Answer TWO questions out of THREE

This examination is worth 50%. The coursework was worth 50%

Note: This is a specimen paper

University approved calculators without text storage facilities MAY be used.
Question 1

(a) Give the four properties that are considered for search algorithms, and give a brief explanation of each. (4 marks)

(b) In the context of the $A^*$ algorithm, explain what an admissible and a consistent heuristic functions are. (5 marks)

(c) For what choice of heuristic function does $A^*$ reduce to breadth-first search? Using a problem such as n-queens as an example, explain how you would go about choosing a heuristic function for a given problem. (7 marks)

(d) What does it mean for $A^*$ to be optimal? Give a proof that $A^*$ is optimal. (9 marks)
Question 2

(a) What are the components of an agent function? What is the difference between a rational function and an irrational one?  
(5 marks)

(b) How does the environment of a robot insect differ from that of a chess program?  
(10 marks)

(c) What is the symbol grounding problem? Is it a practical problem for AI practitioners? Explain your answer.  
(10 marks)
Question 3

Figure shows a Bayesian network where each of the letters denote binary variables that can take the values *true* or *false*.

(a) Say how many independent entries would the joint probability table for $P(A, B, C, D, E)$ require if we did not have access to the conditional independence information from the network, and write down the joint probability distribution implied by the network.

(5 marks)

(b) When using the network, how many independent values for the probabilities are required? Explain your answer.

(3 marks)

(c) When building a Bayesian Network why is node ordering important? How does it affect calculations made using the network? Is there a general scheme one should follow when constructing a Bayesian Network to represent a problem?

(7 marks)

(d) A patient comes to a doctor with symptom S. The doctor knows that 20% of the people with this symptom have a disease D from which they will die if not operated on immediately. However, the operation is dangerous with 60% fatality, irrespective if the patient has the disease or not. The doctor knows that 60% of the people with D have blood type O, whereas only 30% of the population has this blood type. On performing a blood test the person does not have blood type O should the doctor operate?

(10 marks)