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NATIONAL UNIVERSITY OF IRELAND GALWAY

SUMMER EXAMINATIONS 2004

Bachelor of Science in Information Technology

ARTIFICIAL INTELLIGENCE (CT421) - 4IF1

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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:

*distance(galway, oranmore, 5).*  
*distance(oranmore, loughrea, 17).*  
*distance(loughrea, ballinasloe, 18).*  
*distance(galway, ougtherard, 17).*  
*distance(galway, claregalway, 6).*  
*distance(claregalway, tuam, 14).*

where *distance(X, Y, Z)* is defined as the distance between place *X* and place *Y* is *Z* miles.

- (i) Write a rule *find\_distance(X, Y, Z)* which returns the distance between two adjacent towns. Your rule should work for both directions.

For example the query:

*find\_distance(galway, oranmore, Dist).*

would give the result:

*Dist = 5*

and the query:

*find\_distance(loughrea, oranmore, Dist).*

would give the result:

*Dist = 17*

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

*find\_distance(X, Y, 17).*

(6 marks)

- (ii) Write a rule *long\_distance(X, Y, Z)* which checks that the distance between towns *X* and *Y* is *Z*. Your rule should allow for longer journeys, for example the query:

*long\_distance(tuam, galway, Dist).*

would give the result:

*Dist = 20*

- What results would your rule return in answer to the following queries:  
`long_distance(ballinasloe, tuam, X).`  
`long_distance(Galway, loughrea, X).`  
`long_distance(X, Y, Z).`  
 (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) Given the following nodes:

`< X, {{A1, A2, A3}, {A2, A5, A7}, {A3, A7}} >`  
`< Y, {{A3, A6}, {A2, A5}, {A1, A2, A3, A4}} >`  
`< Z, {{A7, A4}, {A2, A3}, {A1, A5, A7}} >`

- (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 2(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:

`< FALSE, {{A2, A7}, {A2, A3}} >`

(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

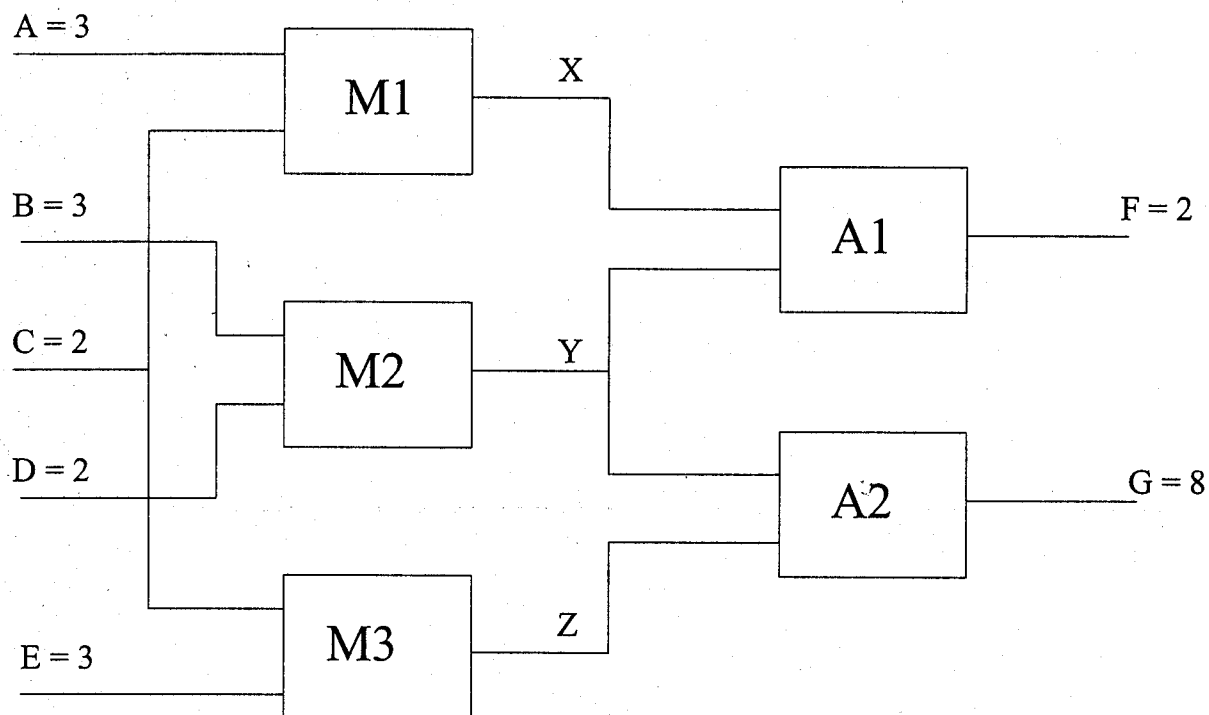
(iii) Depth bound depth first search

(iv) Depth first search with iterative deepening

(v) Heuristic search

(10 marks)

3. (a) Consider the following, simple, electrical circuit:



Show all the steps that GDE would take to determine likely fault candidates.

(10 marks)

(b) Describe how GDE discriminates between likely fault candidates.

(5 marks)

(c) What are the limitations of the GDE approach to fault diagnosis.

(5 marks)

(d) Describe both GDE+ and Sherlock, highlighting their approach to overcoming the limitations of GDE. What are the disadvantages of both of these techniques.

## SECTION B

4. (a) What do you understand by the term pathfinding in a game context?  
(5 marks)
- (b) Using the example of a two dimensional maze, outline any one pathfinding strategy for finding a way out of the maze  
(10 marks)
- (c) Comment on any AI middleware product of your own choosing under the following two headings: support for decisions, support for behaviour  
(10 marks)
5. (a) In the context of interactive narrative, what do you understand by the terms simulation and structured narrative?  
(7 marks)
- (b) Give an account of Mateas and Sterns interactive drama Faade under the following three headings: architecture, believable agents, drama management  
(18 marks)
6. (a) Explain what is meant by the term Hidden Markov Model?  
(5 marks)
- (b) Briefly outline how a bigram model could draw on a two dimensional array and a training set of quotes in order to generate text  
(11 marks)
- (c) With regard to Singhs vision of the Pragmatic Web, explain what is meant by each of the following three challenges: interaction, composition, compliance and trust  
(9 marks)