

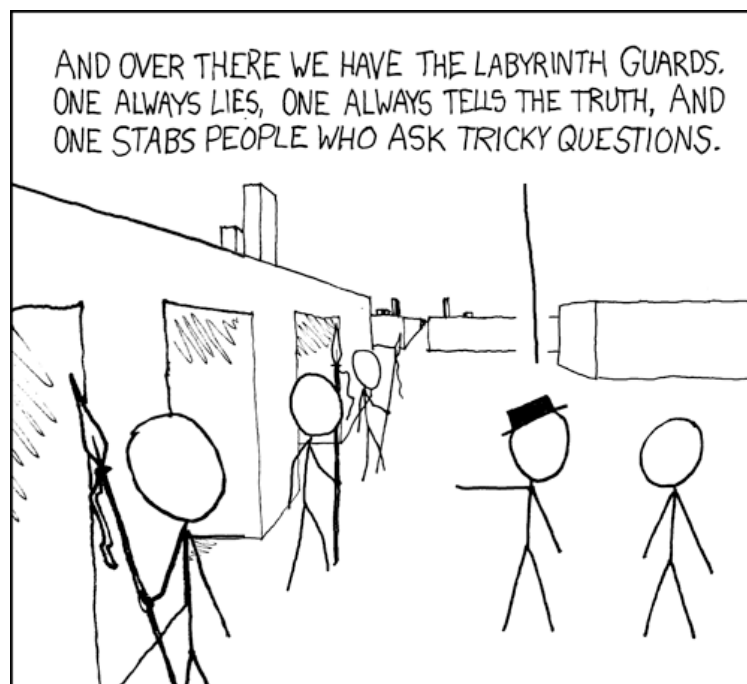
# CITS3001 Mid-semester Test 2016

Semester 2

Fifty minutes

Answer all four questions

Total marks 60



Name: \_\_\_\_\_

Student Number: \_\_\_\_\_

When showing the operation of an algorithm, include enough detail to make it clear that you understand how *the algorithm* solves the problem.

Answer all questions in the spaces provided in the booklets.



**Question 1: Pattern matching**

**(15 marks)**

*Briefly* describe the principles, operation, and performance issues of any *one* commonly-used (not naïve) pattern matching algorithm for finding all the matches of a pattern string in a given text.

Illustrate your algorithm searching for the pattern

LLAMA

in the text

FUZZYLLAMAFUNNYLLAMALLAMALLAMADUCK

Make sure that you show all relevant operational details of your chosen algorithm.



**Question 2: Search****(15 marks)**

*Letters and Numbers* is a game show, where contestants are given a set of randomly chosen numbers and a target number. The contestants then have to use arithmetic (addition, subtraction, multiplication and integer division) using each number at most once, to get as close as possible to the target number. For example, given 3, 5, 12, 15, and a target of 21, an answer of  $(3 \times 12) - 15$  or  $(15 \times 3) / 5 + 12$  give perfect answers.

**Briefly** describe what you think is the best search strategy to solve this problem, justifying why it is better than other alternatives.

Demonstrate your search algorithm in action over the set of numbers 2, 5, 7 with target 6.



**Question 3:  $A^*$**

**(15 marks)**

*Briefly* describe the role an estimation heuristic plays in the  $A^*$  algorithm. Define admissibility and monotonicity, and explain their importance to an estimation function.

Recall the missionaries and cannibals problem from lectures. There were three cannibals, three missionaries, and they needed to cross a river using a boat that could hold at most two people. If the cannibals ever outnumber the missionaries on either side of the river, they will eat them.

Propose an estimation heuristic for this problem and show that it is admissible and monotonic.

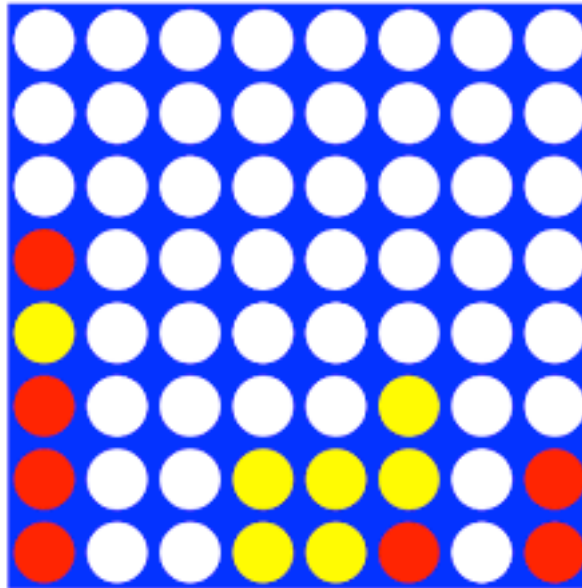




#### Question 4: Game-Playing

(15 marks)

Connect Four is a game where players (red and yellow) take turns to drop pieces (with your colour) into a 7-column, 6-row grid, so that the pieces either fall to the bottom, or land on top of another piece. The aim is to have four of your pieces in a row: vertically, diagonally or horizontally.



In the context of Connect Four, answer the following questions:

- What is the branching factor of the connect four?
- What is Quiescence?
- What would be a good evaluation function, and why?
- What is  $\alpha$ - $\beta$  pruning?

