PAPER CODE NO.	EXAMINER : Frank Wolter	Tel. No. 54238
COMP111	DEPARTMENT : Computer Science	

UNIVERSITY OF LIVERPOOL

TEST 1

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

TIME ALLOWED : 35 minutes

INSTRUCTIONS TO CANDIDATES

NAME OF CANDIDATE . . . . . .

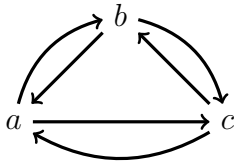
USUAL SIGNATURE . . . . . .

READ THE FOLLOWING CAREFULLY:

1. Each of the following questions comprise 5 statements, for which you should select the one most appropriate answer.
2. On this test paper, place a tick in the appropriate box to indicate your answer.
3. The mark is based on the overall number of correctly answered questions. The more questions you answer correctly, the higher your mark. Incorrectly answered questions do not count against you.
4. Enter your name and student ID number IN PENCIL on the computer answer sheet according to the instruction on that sheet. The digits should be entered in the boxes under Student ID Number and entered by means of horizontal lines in the appropriate boxes underneath, exactly as when answering questions.
5. When you have completed this test, read the instructions on the computer answer sheet carefully and transfer your answers from the test paper. Use a HB pencil to mark the computer answer sheet and, if you change your mind, be sure to erase the mark you have made. You may then mark the alternative answer.
6. At the end of the test, be absolutely sure to hand in BOTH this test paper AND the computer answer sheet.

THIS PAPER MUST NOT BE REMOVED FROM THE ROOM

1. Consider the following search graph with start state $s_{\text{start}} = a$.



Then the number of paths of length 2 starting at a is

☐ **A.** 1

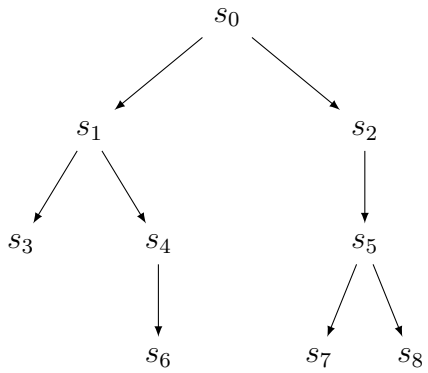
☐ **B.** 2

☐ **C.** 3

■ **D.** 4

☐ **E.** 5

The next two questions refer to the following search graph with start state $s_{\text{start}} = s_0$.



2. Which of the following sequences of expanded states can be obtained by a depth-first search algorithm?

(1) $s_0 s_1 s_2 s_3 s_4 s_5 s_6 s_7 s_8$

(2) $s_0 s_1 s_3 s_4 s_6 s_2 s_5 s_7 s_8$

(3) $s_0 s_2 s_5 s_8 s_7 s_1 s_4 s_6 s_3$

(4) $s_0 s_2 s_1 s_5 s_8 s_7 s_3 s_4 s_6$

☐ **A.** (1), (2), and (3) only

☐ **B.** (2) only

☐ **C.** (3) only

■ **D.** (2) and (3) only

☐ **E.** (2) and (4) only

3. Suppose a breadth-first search algorithm A is applied to the search graph, and $S_{goal} = \{s_7\}$. Which of the following sequences of frontiers could be the beginning of the sequence of frontiers computed by A?

(1) $\{s_0\}, \{s_0 s_1, s_0 s_2\}, \{s_0 s_2, s_0 s_1 s_3, s_0 s_1 s_4\}, \{s_0 s_2, s_0 s_1 s_3, s_0 s_1 s_4 s_6\}$

(2) $\{s_0\}, \{s_0 s_1, s_0 s_2\}, \{s_0 s_1, s_0 s_2 s_5\}, \{s_0 s_2 s_5, s_0 s_1 s_3, s_0 s_1 s_4\}$

(3) $\{s_0\}, \{s_0 s_1, s_0 s_2\}, \{s_0 s_1, s_0 s_2, s_0 s_2 s_5\}$

(4) $\{s_0\}, \{s_0 s_1, s_0 s_2\}, \{s_0 s_2, s_0 s_1 s_3, s_0 s_1 s_4\}, \{s_0 s_2, s_0 s_1 s_4\}$

☐ **A.** (1) only

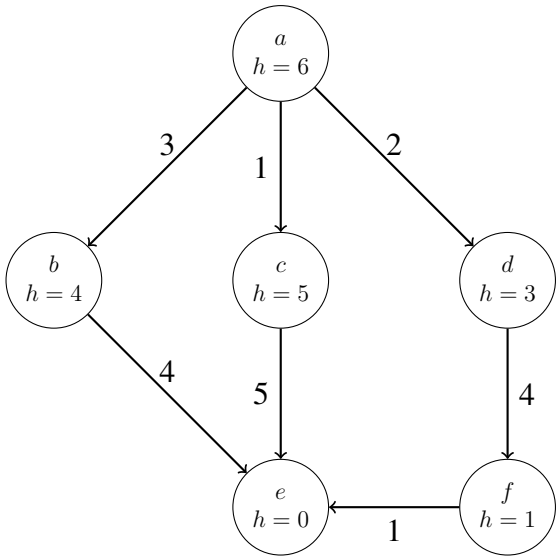
■ **B.** (2) only

☐ **C.** (2) and (3) only

☐ **D.** (3) and (4) only

☐ **E.** None

The next five questions refer to the following search graph with heuristic function h and start state $s_{\text{start}} = a$. It has a single goal state e. The heuristic value for each state is expressed within the state underneath the state name, and the cost of each action is shown next to the arrow representing the action.



4. Suppose a uniform cost search algorithm is applied to the search graph. After the expansion of a, what is the state that is expanded next?

☐ **A.** only b

■ **B.** only c

☐ **C.** only d

☐ **D.** b or d

☐ **E.** c or d

5. Suppose a greedy search algorithm is applied to the search graph. After the expansion of a, what is the state that is expanded next?

☐ **A.** only b

☐ **B.** only c

☐ **C.** b or c

■ **D.** only d

☐ **E.** c or d

6. Suppose a greedy search algorithm is applied to the search graph. What path is returned and what is its cost?

☐ **A.** abe with a cost of 7

☐ **B.** ace with a cost of 6

■ **C.** $adfe$ with a cost of 7

☐ **D.** $adfe$ with a cost of 17

☐ **E.** Does not return any path because it does not reach the goal state

7. Suppose an A* search algorithm is applied to the search graph. After the expansion of a, what is the state that is expanded next?

☐ **A.** only b

☐ **B.** only c

☐ **C.** b or c

☐ **D.** only f

■ **E.** only d

8. Suppose an A* search algorithm is applied to the search graph. What path is returned and what is its cost?

☐ **A.** abe with a cost of 7

☐ **B.** abe with a cost of 17

■ **C.** ace with a cost of 6

☐ **D.** $adfe$ with a cost of 7

☐ **E.** adf with a cost of 6

9. Which of the following is false?

☐ **A.** $\{A(a), A(x) \to B(x)\} \models B(a)$

☐ **B.** $\{A(a), A(x) \to B(x)\} \models A(a)$

☐ **C.** $\{A(a), A(x) \to B(x), B(x) \to C(x)\} \models C(a)$

■ **D.** $\{B(a), A(x) \to B(x)\} \models A(a)$

☐ **E.** $\{B(a), B(x) \to A(x)\} \models B(a)$

10. Let K be a knowledge base containing the rules K_r:

- $B(x) \to C(x)$
- $A_1(x) \wedge A_2(x) \to B(x)$
- $B(x) \to A_1(x)$

and the atomic assertions K_a:

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

Let *DerivedAssertions* be the set of assertions that follows from K. The lecture notes give an algorithm computing *DerivedAssertions* from K. Then *DerivedAssertions*

☐ **A.** contains exactly $A_1(a)$, $A_2(a)$, and $B(b)$.

☐ **B.** contains exactly $A_1(a)$, $A_2(a)$, $B(a)$, $C(a)$ and $B(b)$.

☐ **C.** contains exactly $A_1(a)$, $A_2(a)$, $B(a)$, $C(a)$, $B(b)$ and $C(b)$.

■ **D.** contains exactly $A_1(a)$, $A_2(a)$, $B(a)$, $C(a)$, $B(b)$, $A_1(b)$ and $C(b)$.

☐ **E.** contains exactly $A_1(a)$, $A_2(a)$, $B(a)$, $C(a)$, $B(b)$, $A_1(b)$, $A_2(b)$ and $C(b)$.