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

Xi'an Jiaotong-Liverpool University

西交利物浦大学

2015/16 Semester 2 - Final Exam

Bachelor Degree - Year 3

Introduction to Artificial Intelligence

Time Allowed : 2 Hours

Instructions to Candidates

1. Total marks available are 100. This exam will count for 80% in the final assessment.
2. Answer all questions.
3. The number in the column on the right indicates marks available for each section.
4. Answers 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. Describe the main components of Expert Systems.

2. Why is knowledge acquisition often referred to as the ES bottleneck?

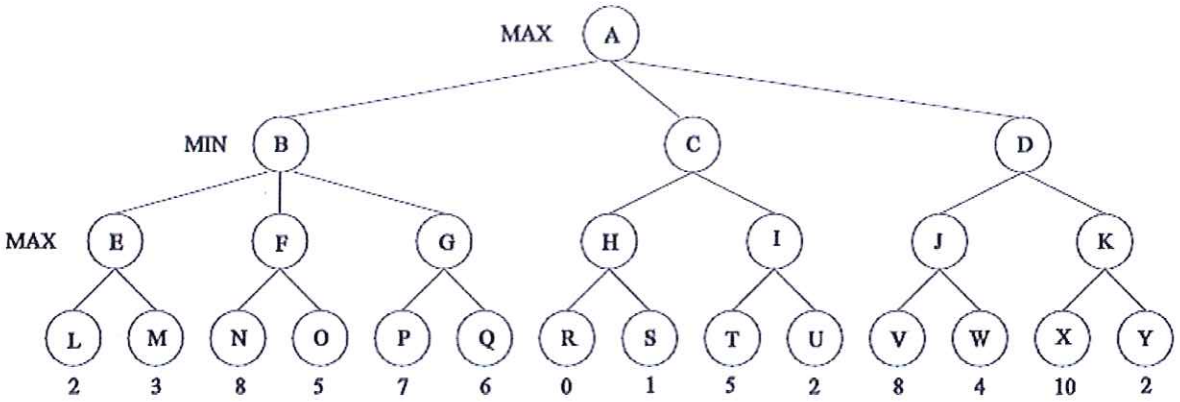
3. Rational agents are often specified by a PEAS description. What does each of the letters in the acronym PEAS stand for? For a web-based machine translation system, give the PEAS descriptions.

4. What is the main difference between the techniques used to implement AlphaGo and DeepBlue?

5. Let G(x), F(x), Z(x), and M(x) be the statements "x is a giraffe," "x is 15 feet or higher," "x is animal in this zoo," and "x belongs to me," respectively. Express each of the following statements in First-Order Logic using G(x), F(x), Z(x), and M(x).
   (a) Nothing, except giraffes, can be 15 feet or higher.
   (b) There is no animal in this zoo that does not belong to me.
   (c) I have no animals less than 15 feet high.
   (d) All animals in this zoo are giraffes.

Question 3 (15 marks)

Questions on Game Playing. Consider the following game tree in which the root corresponds to a MAX node and the values of a static evaluation function, if applied, are given at the leaves. Answer the following questions. Each question from (a), (b) and (d) is worth 4 points and question (c) is worth 3 points.



(a) What are the minimax values computed at each node in this game tree? Write your answers to the LEFT of each node in the Figure above.

(b) Which nodes are not examined when Alpha-Beta Pruning is performed? Assume children are visited left to right.

(c) Is there a different ordering of the children of the root for which more pruning would result by the Alpha-Beta? If yes, give the order. If no, explain why not.

(d) Now assume your opponent chooses her move uniformly at random (e.g., if there are two moves, $\frac{1}{2}$ the time she picks the first move and $\frac{1}{2}$ the time she picks the second) when it is her turn, and you know this. You still seek to maximize your chances of winning. What are the expected minimax values computed at each node in this case? Write your answers to the RIGHT of each node in the tree above.

Question 4 (15 marks)

Question on propositional logic. Using resolution, show that the following sentence is valid.

$$\neg((p \wedge \neg q) \vee \neg(\neg r \Rightarrow \neg q)) \Rightarrow r \vee \neg p$$

Question 5 (20 marks)

Answer the following questions on Predicate Logic. The first question is worth 8 points and the second question is worth 12 points.

(1) Give logical expressions for the statements below. Use quantifiers, connectives, and the predicates $P(x)$ and $H(x)$. Assume $P(x)$ means "x passed the class" and $H(x)$ means "x turned in all of the homework".

a) Every student that passed the class turned in all of the homework.

b) There was a student that passed the class, but did not turn in all of the homework.

(2) For each of the following sentences in English, is the accompanying sentence in first-order logic a good translation? If yes, answer yes. If no, explain why not.

a) No two XJTLU students have the same ID number.
$\neg\exists p, q, n(XJTLUStudent(p) \wedge XJTLUStudent(q) \wedge \neg(p = q)$
$\Rightarrow (IDNum(p, n) \wedge IDNum(q, n))$

b) All XJTLU students except business majors like CS majors.
$\forall p, q(XJTLUStudent(p) \wedge \neg BusinessMajor(p))$
$\Rightarrow (XJTLUStudent(q) \wedge CSMajor(q) \wedge likes(p, q))$

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