
    (assert (lista $?c)))
```

After the first pattern-matching:

A. No rule instances will be produced
B. 9 rule instances will be produced
C. 10 rule instances will be produced
D. 11 rule instances will be produced

---

6) Given the initial WM, WM={(list 3 5 2 5 3 4 2 9 8 8 9 6) (num 5) (repetitions 0)}, and the following rule that calculates the number of times an element is repeated in a list of numbers.

```
(defrule R1
    ?f1 <- (list $?a ?b $?c)
    ?f2 <- (num ?x)
    ?f3 <- (repetitions ?z)
    (test (= ?b ?x))
=>
     (assert (list $?a $?c))
      (assert (repetitions (+ 1 ?z))))
```

Assuming we want to get a final WM (after the successive application of the rule), in which the fact (repetitions …) appears only once and the value of this fact is the number of times that the number ?x of the pattern (num ?x) appears in the list, mark the **CORRECT** answer to accomplish our objective.

A. The rule is correct
B. It is necessary to add (retract ?f1)
C. It is necessary to add (retract ?f1) and (retract ?f3)
D. It is necessary to add (retract ?f3)

---

7) Let be a RBS composed of WMinitial={list 2 1 5 3)}, and the following rules:

```
(defrule R1
   (declare (salience 200))
  ?f <- (list $?x ?z ?y $?w)
        (test (< ?z ?y))
 =>
  (assert (list $?x ?z ?y $?w)))
```

```
(defrule R2
    (declare (salience 50))
    ?f <- (list $?x ?z ?y $?w)
          (test (>= ?z ?y))
=>
    (assert (list $?x ?z ?y $?w)))
```

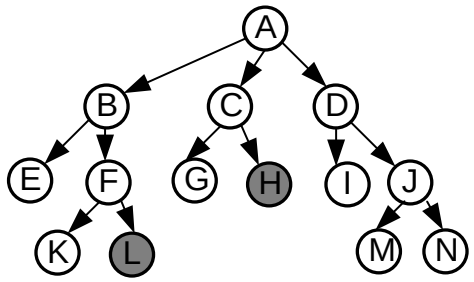
```
(defrule final
  (declare (salience 150))
    (list $?list)
 =>
  (halt))
```

after the first pattern-matching, how rules would be ordered in the Agenda?

A. One instance of R1, one instance of the final rule, and two instances of R2
B. Two instances of R2, one instance of R1, and one instance of the final rule
C. Once instance of the final rule, two instances of R2, and one instance of R1
D. Once instance of the final rule

---

8) Let be the search tree of the figure, mark the answer that shows the correct order in which nodes would be generated when applying Iterative Deepening and the reached goal node.



A. ABCDEFKL and finds goal state L
B. ABCDEFGHIJKL and finds goal state H
C. AABCDABCDEFGH and finds goal state H
D. ABCDEFGH and finds goal state H

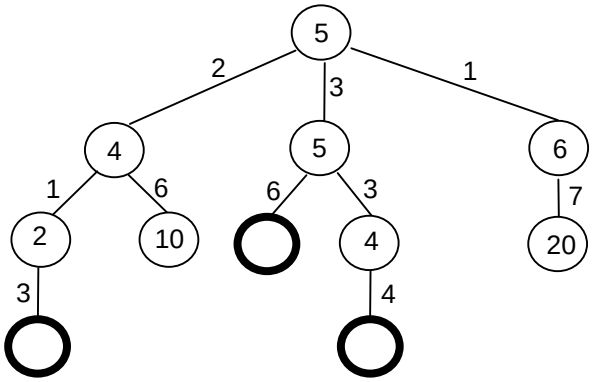
---

9) Given two A* algorithms for one same problem, where algorithm A1 uses heuristic $h1(n)$ and algorithm A2 uses $h2(n)$, such that $\forall n$, $h^*(n) \geq h2(n) > h1(n)$, show the **CORRECT** answer:

A. It is guaranteed that A1 will take less time than A2
B. It is guaranteed that A1 will expand fewer nodes than A2
C. The solution found by A2 will be better than the one found by A1
D. None of the above answers is correct

---

10) Let be the search tree of the figure, where bold-circled nodes are goal states, the value inside a node is the heuristic value of the node and the numeric value on the arcs is the operator cost. Show the **CORRECT** answer:



A. The heuristic is admissible and consistent
B. The heuristic is not admissible nor consistent
C. The optimal solution is found when an algorithm of type A is applied to the tree
D. None of the above answers is correct

---

11) Let be a search problem where operators have different costs. We know the search tree contains a solution node *G1* at level d1, and a solution node *G2*, which is an optimal solution, at level d2. We also know that d2 > d1. Show the **CORRECT** answer:

A. The time complexity of a breadth-first strategy with respect to the number of generated nodes is $O(b^{d1})$
B. A depth-first strategy will never return the solution *G1*
C. An iterative deepening strategy will never find the solution *G1*
D. A uniform-cost strategy will always find the solution *G2*

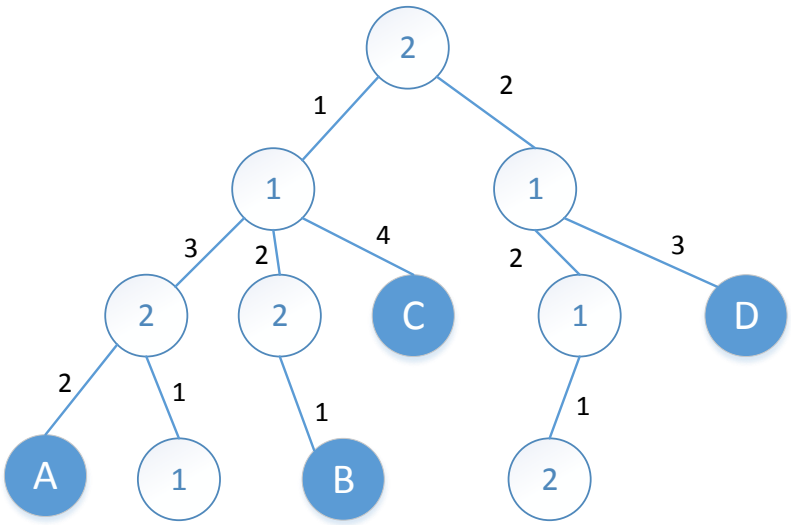
---

12) Let be the search tree generated with an A* algorithm. The tree contains two nodes, n1 and n2, which correspond to two repeated states. We also know that n1 is a node on the optimal path to a solution node *G*, whereas n2 is not on the optimal path to *G*. Show the **INCORRECT** answer:

A. Se cumple siempre $f(n1) \leq f(G)$
B. Se cumple siempre $g(n1) < g(n2)$
C. Se cumple siempre $h(n1) < h(n2)$
D. Se cumple siempre $h(n2) \leq h^*(n2)$

---

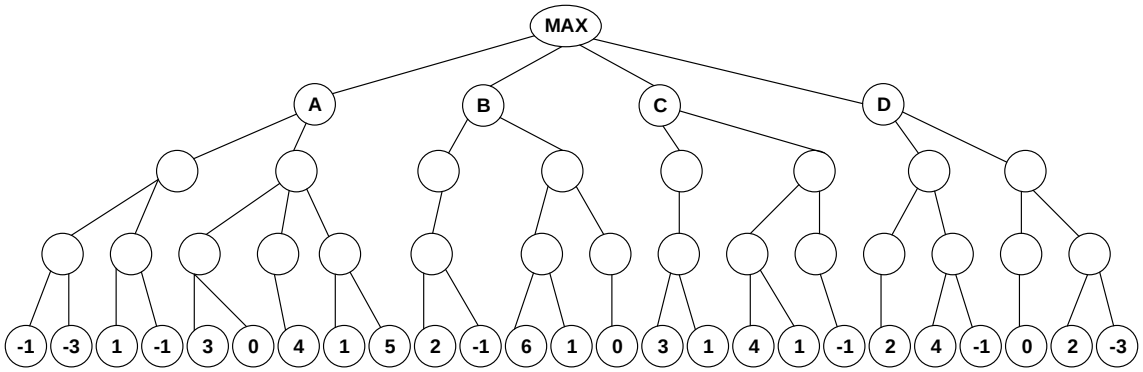
13) Let be the search tree of the figure, where the value inside the node is the heuristic value of the node and the numeric value on the arcs is the operator cost. The nodes which are labeled as A, B, C and D denote goal nodes. If we apply an A-type search strategy, which goal node is found at first place?



A. A
B. B
C. C
D. D

---

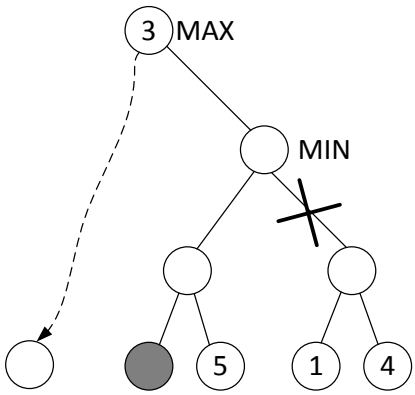
14) Show the branch that will be selected after applying the α-β pruning to the game tree of the figure:



A. A
B. B
C. C
D. D

---

15) Which provisional value should the shadowy mode have in order to get the cutoff shown in the figure?



A. [-∞ , 2]
B. [-∞ , 3]
C. [-∞ , 5]
D. The cutoff is not feasible