Paper Code	Examiner	Department	Ext
CSE 202		Computer Science & Software Engineering	

Xi'an Jiaotong-Liverpool University
西交利物浦大學

2015/16 Semester 2 - Resit Exam

Bachelor Degree - Year 3

Introduction to Artificial Intelligence

Time Allowed : 2 Hours

Instructions to Candidates

1. Total marks available are 100. This will count for 80% in the final assessment.
2. Answer all questions.
3. The number in the column on the right indicates the marks for each section.
4. Answer should be written in the answer booklet(s) provided.
5. All the answers must be in English.

Question 2 (20 marks)

Answer the following questions. Each question is worth 4 points.

1. What is the main difference between conventional computer programs and production systems (rule-based systems)?

2. What does each of the lettered items in the Figure 1 represent?

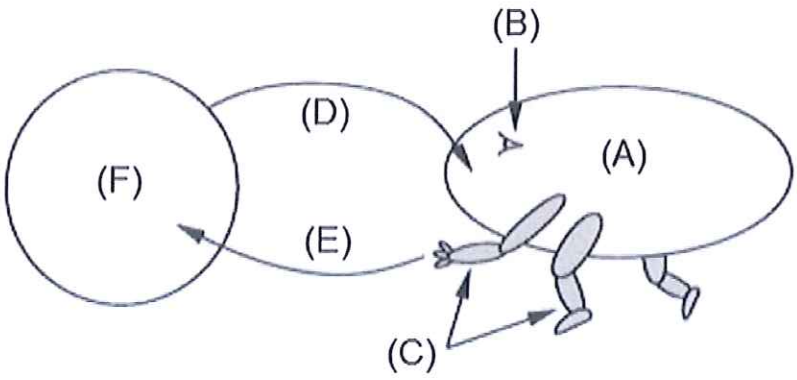
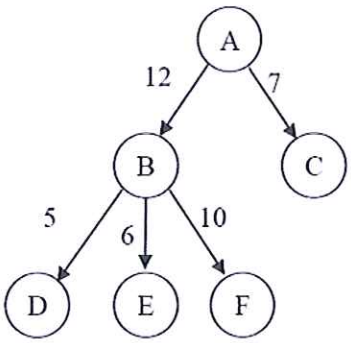


Figure 1: Figure for Question 2-2.

3. The graph in Figure 3 shows an A^* search in progress. Which node should be expanded next: C, D, E, or F? Why? (The numbers on the graph are path costs from one node to the next; the table on the right gives estimated distance to the goal, the admissible heuristic used.)



Node	Estimated distance to goal
A	22
B	11
C	16
D	4
E	4
F	2

Figure 2: Figure for Question 2-3.

4. Read the following Prolog program
   $prog([X, \_], [X, X]).$
   $prog([H|T], [H|T1]) :- prog(T, T1).$

   and provide the answer to the query
   $? - prog([a, b, c, d], P).$

5. Discuss the advantages and disadvantages of using 'rules' as a knowledge representation method.

Question 3 (15 marks)

Questions on Game Playing. Assume that you are playing 2 dimensional tic-tac-toe on a 3×3 board. You are the "X" player, it is your turn to move, and the current board configuration is depicted below:

X	O	
X	O	O

Assume also that the utility function is given by:

$$\text{utility of a terminal board configuration} = \begin{cases} 10, & \text{if } X \text{ wins} \\ 0, & \text{if it is a draw} \\ -10, & \text{if } O \text{ wins} \end{cases}$$

Use the minimax procedure together with Alpha-Beta pruning to select your next move. Mark with the word "PRUNE" the nodes/branches that do not need to be evaluated (and do not expand those unnecessary branches). Show your work on an adversarial search tree and explain your answer.

Question 4 (15 marks)

Questions on propositional logic. The first question is worth 5 points and the second question is worth 10 points.

Consider the following KB containing four sentences in PL:

$$P \Rightarrow (R \vee S), \neg P \Rightarrow (R \vee S), \neg S, (R \vee U) \Rightarrow Q$$

(1) Convert the given sentences into conjunctive normal form (CNF) and show the result as a set of clauses.

(2) Prove the query sentence Q is entailed by KB using the Resolution algorithm.

Question 5 (20 marks)

Questions on Predicate Logic. Each question is worth 10 points.

(1) Translate the following English sentences into predicate logic where the universe is the set of people and the allowable predicates are:

S(x):	x is a student
F(x, y):	x and y are friends
O(x, y):	x is older than y

a) Every student has a friend who is also a student.

b) There is someone who is older than all of his/her friends.

End of paper