



FACOLTÀ DI INGEGNERIA DELL'INFORMAZIONE

Artificial Intelligence 2007–08

Test 5 – September 24, 2008

RULES: You have 2 hours to complete the test

You can use no texts, written notes, computers, calculators, mobile phones

Please write your name and student ID number on all sheets

The solutions of exercises 1-2 and of exercise 3 should be written on different sheets

1. State space search (10+1 points)

- 1.1 Using pseudocode or a programming language of your choice, describe the general algorithm for tree search.
- 1.2 Then explain in details: (i) what changes are needed to turn the algorithm into a general algorithm for graph search; (ii) how the algorithm is adapted to obtain breadth-first search, depth-first search, and uniform-cost search.

2. Planning (10+1 points)

- 2.1 Explain how STRIPS represents: (i) states; (ii) goals; (iii) action schemes.
- 2.2 Explain the concept of Sussman's anomaly. Then completely specify in STRIPS a blocks world (with action schemes and initial state), and specify a goal that is an example of Sussman's anomaly.

3. Logic (10+1 points)

Given the following incomplete formula with 4 empty positions:

$$(p \Rightarrow q) [_1] [_2] [_3] [_4] q$$

provide 5 different combinations of symbols $\langle s_1, s_2, s_3, s_4 \rangle$ such that when written in positions 1 to 4 they transform the formula into 3 different tautologies and 2 different contradictions, respectively. Every formula must be provided with a proof of the fact that it is a tautology or a contradiction.

Note: a position may be left empty (symbol: $_$).

Example: the combination $\langle \wedge, _, _, _ \rangle$ would not be a correct answer, because it transforms the incomplete formula into $(p \Rightarrow q) \wedge q$, which is equivalent to q and, thus, is a contingency (not a tautology nor a contradiction).

Logic solution:

tautology examples:

1. $\langle \wedge, p, \Rightarrow, \perp \rangle$
2. $\langle \vee, q, \vee, \neg \rangle$
3. $\langle \Leftrightarrow, \neg, p, \vee \rangle$

contradiction examples:

4. $\langle \wedge, q, \wedge, \neg \rangle$
5. $\langle \wedge, p, \wedge, \neg \rangle$