

Fall 2004.05

American University of Beirut
Faculty of Arts and Science,
Department of Mathematics and Computer Science

CMPS 287 Final
Artificial Intelligence
Exam duration: 2 hours

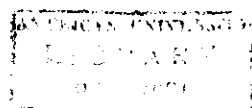
Name: _____

ID: _____

Question 1: (10 marks)

- A. (2 marks) A method which can be used to be build an intelligent system for any domain is said to be highly _____. A method which can be used very effectively to solve a problem for a specific domain is said to be highly _____ thus, search methods are highly _____.
- B. (3 marks) Trace the execution of A* in finding the shortest path from *Arad* to *Bucharest* (see Romanian map attached). Use the straight line distance estimate included on the map as your admissible function. Show stages involved on the back of this question sheet (note each stage increases the search depth by 1).
- C. (3 marks) Prove that A* is optimal if the heuristic function is admissible

- D. (2 marks) When the search state in a two player game does not seem to be promising for either player it is said to be _____. In games which involves throwing a dice, a minimax tree has to be interleaved with _____ nodes.





Question 2: (10 marks)

A. (2 marks) Define the following

Knowledge Acquisition Bottleneck _____

Occam's Razor _____

B. (2 marks) Name three niche application areas of *Machine learning* and give one domain of each area:

1. _____

2: _____

3: _____

C. (3 marks) What are the first four steps to formulate a problem as a Machine Learning problem? Illustrate these steps in a domain of your choice.

Your example: _____

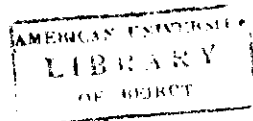
Step 1: _____

Step 2: _____

Step 3: _____

Step 4: _____

D. (3 marks) What is *overfitting*? Describe two approaches to deal with it when inducing decision trees.



Question 3: (8 marks)

A. For the following dataset, show the steps for inducing a decision tree using the information gain criterion.
(6 marks)

	Outlook	Temperature	Humidity	Wind	Play_tennis
1	Sunny	Hot	High	Weak	Yes
2	Sunny	Hot	High	Strong	No
3	Overcast	Mild	High	Weak	Yes
4	Sunny	Mild	Normal	Strong	Yes
5	Overcast	Hot	Normal	Weak	Yes
6	Rain	Mild	High	Strong	No



D. Give three attributes which are useful for the learning task of *Speaker Verification* (2 marks)

Question 4: (10 marks)

A. (2 marks) Give an example of a function which cannot be learnt using a perceptron (illustrate with a diagram)

B. (4 marks) Implement the XOR (exclusive or) using two layers of perceptrons with suitable thresholds and weights



C. (4 marks) Give strengths and weaknesses of each of the learning methods for a perceptron: *the perceptron training rule* and *the gradient descent*

D. (2 marks) Give a brief description of the backpropagation algorithm

----- Good luck