Examiners' reports 2009

310 Artificial intelligence – Zone B

Comments of specific questions

Question 1

Part a) is bookwork and, with the exception of complexity, was well answered. The complexity of an algorithm is a description of its behaviour in terms of how its need of time and space varies *as the size of the problem increases*. An algorithm with low complexity **need not** run faster, for a given problem, than one that is more complex!

In b) candidates should tie solving game problems with the language of part a) above. That is, they should explain how the problem is one of search where the search space is the set of states reachable from the start state using only legal moves.

Excellent answers may go on to say something about using information to help find good moves – making the search an informed one.

Completeness and complexity are hinted at in part a) of the question. However there are practical issues of real computing such as actual runtime and space requirements for the actual runs needed.

Many answers to part d) were disappointing. Candidates should have no difficulty giving a general search algorithm and should be able to highlight the need for mechanisms, taking into account a) the possibility of the search space not being a tree and b) the alternating views needed when one player plays against others.

To make an algorithm suitable for game playing in real time there needs to be a mechanism for stopping gracefully in a limited time. Limiting the search depth is one possibility.

Question 2

Although many candidates were able to define the terms *sentence*, *theorem*, *valid* and *soundness*, some were not able to do this convincingly. To lose marks because of a lack of understanding of definitions is a pity.

A truth table is a way showing that an identity holds – by exhausting all possibilities. This explanation, illustrated with a required example, should be quite straightforward – helped, of course, by the discipline of including all combinations of truth values for A and B. A minority of candidates still insists on not using a systematic ordering of the truth values and this sometimes leads to the omission of some rows and the duplication of others.

An explanation of how semantic tableau can be used to prove theorems and provide a notation for a systematic search for a proof by contradiction was the subject of part b). Although an example was not asked for, its use may make an answer clearer. Care needs to be taken

to i) describe the notation and ii) explain the finishing conditions – that is with each branch closed.

Whether it is better to use a truth table or a semantic tableau in a given circumstance depends to some extent upon one's skill at the tableau method. However, in this question we were looking for understanding of each technique. So, for example, the truth table doubles in size with each additional variable but for small numbers is quite efficient. The tableau requires more thought but is more natural when looking to see if one set of statements follows from another.

Parts e) and f), using a semantic tableau for a small example were mostly well done. The difficulty seem to have been in realising that the 'translation' from English to predicate form was not straightforward and implied some assumption on the semantics.

Question 3

Most candidates were able to distinguish between progression planners and regression planners.

Sketching an algorithm for progression planning proved slightly more difficult but most candidates achieved reasonable marks.

The relative advantages and disadvantages of progression over regression hinge on branching factors and the complexity of specification. Often there are lots of things that we can do but few that lead us closer to our goal – so the branching factor for regression planning is often (but not always) much less than that for progression planning.

Each action in a linear plan has its order: by contrast non linear plans have actions that do not have to be done in a particular order. There was much confusion amongst candidates about this distinction.

To answer the last part correctly candidates should have explained the STRIPS notation. Once this has been done the search itself is quite straightforward as the example was chosen to make this so.

Question 4

This question concerned grammars. Estimating the number of sentences that are defined by the given grammar should be quite straightforward as no recursion was involved. It was surprising that a significant minority of candidates could not do this.

There are many types of ambiguity and most candidates had no difficulty giving two or more.

Example sentences showing the ambiguities asked for were readily found by most candidates. There were some whose likelihood was questionable, but markers gave the benefit of the doubt to those candidates.

Giving parse trees also proved not to be difficult.

Attribute-values are a way of reducing the size of a grammar (or increasing the number of legal sentences that it describes). There were many candidates who did not understand this and were not able to make the required changes – though many possible changes would have sufficed.

Semantic annotations add (as their name implies) semantic knowledge to a grammar, allowing meaning to be deduced as the sentences are parsed. This part was answered poorly in general.

Quantifier scope ambiguity was known to most candidates, though semantic analysis showing the ambiguity was less well understood.

Question 5

This question required candidates to describe and evaluate an AI application or development they had learned about whilst completing this course. Whilst this gives lots of scope for candidates' preferences, the evaluation proved difficult for some because they had not considered the application in the light of the debate between followers of Turing and Searle. It is hoped that candidates will not omit this aspect in future.

Candidates should, at least whilst revising if not before, look at AI as a whole and not as a bag of unrelated topics.

The final part allowed candidates to give their opinions on AI and its penetration into everyday activities. Whilst all had opinions, reasoning was often not given well. This skill should be practiced **before** the examination.