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DE VALÈNCIA

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INFORMÁTICOS Y COMPUTACIÓN

Escuela Técnica Superior de Ingeniería Informática



**Departamento de Sistemas Informáticos y Computación
Escuela Técnica Superior de Ingeniería Informática
Universitat Politècnica de València**

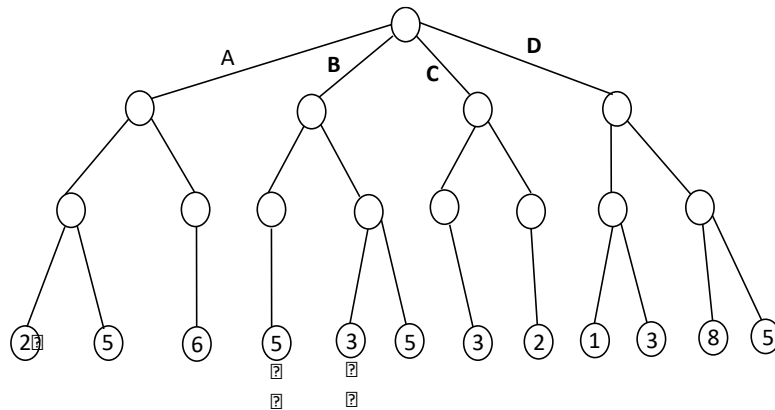
SOLUTIONS TO COLLECTION OF EXERCISES INTELLIGENT SYSTEMS

Block 1: Adversarial Search

November 2022

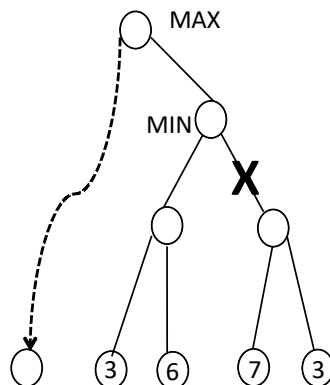
MULTIPLE CHOICE QUESTIONS

- 1) Given the following game search space, which is the best move for the root MAX node if we apply an alpha-beta algorithm?



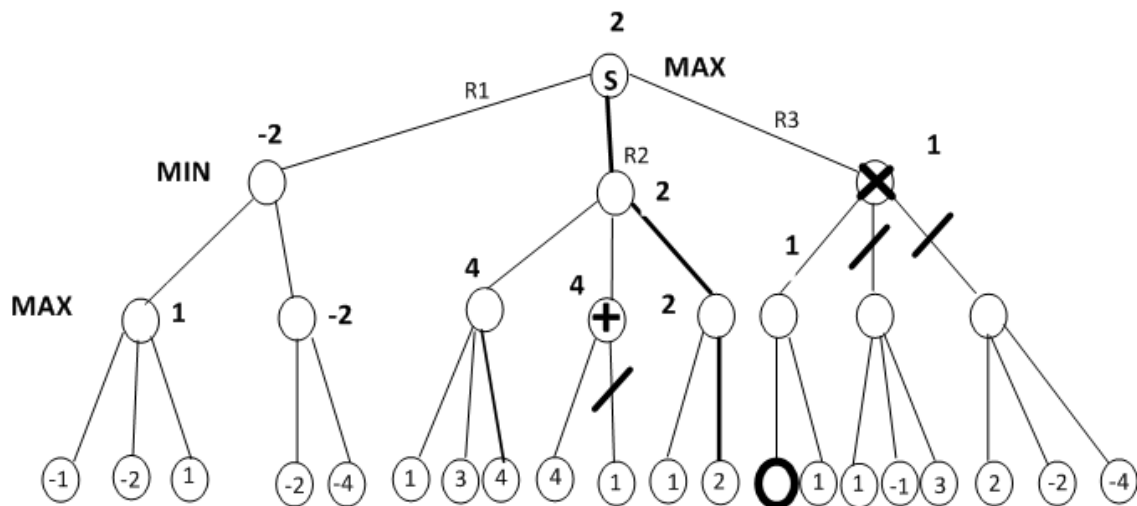
- A. Branch A
- B. Branch B
- C. Branch C
- D. Branch D

- 2) Given the following partial tree of an alpha-beta algorithm, which provisional backed up value should the node MAX have for that the cut-off is produced?



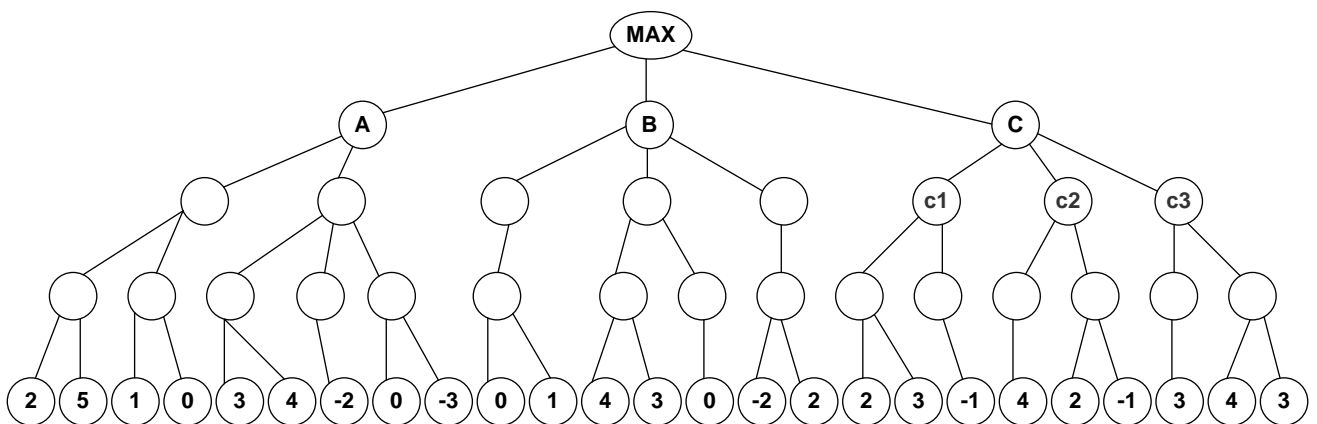
- A. 7
- B. Higher or equal than 6
- C. Lower or equal than 6
- D. Lower than 3

- 3) Given the search space of a game shown in the figure, which value should the terminal node in bold type have?



- A. $[-\infty, 1]$
- B. 1
- C. $[2, +\infty]$
- D. It is not possible to determine the value of the terminal node with the available data

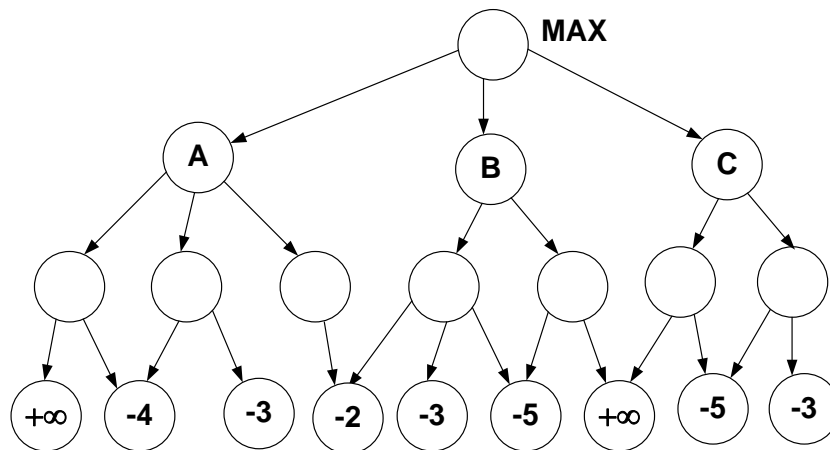
4) Given the game tree of the figure, which is the best move for MAX (root node) if we apply an alpha-beta procedure?



- A. Branch A
- B. Branch B
- C. Branch C
- D. Branch A or branch B

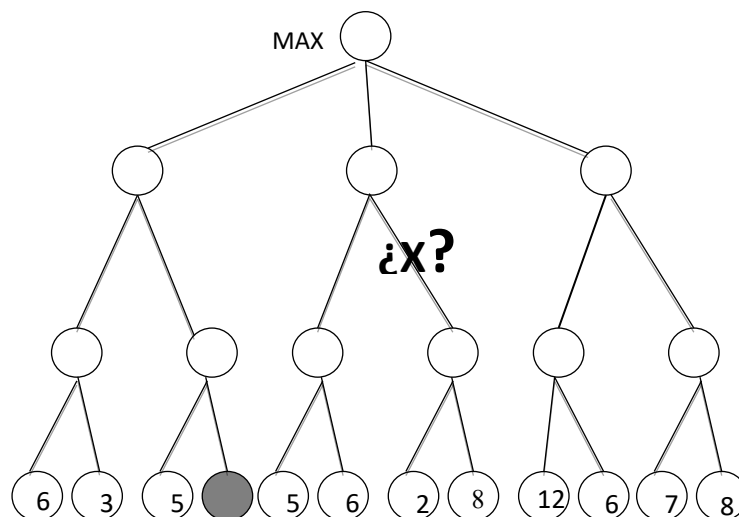
5) Given the game tree of the figure and assuming we apply an alpha-beta procedure:

- 7) 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:



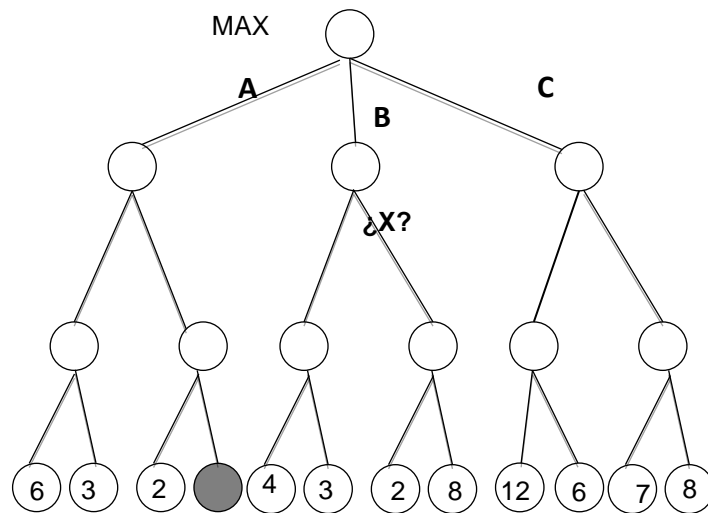
- A. MAX will choose any of the three branches because all of them lead to a winning position for MAX
- B. MAX will choose the branch A
- C. MAX will choose the branch B
- D. MAX will choose the branch C

- 8) 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)

9) Given the game tree of the figure and assuming we apply an alpha-beta algorithm:



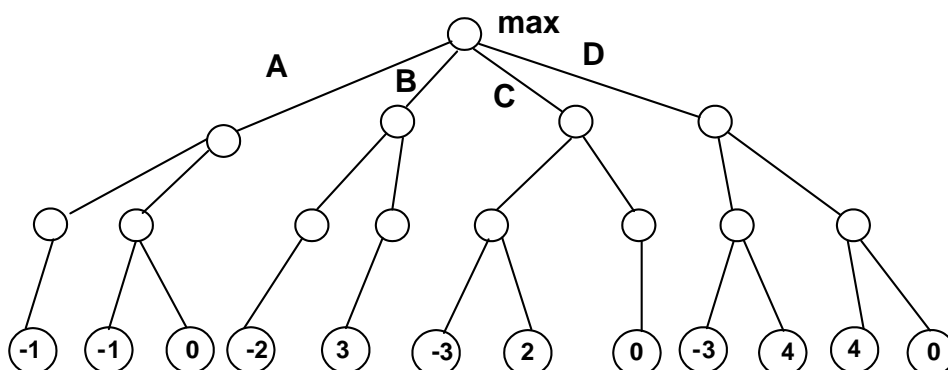
which is the value that the shadowed node should have in order to get the cut-off of the figure?

- A. Any value
- B. A value lower than 3
- C. A value higher or equal than 4
- D. The cut-off would never be produced (or none of the above answers)

10) Given the game tree of the above figure and assuming the cut-off is produced, after applying an alpha-beta algorithm:

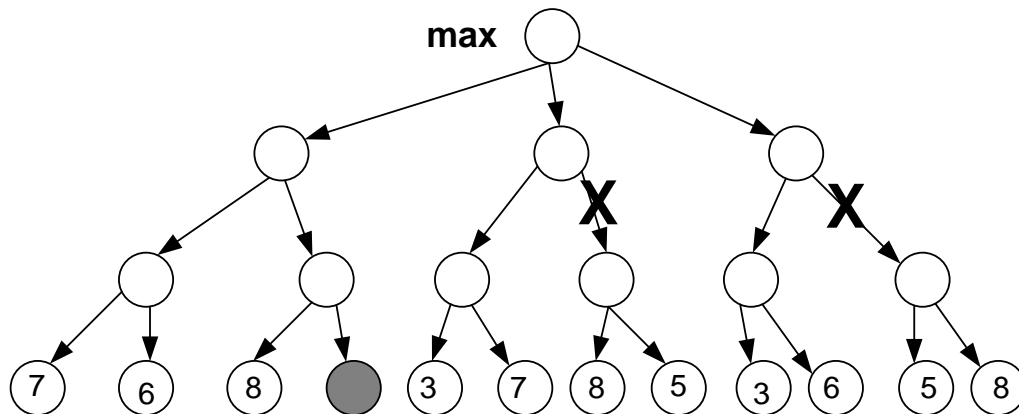
- A. MAX will choose branch A
- B. MAX will choose branch B
- C. MAX will choose branch C
- D. MAX will choose either branch A or B

11) Assuming we apply an ALPHA-BETA algorithm on the game tree of the figure, how many nodes do we save with compared to MINIMAX?



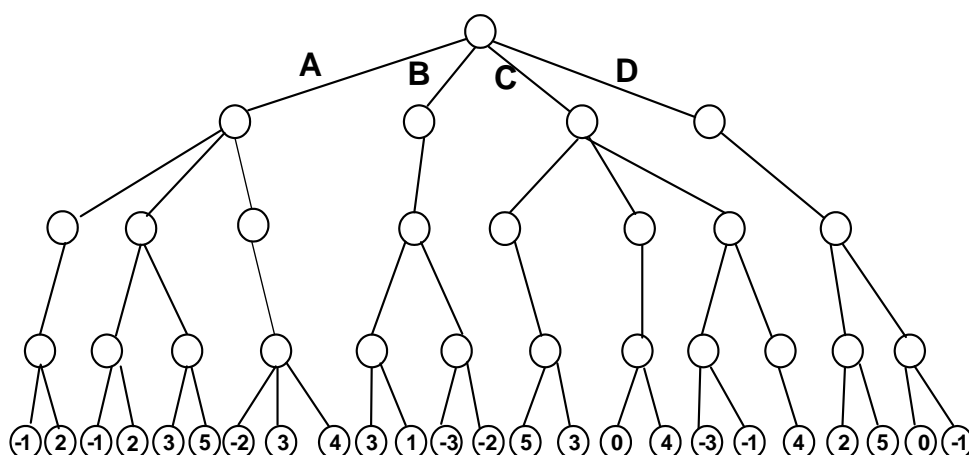
- A. 3
- B. 4
- C. 5
- D. 6

12) Assuming we apply an ALPHA-BETA procedure on the game tree of the figure, which value should the shadowed node have to provoke the shown cut-offs?



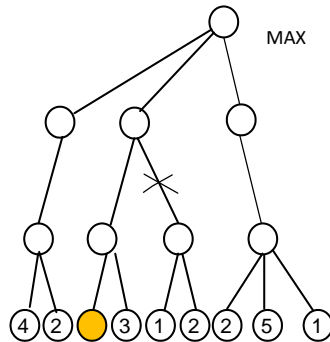
- A. Equal or higher than 7
- B. Equal or higher than 8
- C. Equal or lower than 7
- D. Any value would provoke the cut-offs

13) Which branch of the game tree of the figure below will be chosen if we apply the MINIMAX algorithm?



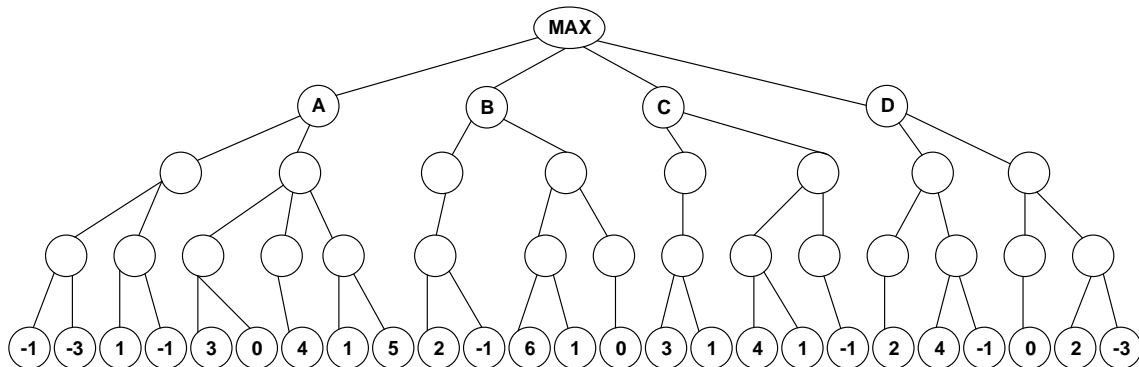
- A. A
- B. B
- C. C
- D. D

14) Which values should the shadowy node have so that the cutoff of the figure is always produced?



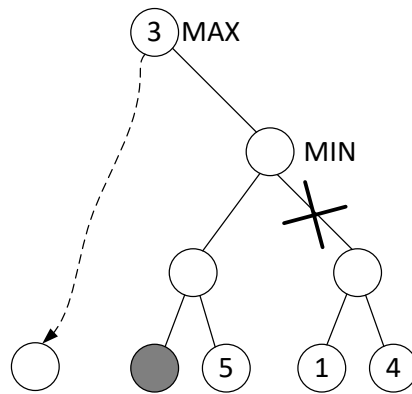
- A. Any value in $[-\infty 4]$.
- B. Any value.
- C. Any value in $[4 +\infty]$.
- D. The cutoff can never happen.

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



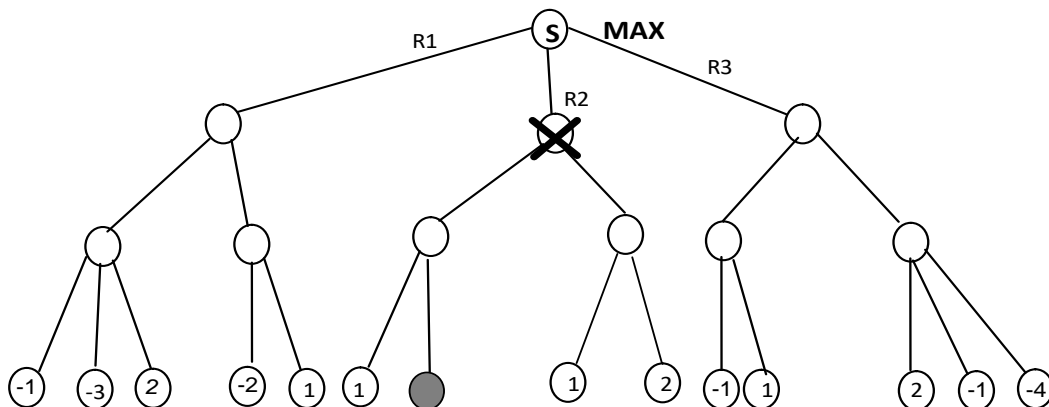
- A. A
- B. B
- C. C
- D. D

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



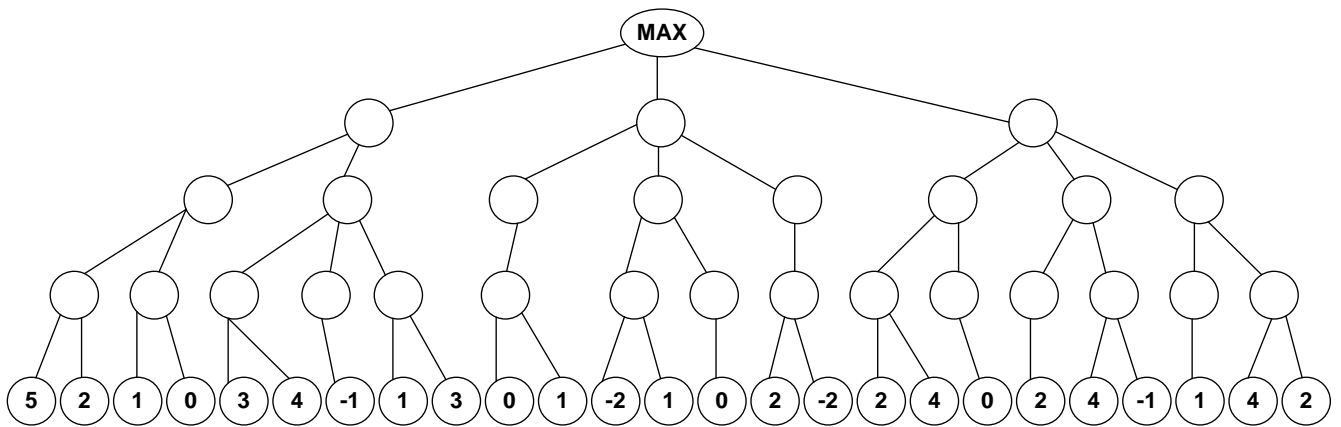
- A. $[-\infty, 2]$
- B. $[-\infty, 3]$
- C. $[-\infty, 5]$
- D. The cutoff is not feasible

17) The figure below shows a game search tree. If we apply an alpha-beta procedure, which value should the shadowy node take on so that the cutoff in branch R2 is produced?



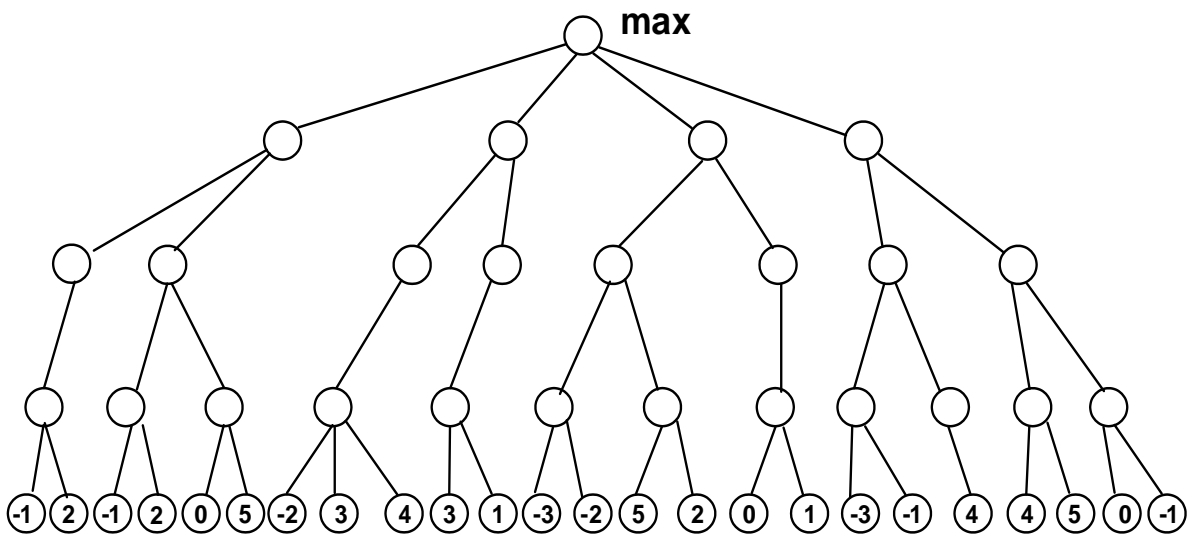
- A. Any value in $[-\infty, 1]$
- B. Any value in $[1, +\infty]$
- C. The shadowy node can only take on the value 1.
- D. The cutoff of the figure cannot be produced.

18) Given the below game search tree and assuming we apply an alpha-beta procedure, how many terminal nodes do not need to be generated?



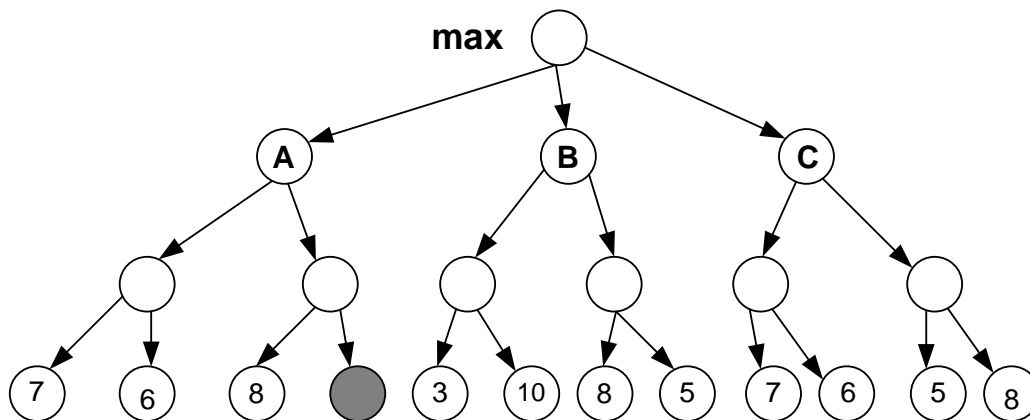
- A. 13
- B. 15
- C. 16
- D. 17

19) Show how many terminal nodes would be generated if we apply an alpha-beta procedure to the game tree of the figure:



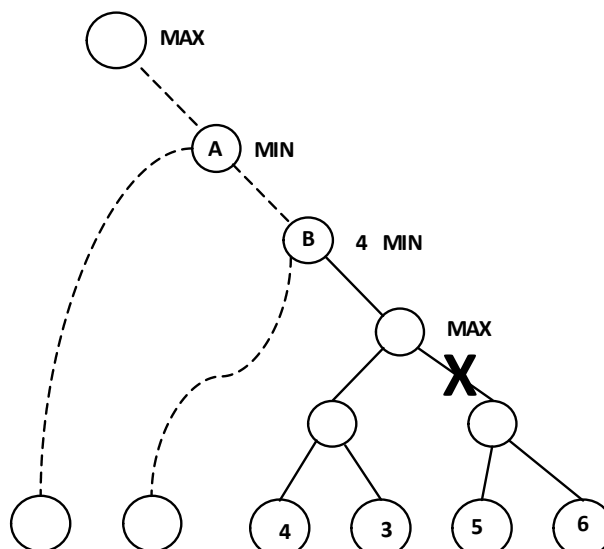
- A. 13
- B. 12
- C. 11
- D. 14

20) Given the game search tree below, and assuming we apply an alpha-beta procedure, show the **CORRECT** answer:



- A. If the shadowed node takes on a value ≤ 8 , an alpha cut-off will be produced in both node B and node C.
- B. If the shadowed node takes on a value ≥ 10 , an alpha cut-off will be produced in both node B and node C.
- C. Regardless the value of the shadowed node, an alpha-beta cut-off will be always produced in node B.
- D. Regardless the value of the shadowed node, an alpha-beta cut-off will be always produced in node C.

21) In the partial alpha-beta search of the figure below, the node B has a provisional backed-up value of 4. Which provisional value should node A have so that the effective cut-off shown in the figure is produced?

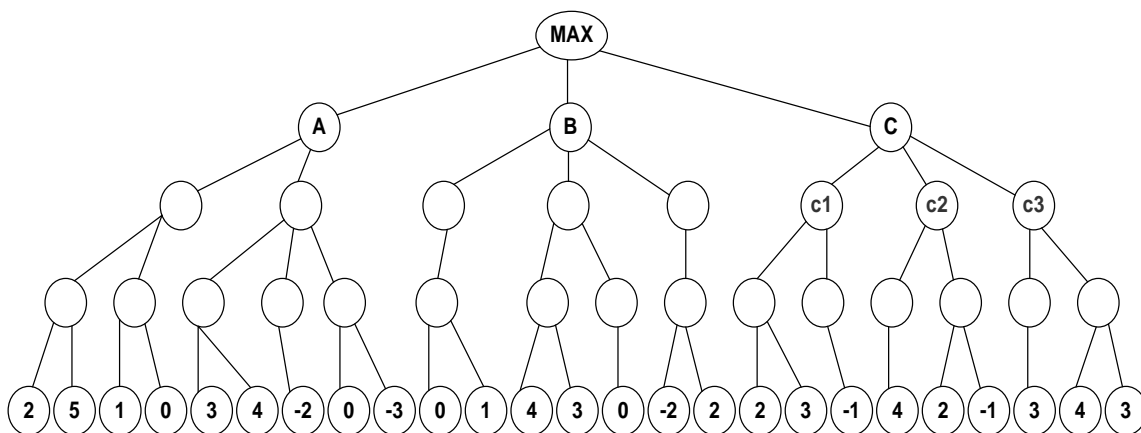


- A. The cutoff of the figure can never be produced.
- B. A value lower or equal than 3.
- C. A value higher or equal than 3.
- D. A value lower than 3.

22) Let n_1 and n_2 be the only two children nodes of a MAX node n in a game tree. We assume that node n_1 is explored first and then node n_2 . Show the **CORRECT** answer:

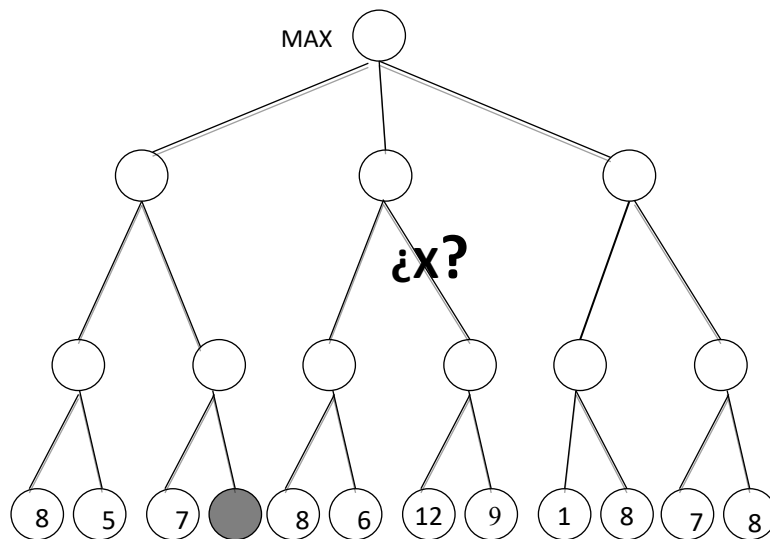
- A. The definite value of node n is the maximum value between the definite value of n_1 and n_2 only when n_1 and n_2 are terminal nodes.
 - B. When the value of n_1 is backed up to its parent n , the node n can have a previously backed up value.
 - C. When the value of n_1 is backed up to its parent n , a β cut-off can be produced in node n
 - D. None of the above answers is correct.
-

23) Which branch will be selected when we apply the α - β algorithm to the game tree of the figure?



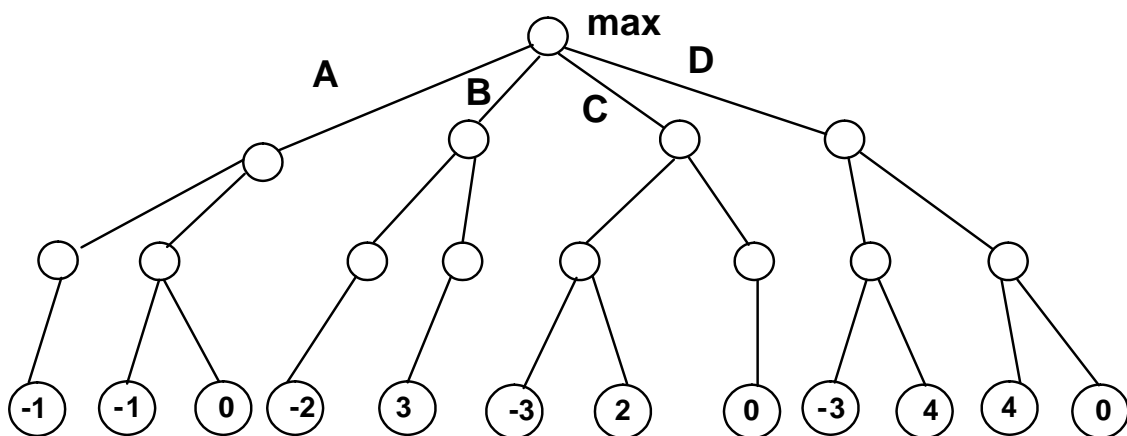
- A. Branch A
 - B. Branch B
 - C. Branch C
 - D. Branch A or B
-

24) Given the game search of the figure below, and assuming we apply an alpha-beta procedure, show the value that the shadowed node should have in order to get the cut-off shown in the figure.



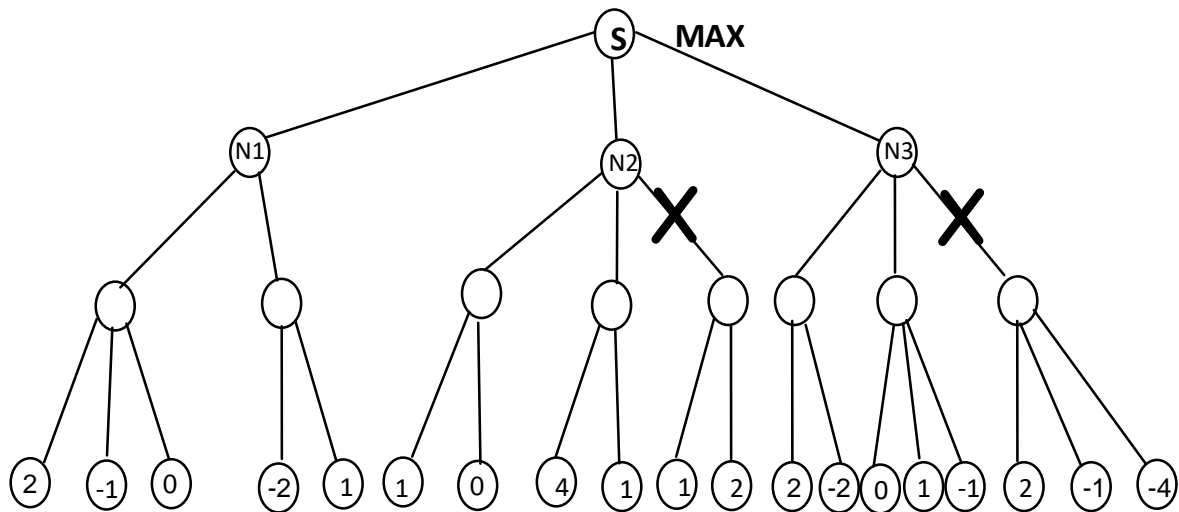
- A. Any value of the shadowed node would produce the cut-off.
- B. A value lower than 8.
- C. A value equal or higher than 8.
- D. The cut-off can never happen (or none of the above answers is correct).

25) Given the game search space of the figure, if we apply an alpha-beta procedure, how many nodes are not needed to be generated compared to the application of a MINIMAX algorithm?



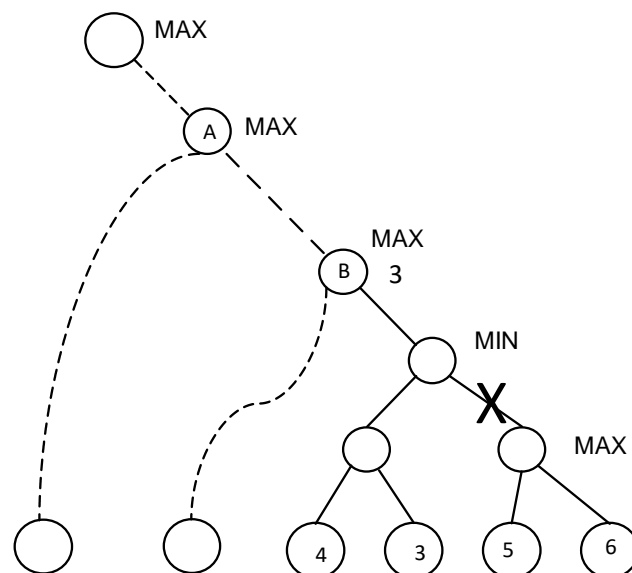
- A. 3
- B. 4
- C. 5
- D. 6

26) Given the game tree of the figure in which an alpha-beta procedure has been applied, show the **CORRECT** answer:



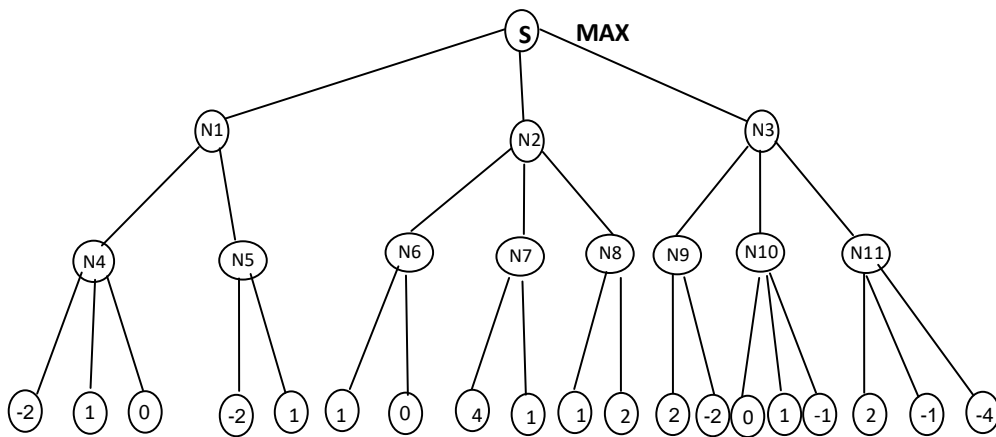
- A. A cut-off is produced in node N2, which would also prune the middle branch of N2
- B. A cut-off in N2 is not produced and so the right branch of N2 would not be pruned
- C. A cut-off is produced in node N3, which would also prune the middle branch of N3
- D. A cut-off in N3 is not produced and so the right branch of N3 would not be pruned

27) Given the partial game tree of the figure resulting from the application of an alpha-beta procedure, which provisional value should node A have so that it will provoke the cut-off the figure?



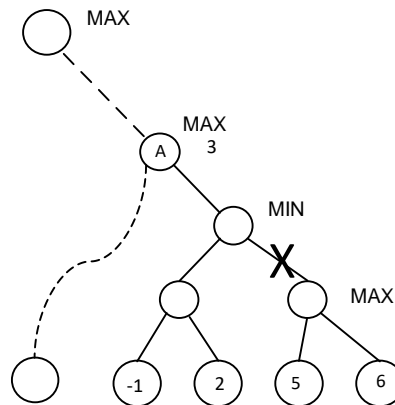
- A. Every value within the interval $[-\alpha, 3]$ would provoke the cut-off
B. Every value within the interval $[3, +\infty]$ would provoke the cut-off
C. Every value within the interval $[4, +\infty]$ would provoke the cut-off
D. The cut-off can never happen

28) Assume we apply an alpha-beta procedure to the game space of the figure. Show the **CORRECT** answer:



- A. A cut-off is produced in node N5
- B. A cut-off is produced in node N6
- C. A cut-off is produced in node N7
- D. A cut-off is produced in node N10

29) Given the partial alpha-beta of the figure below, show the **CORRECT** answer:



- A. The cutoff of the figure can never be produced.
- B. If the value -1 would be replaced by 4 then the cutoff would be produced
- C. If the value 2 would be replaced by 4 then the cutoff would be produced
- D. None of the above answers is correct.