

# Artificial Intelligence (COMP111)

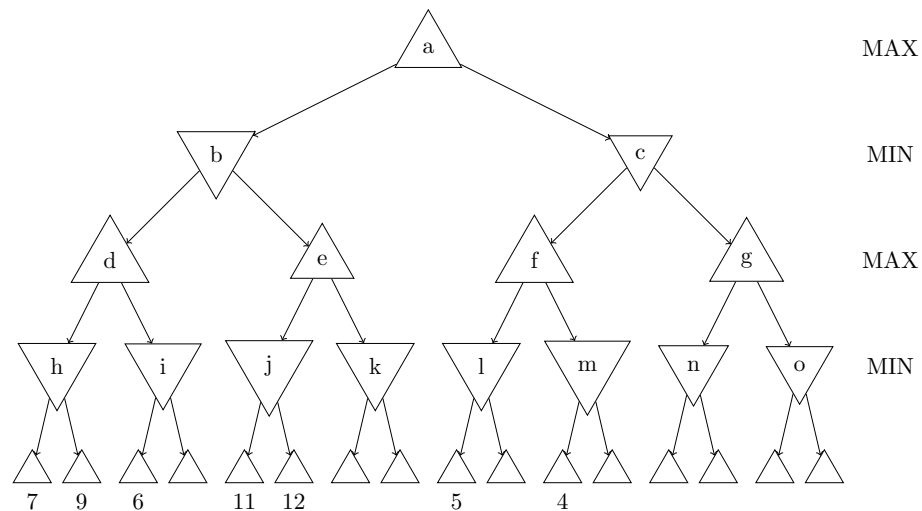
## Exercise 4

Your answers to Questions 4 and 6 should be submitted on canvas for assignment *Exercise 4* either as a text entry, a text file (txt), a pdf file, or a photo of the handwritten solution. The deadline is Monday, 9th of November, at 6pm. You should also attempt to answer the other questions before your tutorial (but not submit them).

You obtain 1 point (1 percent of the final mark) if you make a reasonable attempt to answer Questions 4 and 6 *and* actively participate in your tutorial in the week starting Monday 9th of November.

We would like to encourage you to discuss the questions with your fellow students, but do not copy your answer from anybody else.

1. Show that the minimax value of the state *a* is 7 in the following game tree:



The BBC maintains a variety of knowledge bases (ontologies) ([www.bbc.co.uk/ontologies/sport](http://www.bbc.co.uk/ontologies/sport)). In its sport ontology it introduces class names

- Competition, DevisionalCompetition,

- MultiRoundCompetition, KnockoutCompetition,
- LeagueCompetition, UnitCompetition,
- Match, MedalCompetition
- and many more class names related to competitions.

It uses the term '*A is subclass of B*' to state the rule

$$A(x) \rightarrow B(x)$$

and uses the term '*A is a superclass of B*' to state the rule

$$B(x) \rightarrow A(x)$$

2. List the rules that the BBC states for the class names given above.
3. Consider the atomic assertions
  - LeagueCompetition(PremierLeague).
  - KnockoutCompetition(FACup).

Using the algorithm given in the lecture notes, compute the set *DerivedAssertions* for the set  $K_r$  of rules from Question 2 and the set  $K_a$  consisting of the two atomic assertions above.

Let  $K$  be a knowledge base containing the rules  $K_r$ :

- $A_1(x) \wedge A_2(x) \rightarrow A(x)$
- $A_2(x) \wedge A_3(x) \rightarrow B(x)$
- $A(x) \rightarrow C(x)$

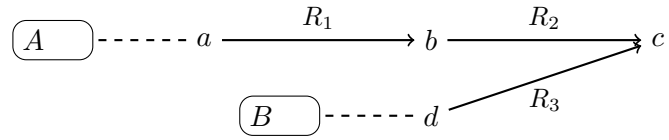
and the atomic assertions  $K_a$ :

- $A_1(a)$ ,  $A_2(a)$ , and  $A_1(b)$ .

4. Compute the set *DerivedAssertions* for the knowledge base  $K$ .
5. Using your answer to Question 4, decide whether  $K \models B(a)$  and whether  $K \models C(a)$ .
6. Which of the following statements are correct? Explain your answers.
  - $\{A(a), B(b), A(x) \rightarrow B(x)\} \models B(a)$ ?
  - $\{A(a), B(b), A(x) \rightarrow B(x)\} \models A(b)$ ?
7. Let  $K$  be a knowledge base containing the rules  $K_r$ :

- $A(x) \wedge R_3(x, y) \rightarrow C(x)$
- $R_1(x, y) \wedge R_2(y, z) \rightarrow R_3(x, z)$

and the following knowledge graph



Which of the following statements are correct?

- $K \models C(a)$ ?
- $K \models C(d)$ ?