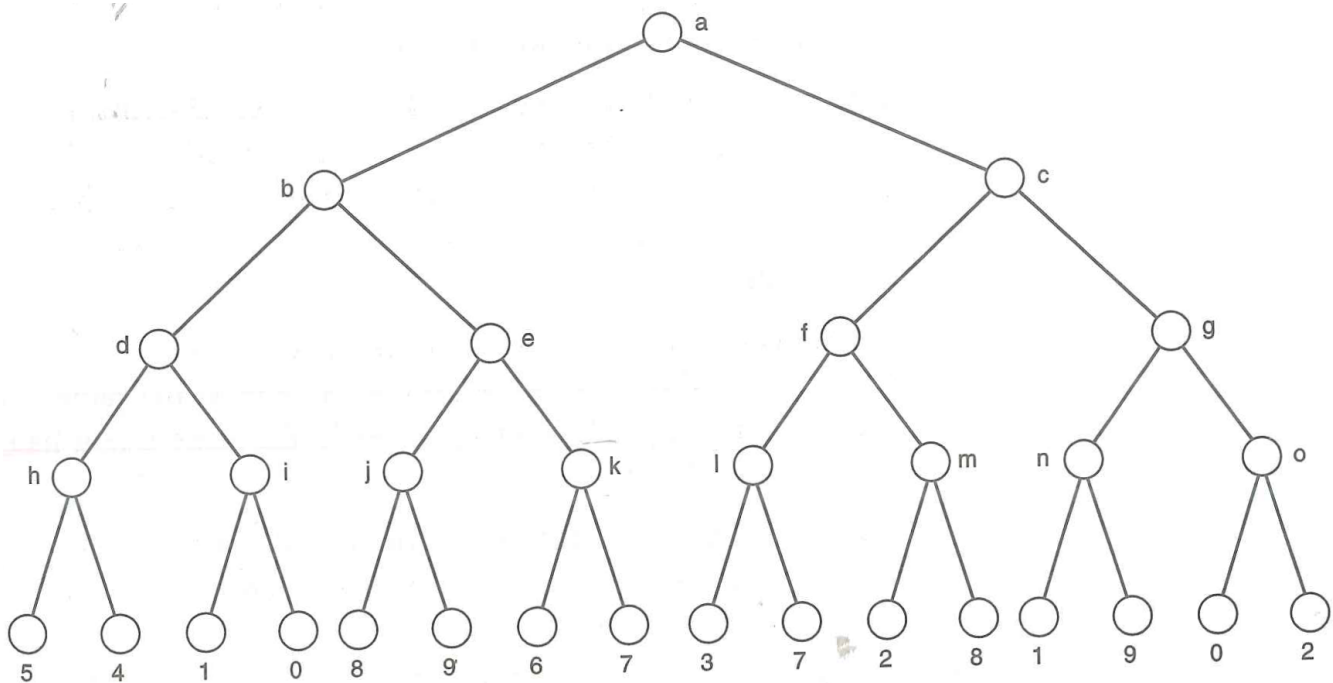# COURSEWORK   AI METHODS COB107

Answer all the following questions.

1. Suppose that the first mover is MAX. Solve the game tree given in Figure 1 (by labelling each node with a utilitiy and giving an explanation for it), for the following methods:

- Minimax algorithm. [3 marks]

- Alpha-beta pruning algorithm [3 marks]

Figure 1

2. In the 8-puzzle problem, 8 labelled tiles are fitted into a 3X3 square grid as shown in Figure 2. One space is left blank so that tiles can be moved around to form different patterns. The legal moves are:
   - move the blank up
   - move the blank down
   - move the blank left
   - move the blank right.

Figure 2

a	b	c
d	e	f
g	h	

Figure 3

a	e	b
	h	c
d	g	f

i.   Suppose S1 and S2 denote two distinct states of the 8-puzzle. Suppose R(S1) is the set of all those states that are reachable from S1 by one or more moves, and R(S2) is the set of all those states that are reachable from S2 by one or more moves. Write and explain a high-level depth-first search based algorithm that takes any two states S1 and S2 as input, and generates as output R(S1), R(S2), and R(S1)\R(S2) (where R(S1)\R(S2) is the set of elements that are in R(S1) but not in R(S2)).
See the illustration given overleaf.

[3 marks]

ii.   Implement the above algorithm in C++/Java. Your program must be well commented. A printed version of the source file must be submitted. You must also submit the source and executable files as electronic copies. In a separate document (this document must also be submitted in electronic and printed forms), give detailed instructions on how your program can be run and whether it runs on Mac or Windows. When your program is run, it must take any S1 and any S2 as input, and generate as output R(S1), R(S2), R(S1)\R(S2), |R(S1)| (where |R(S1)| denotes the number of elements in R(S1)) , |R(S2)|, and |R(S1)\R(S2)|.

[10 marks]

iii.   Suppose that that state S1 is as shown in Figure 2, and S2 is as shown in Figure 3. For this input, what is the number of states in R(S1), R(S2), and R(S1)\R(S2) generated by your program? This must be submitted as a printed copy.

[1 mark]

_____

Submission details:
- Answers to all questions (except the executable code of Question 2ii) must be typed and printed and physically submitted in the Admin Office in Schofield Building. All pages together with the coversheet must be securely stapled. If you use a folder, please ensure that the coversheet is visible.
- The answer to Question 2 ii (this includes the C++/Java program, the executable code and the instructions for running the program) must be uploaded on LEARN.

Example: This is an illustration for a 2X2 grid. The states that are reachable from the state

a	b
c	

are:

a	b
c	

a	
c	b

a	b
	c

	a
c	b

	b
a	c

c	a
	b

b	
a	c

c	a
b	

b	c
a	

c	
b	a

b	c
	a

	c
b	a
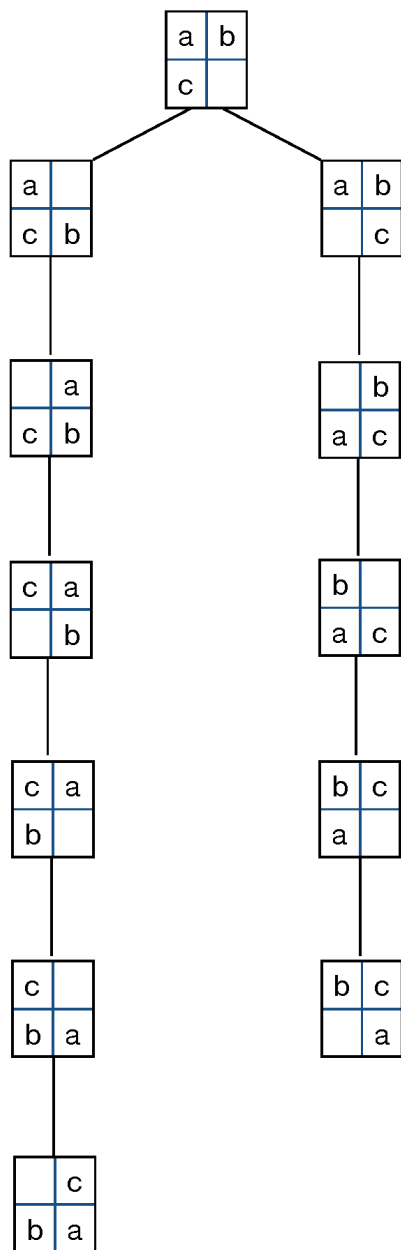
This is a 2X2 grid illustration. The problem to be solved in Question 2 of the coursework is for 3X3 grid.