UNIVERSITY OF BRISTOL
DEPARTMENT OF COMPUTER SCIENCE

Final Year Examination for the Degrees of
BSc, BEng, BA and MEng

COMS 30106

ARTIFICIAL INTELLIGENCE

This paper contains *FOUR* questions.
The best *THREE* answers will be used for assessment.

Please use *ONE* blue answer book.

Q1   a)   Let h_1 and h_2 be heuristic functions. Define what is meant by: "h_1 is more informed than h_2" and "h_1 is admissible". Explain the principle of graceful decay of admissibility and briefly discuss its practical use.
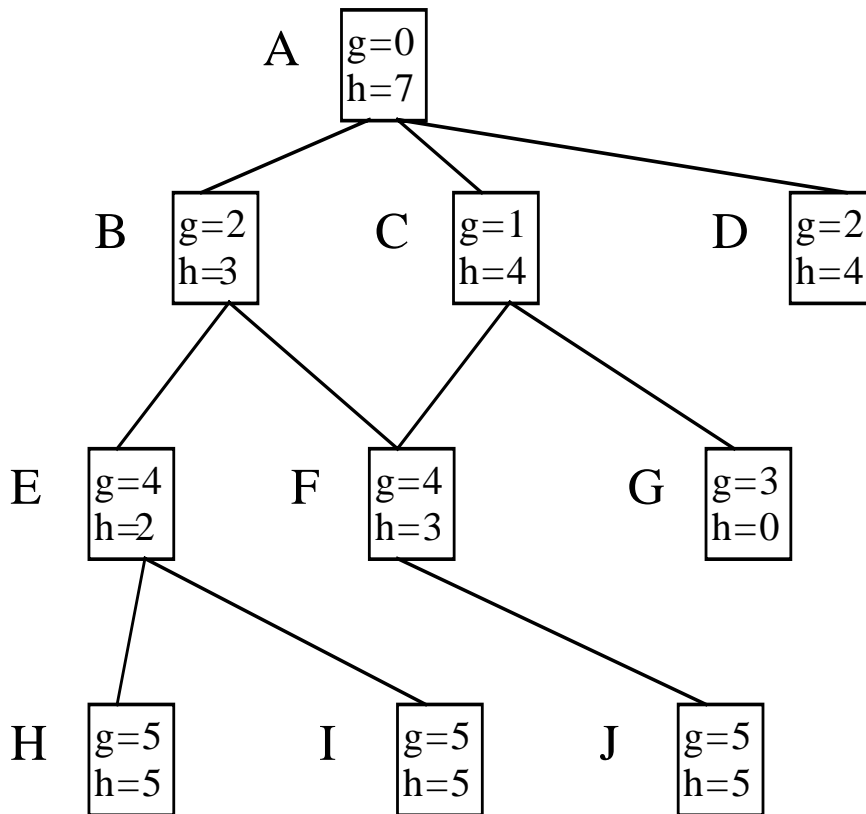
[4 marks]

b)   Describe in some detail the components of a production system. Use the 8-puzzle or N-queens to illustrate your definition.
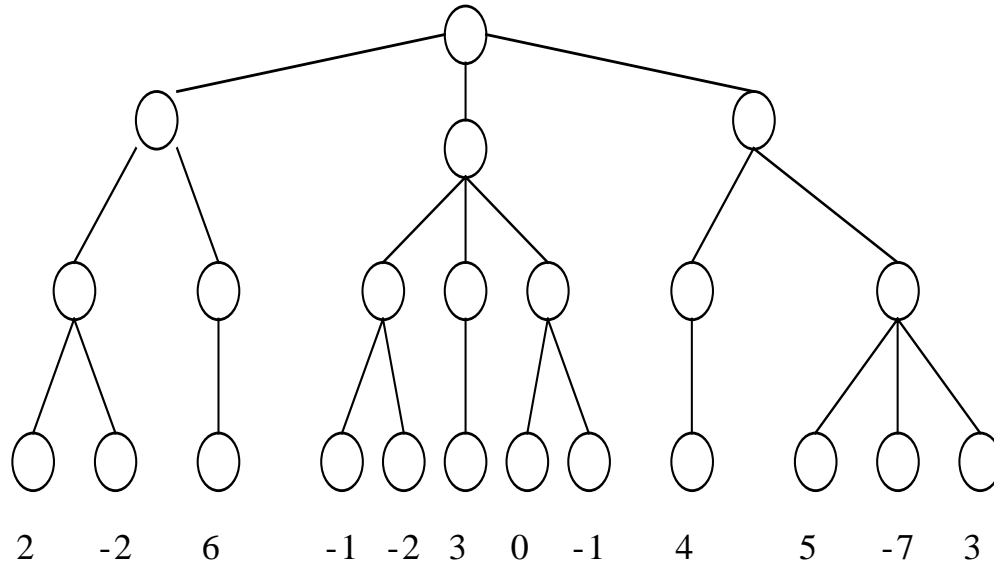
[5 marks]

c)   In the equation $f = g+h$, what is g? What is h? What does the use of g guarantee about the solution path? What added benefit is gained by using h as well? Given the following search tree , list the order in which nodes are visited by (i) depth-first search, (ii) best-first search and (iii) A* search.

[7 marks]

d)   In the following game tree, it is the turn of Max to move at the root. Using minimax, find the next best move for Max (show your work). Add α - β pruning to your search and show which branches would be pruned (show your work).

[4 marks]

2   -2   6   -1 -2 3   0   -1   4   5   -7   3

Q2 a)   List and describe the function of the five architectural components of an expert system. Indicate which of these are shell components.

[6 marks]

b)   Define the role of the knowledge engineer in expert system design. Why is it recommended that the knowledge engineer be a novice in the field? List three characteristics of expertise that make knowledge engineering difficult.

[5 marks]

c)   Consider the following applications. For each, state whether an expert system approach to their solution is appropriate. Justify your answers (hint: think of guidelines discussed in class).

   i)   Solving systems of linear equations.
   ii)   Diagnosing pulmonary infections in children.
   iii) Identifying rocks on the surface of Neptune.
   iv)   Getting to work safely.

[6 marks]

d)   State the physical symbol system hypothesis and briefly discuss its consequences (e.g., impact on AI research, etc).

[3 marks]

Q3 a) Give a formal description of the generalisation problem. Describe two generalisation operators and illustrate each with an example.

[6 marks]

b) Assume that ID3 is modified so that the selection criterion for properties is: "From the set of available properties, choose the one that has the largest number of possible outcomes". Construct a decision tree using the modified ID3 for the following set of examples. Show your work (ie, each step of the algorithm).

[8 marks]

P_1 has outcomes A, B

P_2 has outcomes X, Y, Z, T

P_3 has outcomes U, V, W

	P_1	P_2	P_3	Class
1	A	X	V	C_1
2	B	Y	U	C_1
3	A	Z	U	C_2
4	B	Z	W	C_1
5	B	X	V	C_2
6	A	X	U	C_2
7	B	Z	V	C_2
8	A	T	V	C_2
9	B	X	W	C_1

c) Give an outline of the genetic algorithm. What is the role of the fitness function? What is the purpose of cross-over? What is the purpose of mutation?

[6 marks]

Q4   a)   Briefly describe the Turing test. Discuss the validity, limitations, pros and cons of the Turing test as a test of intelligence.

[5 marks]

b)   What is the difference between supervised and unsupervised learning? Illustrate each one with a specific example. Give an outline of the competitive learning algorithm.

[6 marks]

c)   What does it mean for a neural network to exhibit graceful degradation? List two other properties of neural networks that make them attractive as AI models. Give an outline of the back propagation algorithm.

[5 marks]

d)   Briefly describe semantic networks, frames and scripts. Be sure to mention content and use of each of the knowledge representation techniques.

[4 marks]