Examiners' commentary 2017–2018

CO3310 Artificial intelligence – Zone B

General remarks

As in previous years, this examination was set as a combination of questions that tested basic knowledge and understanding of the subject ('bookwork'), problem-solving questions that required application of knowledge gained during the course, and reflective essay questions that involved argumentation and consideration of how Artificial intelligence (AI) can be applied to real-life concerns, and gave candidates an opportunity to show knowledge they may have gained from independent reading.

You are reminded to read each question carefully and address all aspects of it. In particular, when asked to 'explain', 'describe' or 'justify' something, you should make sure you have done so. Answers should not say: 'I believe/feel' or 'my opinion is…', but should be justified with evidence and argumentation. You should not argue from authority (e.g. "Bryson says that…") without explaining the substance of the arguments.

Some questions explicitly ask you to show workings and/or give an explanation for an answer, and marks are allocated accordingly. It is good practice to show workings on any questions that involve calculation or the application of a process, as a mistake midway may lead to a wrong answer. You may still get partial marks if the examiners can see from your answer that you have some understanding of the problem.

Comments on specific questions

Question 1

Agents and Learning

Part (a) was bookwork which should have been answerable by candidates who had diligently studied the subject guide.

Part (b) required candidates to apply book knowledge to a particular instance, an automated domestic cleaner. Any reasonable well-motivated answers would be accepted, but they should be clearly motivated, taking account of issues such as:

- Does the agent have a clear, unimpeded view of its environment?
- Can the agent easily detect whether its actions have succeeded?
- Is the environment likely to change in the course of the task, independently of the agent's actions?

Part (c) involved machine learning and decision trees. This question combined book knowledge and problem-solving. Part of the question asked candidates to make intuitive choices, so different answers were possible. Candidates may have had some surprising results, indicating that the data did not cover all possible choices. Depending on branching choices, results may have been highly granular, e.g. with paths accounting for just one example – indicative of *overfitting* results which may not generalise well.

Question 2

Logic and Reasoning

Part (a) assessed candidates' understanding of propositional or Boolean logic. This topic is covered in the subject guide: in particular, the Learning Activity on p.21 would have prepared candidates for this kind of problem. In fact, very few were able to tackle the question, and most did not appear to know what is meant by a 'literal'. Some credit was given for showing ability to construct truth tables – however for this kind of question it is not enough to construct a table, candidates must explain how it manifests certain inferences rather than leaving it to the marker.

Part (b) involved predicate calculus, also known as FOPC or First-Order Logic. This formalism is fundamental to the symbolic tradition in AI and regularly features in examinations. Candidates are advised to revise this topic carefully, using the subject guide as well as sources like Oxford University's online tutorial (cited in coursework assignment 1) and Wilfrid Hodges' *Logic* from the recommended reading list. You should be sure you understand how the quantifiers and connectives interact: for example, $\forall x(Bird(x)\ \&\ Fly(x))$ does not mean that all birds fly, but that everything in existence is a bird and flies.

Part (c) involved Bayes' Rule, which is also fundamental to modern AI and regularly features in examination questions. Candidates mostly tackle these questions well, but some lose marks by failing to show working or explain their results. It is important to do so to be sure of getting at least partial marks if your answer contains mistakes, e.g. if you misremember the formula or make slips in the calculation.

Question 3

Natural Language

Part (a) required candidates to identify different types of ambiguity in ordinary language. It was not necessary to use technical terms like "metonymy" to get good marks for this question as long as the meaning was clear.

Part (b) involved formal language theory, which has many applications in Computer Science outside NLP and AI. This involves an unfamiliar way of thinking about ordinary language, and candidates sometimes find it difficult to grasp such distinctions as context-free versus regular grammars. You are advised to revise this topic thoroughly, using the subject guide and other sources in the recommended reading.

Part (c) required candidates to construct a "toy" grammar for a small fragment of English. The use of technical terms for specific constructions is not essential as long as the meaning is clear. For full marks, grammars should be concise and general rather than tailored to individual examples in ad hoc ways, though they should be illustrated with specific examples.

Rules for coordination should be of the form X → X Conj X, i.e. conjuncts must be of same grammatical category. Something like S → NP conj S would not be an appropriate answer. It is often useful to consider whether *recursive* rules are appropriate.

Question 4

Search and Planning

Part (a) involved bookwork, and should have been answerable by candidates who had studied the subject guide diligently. Surprisingly, few were familiar with the term "frontier", which is standard terminology in AI search.

Part (b) dealt with something that candidates have sometimes found confusing, the distinction between a heuristic search method and a heuristic function. Simply put: a heuristic search method such as A* is one that makes use of heuristic functions. Examples of heuristic functions are discussed in the subject guide and recommended readings.

Part (c) required candidates to solve a simple planning problem, using the PDDL formalism. When answering a question like this, it is important to stick to the formal expressions used in the question, rather than making up your own.

Question 5

Philosophy of AI and Social Issues

Part (a) asked candidates to evaluate some definitions of AI that have been proposed in the literature. There is no clearly correct answer, and marks were awarded according to the quality of argumentation and display of relevant technical knowledge and understanding. Astute candidates may observe that all the definitions date from the 20th century, and may well be outdated in 2019. They may also note that (4) is almost vacuous, essentially paraphrasing "artificial intelligence" without explaining any of the constituent terms.

Part (b) addressed some ethical issues arising from the use of machine learning for targeted marketing. Marks were awarded according to the number of relevant substantive points in candidates' answers, as well as for the quality of argumentation and clarity of presentation.