Coursework commentaries 2016–17

CO3310 Artificial intelligence – Coursework assignment 1

General remarks

Some students avoidably lost marks by failing to follow the guidance given in the coursework rubric, or in previous years' coursework commentaries.

You should list all references at the end of your work, and they should be properly cited in-text. Note that any answers which consist entirely or mostly of quoted material are unlikely to get high marks even if properly cited and referenced, as you have not demonstrated understanding.

Most students remembered to submit their work as a single PDF file, with an appendix including any Prolog code, and the results of running the code.

Students who received a fail mark in this coursework invariably did not attempt large parts of it. Most submissions showed students working very hard to engage with the concepts.

A pleasing proportion of the submissions were very good indeed and it was a pleasure to mark them accordingly.

The following remarks are relevant to the next coursework and the examination:

- Coursework allows time for additional reading, and those questions that require students to discuss and argue a point should be carefully researched to help gain high marks.
- The question should be read carefully. It will tell you if you need to give working, explain your answer, etc.
- In an examination situation, students should spend effort on a question that is proportionate to the marks obtainable (i.e. do not write two pages for a question worth 5%), which leads to the next point…
- Many questions require students to follow a process (i.e. algorithms, calculations). Though it was pleasing in this coursework to see some exceptionally detailed and worked through answers, with search trees depicted at each step and extensive commentary, it is unlikely that such detail could be given in an examination. You should therefore consider how such answers might be clearly presented within the time limitations of an examination.
- It would also aid marking such questions that the final answer is clearly underlined. It was often the case that it had to be searched for.
- Quality and clarity of English is essential. A minority of students handed in poorly written assignments. Poor English makes examinations and coursework difficult, and is even more challenging in the final project report. English support classes may help if you are struggling.

Comments on specific questions

Question 1

This question concerns agent-based computing. [30 marks]

a. This question was bookwork, which asked for explanations of various technical terms. Most students did reasonably well, although some answers (especially iii and iv) were unclear or uninformative and showed little evidence of having consulted the subject guide or textbooks. Some students just gave intuitive interpretations of these terms without reference to the course readings or dictionary definitions. Circular answers were not acceptable, nor were vague answers such as **'rationality is about doing the correct thing'**. Wider reading will provide more material to inform your answer.

b. The first part of the question required students to evaluate whether some classroom assistance tasks were achievable by an AI/robot in the near future. Many students were able to give considered answer to this. That said, some students did not either consider or were overoptimistic about tasks that required empathy. Others took a contrary view, by either arguing in detail with literature examples that AI could be developed soon to handle empathy enriched tasks and/or constraining the problem so that it was feasible. These were considered valid answers as the students made a well-developed argument with evidence for their viewpoint, and showed understanding of the material. Other (poor) answers were rather broad and overoptimistic in general.

   The second part of the question required students to show an understanding of Russell and Norvig's 'dimensions' of autonomous agent environments by applying them to the above. The word limit did not allow for all duties to be discussed in depth, but you should pick a representative selection and give well-motivated classifications along the listed dimensions. A tabular answer might be appropriate, as long as there is some justification for the classification. This question required careful reading of the relevant section of Russell and Norvig's *Artificial intelligence: a modern approach*.

   Most students gave thoughtful answers showing a good understanding of the issues, though other answers were too brief and unfocused with little discussion of actual concrete tasks. That said, failing to provide any rationale was the most common way marks were lost.

Question 2

This question concerns search. [35 marks]

a. This question was bookwork, testing students' understanding of some basic properties of standard search techniques. Most students did reasonably well. Note that the question required some explanation of the formulas (it need not be long). Most students answered this well, though some found A* more challenging.

b. This question asked students to explain in their own words the difference between tree search and graph search. This question was also bookwork. Many students did fairly well (at least commenting on some of the main differences), but some chose to discuss the formal properties of graphs and trees rather than the specific issue of comparing a tree search with a graph search.

c. This was a practical question applying various search algorithms to a route-finding problem. Marks were awarded for correct solutions, working and presentation. Wrong solutions also received marks where the answer showed sound understanding of the algorithms but went astray in the calculations. Many students gave very good or excellent answers, while others lost marks by giving correct solutions but not showing any working, or through poor presentation. A number of students failed to attempt this question.

Question 3

This question concerns formal logic, knowledge representation and reasoning. [35 marks]

a. This question was bookwork, asking for explanations of various terms from formal logic. The purpose of questions like this is for students to show that they understand the terms, so it is not helpful to offer purely formula-based answers like '$\Sigma \vdash \Phi$ implies $\Sigma \models \Phi$'. Note that answers were supposed to be given 'in your own words', so simply quoting textbook definitions is inadequate.

b. The question concerned the representation of natural language in first order logic. This underpins AI knowledge representation, and is a key skill that students need to master if they are to take their studies further. You should revise and practice this. As in similar questions in previous years, there were some good answers, but some showed confusion about the proper use of existential versus universal quantifiers, and several students only gave one version of each formula. Some points for attention, which seem to recur each year, are: whether to use 'arrow' or 'conjunction'; proper bracketing; correct use of negation; proper explanation of predicate interpretations (do not assume the intended meaning is obvious); and the difference between constants and variables. Note that 'not all' is not equivalent to 'some' as it is also consistent with 'none'. There were also general issues in technique in rewriting the universally quantified version to existentially quantified (or vice versa). There are two approaches. The first is to use logical identities to rewrite the sentence. Those of you who are mathematically stronger but less confident in the subtleties of English may prefer this approach. The other, less precise, approach is to rewrite the English sentence, argue it is equivalent, then convert to logic. It is good advice to show some brief working/explanation for the predicate logic sentences, rather than just writing down the answer. It is then possible to assess how close the understanding was if the answer had an error (and you can assess if what you wrote made sense).

c. For this question, students were expected to use Prolog to encode a knowledge base and then run some queries on it. Answers should give some explanation of the encoded knowledge base (including comments) and show query results. Some students did not explicitly give results, others showed no evidence of running Prolog; however, there were also many good answers. Several students did not attempt this question.

Coursework commentaries 2016–17

CO3310 Artificial intelligence – Coursework assignment 2

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You should list all references at the end of your work, and they should be properly cited in-text. Note that any answers which consist entirely or mostly of quoted material are unlikely to get high marks even if properly cited and referenced, as you have not demonstrated understanding.

Most students remembered to submit their work as a single PDF file, with an appendix including any Prolog code, and the results of running the code.

Students who received a fail mark in this coursework invariably did not attempt large parts of it. Most submissions showed students working very hard to engage with the concepts.

A pleasing proportion of the submissions were very good indeed and it was a pleasure to mark them accordingly.

The following remarks are relevant to the next coursework and the examination:

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Comments on specific questions

Question 1

This question concerned machine learning. [30 marks]

a. This question asked students to use the provided article on Facebook's object recognition technology to discuss object recognition as a machine learning problem.

   i. Good answers typically adopted the pattern of:

   - Clearly articulating what object recognition is (along with any related concepts such as classification and supervised learning).
   - Clearly linking to and summarising the article.
   - Using relevant additional sources.

   Most students gave thoughtful answers showing a good understanding of the issues, while other answers were too brief and unfocused with little discussion of key concepts. Failing to address one or more of the points on the list above was the most common way marks were lost.

   ii. This question asked students to propose three possible applications for the technology that is the focus of this question. Good answers typically adopted the pattern of:

   - Stating the application clearly.
   - Ensuring that each application is in fact potentially solvable with this technology.
   - Providing more than a one or two sentence description to allow determination of the above.
   - Some excellent answers also drew on outside reading.

   The vast majority of students answered this question well.

b. This question invited students to discuss decision tree generation in the context of moving city. Good answers typically followed the pattern of:

   - Providing some relevant factors (with a brief justification).
   - Giving a description of decision tree generation (in most cases this was high-level and qualitative).
   - High marks were obtained for explaining important decision tree concepts such as entropy or considering the mathematical concepts.
   - Many answers helpfully provided an example decision tree.
   - Some outstanding answers also drew on outside reading.

   Most students gave thoughtful answers showing a good understanding of the issues; some were too brief and unfocused and did not cover some of the points above.

Question 2

This question concerned search. [30 marks]

a. This question was bookwork, testing students' understanding of some basic terms in AI planning. Most students answered this well, though some neglected to cite their sources, including the subject guide and AIMA.

b. Both parts of this question focused on a scenario given in AIMA.

   i. This part of the question asked students to write PDDL for six operators and the initial states. There seemed to be a wide range of approaches to syntax, presumably dependent on the textbook read to understand the material, so the focus was on whether the sentences captured the required information.

      Good answers typically followed the pattern of:

   - Clearly defining predicates.
   - Clearly defining the initial state.
   - Clearly defining the six operators.
   - Providing a rationale for the above. Usually in the form of stating assumptions and/or comments on the PDDL sentences.

     Most students answered this well; marks were avoidably lost by neglecting the points above. Some students did not attempt this question.

   ii. This part of the question follows from the above and required the construction of a plan.

      Some students gave very good or excellent answers, while others lost marks by not giving explanations or through poor presentation. Some students did not attempt this question.

Question 3

This question concerned natural language processing and philosophical issues. [40 marks]

a. This question asked students to produce a number of parse trees based on a grammar provided in the subject guide. As in previous years with this kind of task, most students had little difficulty answering the question, though some lost marks by failing to 'justify' their answer adequately. This required more than circular answers such as **'this is not grammatical because it does not satisfy the grammar rules'** or **'because the parse tree could not be generated'**. A few students missed the point and relied on their own grammatical intuitions.

b. This question asked students to adapt and extend the grammar to cope with new sentences. Good answers included rules that are linguistically motivated and will generalise to new examples. In most cases this was done, though not always explained. Some students did not attempt this question.

c. This question was based on a review of NLP research provided in the coursework.

   i. This part was an exercise in summarising parts of an AI research paper, while testing students' understanding of some key concepts explored in that paper. Most students did reasonably well, though some paraphrased in a less than coherent manner.

   ii. This part asked students to distinguish between NLP and NLU (which most students did well) and explain why the authors held their particular views. Most students were able to convey the two concepts and how they differ, and summarise the authors' views.

iii. This part asked students to evaluate the authors' case with regard to the classic Chinese room argument. Good answers typically followed the pattern of:

- Summarising the authors' argument that NLP will eventually evolve into NLU.
- Summarising the relevant parts of the Chinese room argument.
- Evaluating the authors' argument regarding the Chinese room argument.
- Some outstanding answers also drew on outside reading.

Most students gave thoughtful answers showing a good understanding of the issues, while other answers were too brief and unfocused and did not cover some of the points above.

The Chinese room argument is important in the philosophy of AI and you should ensure you are familiar with it and its counterarguments.

A surprising number of students did not attempt this question.