2910310 Artificial intelligence

Examination paper: Zone B

Time allowed: two hours and fifteen minutes

There are **five** questions on this paper.

Do not attempt more than **four** questions. All questions carry equal marks and full marks can be obtained for complete answers to **four** questions.

Questions involving a description or explanation should, wherever possible, be accompanied by an appropriate example.

Question 1

a) Using spell checking as an example, explain the terms percepts, actions, goals and environment in the context of intelligent agents.

[12]

b) Environments are classified according to whether they are:

i) accessible
ii) deterministic
iii) episodic
iv) dynamic
v) discrete

Define each of these terms and use them to classify the environment of a spellchecker. Note carefully in your answer if you think that any of these properties are inappropriate in describing such software.

[10]

c) Give an example of software whose environment is accessible, deterministic, episodic, static and continuous, explaining why you think that this is the case. (NB You should give one example, which satisfies all the criteria)

[3]

Question 2

a) Explain the concept of search and how any problem can be thought of as a search problem.

[4]

b) Explain the different search techniques that could be used to look for a route between cities.

[5]

c) Define the terms: initial state, search state, operator, goal test and path cost function.

[5]

d) Sketch an algorithm for a depth first search.

[5]

e) Give the space and time complexity of depth first search and state whether such searches are optimal and whether they are complete.

[4]

f) In the example of a route finder, would depth first or breadth first search be more appropriate? Justify your answer.

[2]

Question 3

a) What does it mean for a logic to be sound and complete? Give an example of such a logic.

[5]

b) How does First Order Propositional Calculus differ from Propositional Calculus?

[4]

c) Using truth tables show whether:

i) $(\neg a) \vee (b \wedge c) \equiv ((\neg a) \vee b) \wedge ((\neg a) \vee c)$

ii) $a \wedge (b \vee c) \equiv (a \wedge b) \vee (a \wedge c)$

[4]

d) When might Boolean algebra be preferable to truth tables, as a technique for proving statements in propositional calculus?

[4]

e) Consider the following two statements:

i) Dogs have 4 legs

ii) Some dogs lose limbs in accidents

Express each of these in First Order Predicate Calculus.

[4]

f) Explain the difficulties that i) and ii) in e) above together pose to a knowledge engineer and how these difficulties are overcome.

[4]

Question 4

A language (*language 1* say) has the following grammatical and lexical rules:

s	→	np vp		det	→	[a]
np	→	det n		n	→	[footballer]
vp	→	v np		v	→	[kicked]

a) What is the one sentence that is possible in this language? (Show how you obtain your answer)

[4]

b) Draw the syntactic tree of this sentence.

[4]

c) How many more sentences can we make by adding the following rules to *language 1* to form *language 2*? Give your reasoning.

det	→	[every]
det	→	[the]
n	→	[foot]
n	→	[ball]

[4]

d) What will be the effect on the language of adding the rules below to *language 2* to form *language 3*?

vp	→	vp prep
prep	→	prep np
prep	→	[with]

[4]

e) Give two sentences that are possible in *language 3* but show difficulties with the language. Give syntax trees for them that show the difficulties with language 3. State the difficulties shown.

[6]

f) What is linguistically wrong with the sentence; 'a ball kicked the footballer'?

[3]

Question 5

a) Summarise the arguments for the possibility that at some time in the future machines will be deserve to be called intelligent.

[9]

b) Searle argues that a machine cannot be said to have real understanding. Outline the example that he uses to make this argument and the 6 replies that are given by the strong AI community.

[9]

c) In your view what current applications show the most promising progress towards AI? Give reasons for your choice.

[7]