CMPU 4010 Artificial Intelligence

Exam replacement submission

INSTRUCTIONS

This submission is worth **70% of your mark** for the CMPU4010 Artificial Intelligence module.

This is an open book submission but the usual regulations for plagiarism apply, your submitting needs to be your own work.

Please include as part of your submission a signed confirmation that this is your own work.

DECLARATION

I hereby declare that the work submitted is entirely my own work, except where otherwise stated.

Signed: _____

SUBMISSION

Deadline for submission is **15th May 2020**.

Submit your work though Brightspace as **one pdf document** including all three questions (please, don't submit word documents as the formatting of formulas and diagrams may look different)

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QUESTION 1. ARTIFICIAL INTELLIGENCE   [40 MARKS]
(about 1000 words / 2 pages)

Every year the Loebner Prize is awarded to the program that comes closest to passing a version of the Turing Test.

Research and write a short report on the latest winner of the Loebner prize. Discuss the techniques that it uses, and how it advances the state of art in AI.

QUESTION 2. KNOWLEDGE REPRESENTATION AND LOGIC   [30 MARKS]

An online retailer is planning on testing drone parcel deliveries to Dublin and Cork by three new drones - drone A, drone B and drone C. The rules for the deliveries are as follows:

1. If ***drone A*** delivers to Dublin and doesn't deliver to Cork,
   then ***drone B*** delivers to Cork or ***drone C*** delivers to Cork.
2. Either ***drone A*** doesn't deliver to Dublin and **drone B** does deliver to Dublin,
   or ***drone A*** delivers to Dublin and ***drone B*** doesn't deliver to Cork.
3. If ***drone B*** delivers to Dublin,
   then it is necessary that ***drone A*** delivers to Cork, and either ***drone C*** delivers to Dublin or ***drone A*** delivers to Dublin.
4. If ***drone B*** delivers to Dublin and ***drone A*** doesn't deliver to Cork,
   then **drone C** delivers to either Dublin or Cork, and either **drone B** doesn't deliver to Cork or **drone A** delivers to Dublin.

Question 2.1 [5 marks]

Encode statements above in **propositional logic** using the following literals:

- P: Drone A delivers to Dublin
- Q: Drone A delivers to Cork
- R: Drone B delivers to Dublin
- S: Drone B delivers to Cork
- T: Drone C delivers to Dublin
- U: Drone C delivers to Cork

Question 2.2 [5 marks]   *(about 250 words)*

Briefly discuss the advantages and disadvantages of the propositional logic as a knowledge representation in the context of the problem discussed in Question 2.1

Question 2.3 [10 marks]

Convert the propositional logic sentences from part Q2.1 to conjunctive normal form.

Question 2.4 [10 marks]

Prove that $(P \Leftrightarrow Q, P \lor Q)$ entails $P \land Q$.

QUESTION 3. ALPHA-BETA PRUNING   **[30 MARKS]**
Explain the purpose of alpha-beta pruning for min-max search algorithm.
Illustrate the depth-first alpha-beta pruning on the game tree below. Show the workings of your algorithm **step by step** (not only the final pruned tree)

You can draw the trees in a software program, or you can take photos of workings on paper and paste them in your submission document.