

OLLSCOIL NA hÉIREANN GAILLIMH
NATIONAL UNIVERSITY OF IRELAND GALWAY

SEMESTER II EXAMINATIONS 2003

Exam Code 4IF1
Bachelor of Science in Information Technology

ARTIFICIAL INTELLIGENCE (CT421)

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Time allowed: *three* hours.

Attempt two questions from section A AND two questions from section B.

SECTION A

1. (a) Given the following database:

item_costs(hat, 3).

item_costs(coat, 5).

item_costs(jacket, 7).

item_costs(shoes, 3).

item_costs(trousers, 6).

item_costs(scarf, 4).

where *item_costs(X, Y)* is defined as item *X* costs *Y* Euros.

- (i) Write a rule *costs_less(X, Y)* which is true if item *X* costs less than *Y* Euros.

- What results would your rule return in answer to the query:

costs_less(X, 5).

(6 marks)

- (ii) Write a rule *costs_more(X, Y)* which checks if item *X* costs more than item *Y*.

- What results would your rule return in answer to the following queries:

costs_more(scarf, shoes).

costs_more(Jacket, scarf).

costs_more(X, Y).

(9 marks)

- (b) Describe the mechanism Prolog uses to attempt to satisfy queries. Illustrate your answer with an example.

(5 marks)

- (c) Describe the Closed World Assumption, in particular discuss its effect on Prolog.

(5 marks)

2. (a) Explain what is meant by Qualitative Reasoning. What are its advantages and disadvantages.
(4 marks)
- (b) Give an example of an application where Qualitative Reasoning would be suitable. Justify your answer.
(3 marks)
- (c) Give an example of an application where Qualitative Reasoning would not be suitable. Justify your answer.
(3 marks)
- (d) Given the following constraints (which represent the motion of a ball being thrown in the air):

$$DERIV(x, v)$$

$$DERIV(v, a)$$

$$a = g < 0$$

and the quantity spaces:

$$\{-\infty, 0, \infty\} \text{ for } v$$

$$\{0, top\} \text{ for } x$$

If the initial state is:

$$QS(x, t_1) = \langle top, std \rangle$$

$$QS(v, t_1) = \langle 0, dec \rangle$$

$$QS(a, t_1) = \langle g, std \rangle$$

What are the possible next states?

Rule-id	$QS(v, t_i)$	$QS(v, t_i, t_{i+1})$
P1	$\langle l_i, std \rangle$	$\langle l_i, std \rangle$
P2	$\langle l_i, std \rangle$	$\langle (l_i, l_{i+1}), inc \rangle$
P3	$\langle l_i, std \rangle$	$\langle (l_{i-1}, l_i), dec \rangle$
P4	$\langle l_i, inc \rangle$	$\langle (l_i, l_{i+1}), inc \rangle$
P5	$\langle (l_i, l_{i+1}), inc \rangle$	$\langle (l_i, l_{i+1}), inc \rangle$
P6	$\langle l_i, dec \rangle$	$\langle (l_{i-1}, l_i), dec \rangle$
P7	$\langle (l_i, l_{i+1}), dec \rangle$	$\langle (l_i, l_{i+1}), dec \rangle$

(10 marks)

- (e) What discrete states would the ball pass through after being thrown up into the air?
(5 marks)

3. (a) Given the following nodes:

$\langle X, \{\{A1, A2, A3\}, \{A2, A5, A7\}, \{A3, A7\}\} \rangle$

$\langle Y, \{\{A4, A6\}, \{A5\}, \{A1, A2, A3, A4\}\} \rangle$

$\langle Z, \{\{A7, A4\}, \{A2, A3\}\} \rangle$

(i) What would be the resulting nodes for V and W given the following rules:

if X and Y then V

if V and Z then W

(6 marks)

(ii) Using the results of 3(a)i what will be the new labels of the nodes for V, W, X, Y and Z if the following node is now added:

$\langle FALSE, \{\{A2, A7\}, \{A2, A3\}\} \rangle$

(4 marks)

(b) What are the differences between conventional search and AI search?

(5 marks)

(c) Describe each of the following search techniques. You should pay particular attention to the advantages and disadvantages of each of them.

(i) Breadth first search

(ii) Depth first search

(iii) Depth bound depth first search

(iv) Depth first search with iterative deepening

(v) Heuristic search

(10 marks)