CMPT 310
Artificial Intelligence Survey

Simon Fraser University
Summer 2011

Instructor: Oliver Schulte

Assignment 1: Chapters 1, 2, 3.

Total Marks: 76 + 3 bonus points.
Due Date: June 1, 10:20 am.

Instructions: Check the instructions in the syllabus. The university policy on academic dishonesty and plagiarism (cheating) will be taken very seriously in this course. *Everything submitted should be your own writing or coding.* You must not let other students copy your work. Discussion of the assignment is okay, for example to understand the concepts involved. If you work in a group, put down the name of all members of your group. On your assignment, put down your **name**, the number of the assignment and the number of the course. Spelling and grammar count.

Handing in the Assignment. Please post your assignment on our course management server https://courses.cs.sfu.ca/1114-cmpt-310-d100/ . You should post a Word, rtf or Open Office document, so we can add comments on your file directly (*not* pdf). For diagrams please use a drawing program (recommended) or scan a paper and pencil drawing and add it to your Word/Office/rtf file. If the system doesn't take .docx files, try saving your file as .doc instead. *The time when you upload your assignment is the official time stamp.*

We also need a printout. Please hand in the printout to the assignment box in CSIL (Computing Science Instructional Lab). *You need an access card for CSIL*. You should put the printout in the assignment box on the due date, but it doesn't have to be by 10:20 am.

Chapter 1. AI Foundations. 15 points total.

1. (5) "Surely animals cannot be intelligent---they can do only what their genes tell them". Is the latter statement true, and does it imply the former?

2. (5) "Surely computers cannot be intelligent---they can do only what their programmers tell them". Is the latter statement true, and does it imply the former?

3. (5) Match the following concepts/statements with a discipline related to AI.

Give your answer by filling in letters in the table provided. For example, if you think that ``Cookies" best matches ``Computer Matching", put a ``b" into the empty square next to ``Cookies".

	a. Philosophy
	b. Statistics
	c. Economics
	d. Mathematics
	e. Psychology
The mind operates according to rules.	
Decision Theory	
Laws of probability	
Behaviourism	
Computation Theory	

Chapter 2. Agents. 20 points total, plus 3 bonus points.

4. a. (6) Fill in the table below for Watson to describe its environment.

Observable	Agents	Deterministic	Episodic	Static	Discrete

b. (8) Specify a PEAS model for IBM's Watson system.

5. (3) Given a fixed machine architecture, does each agent program implement exactly one agent function?

6. (3) Can there be more than one agent program that implements a given agent function? Give an example, or show why one is not possible.

7. (3) Are there agent functions that cannot be implemented by any agent program? (Bonus question)

Chapter 3. Search problems. 43 points total.

8. (10 points total) Consider the graph below. The goal state is *f*, the starting state is *a*. This problem refers to *tree search* (see Figure 3.7 of the text for pseudocode). The node ordering follows the alphabet.

a. Which paths are explored by Depth-First Search? Show the frontier at each step of the search. (5)

b. Which paths are explored by Iterative Deepening Depth-First Search? Show the frontier at each step of the search. (5)

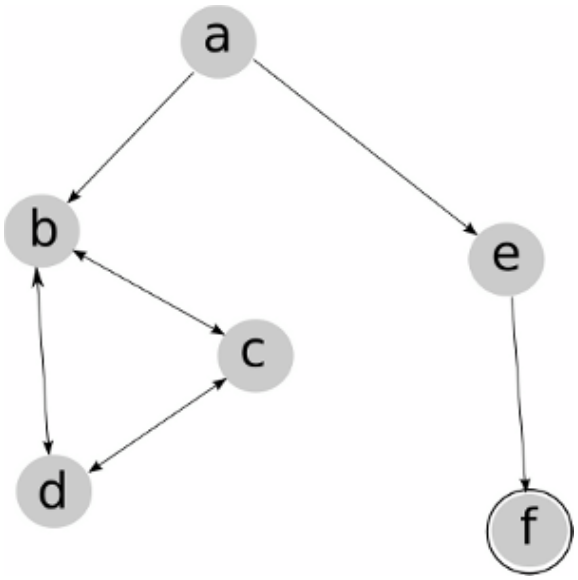

Figure 1

9. (31 points total) The classic missionaries and cannibals problem is as follows. Three missionaries and three cannibals are on one side of the river, along with a boat that can hold one or two people. The boat cannot cross the river by itself with no people on board. Find a way to get everyone to the other side without ever leaving a group of missionaries one side of the river outnumbered by the cannibals on that side. We will use search to solve this problem.

i. Go to http://aispace.org/search/ and run the Graph Search Tool. The website has quick start instructions and a video tutorial in case you need help. I suggest loading some of the sample files and experimenting with it before you continue.

ii. Use the functions File->Create Graph and the Create Node button to define the state space. Please use mnemonic names for your state nodes (e.g., call a node "3 missionaries, 3 cannibals, boat" rather than "node 0"). Model a cost 1.0 for each river crossing. Include a screenshot of your graph showing edge costs, start states and goal states. (10)
Suggestions: To make the task faster, include only legal states. You can also omit states that are not reachable from the goal state. That is, you may want to start with the intial states, draw its legal successors, then their legal successors etc. Include edges that "loop back" to previous states, except for the goal state. That is, you don't need to include any edges coming out of the goal state.

iii. Run Depth-First search to try and find a solution that involves the minimum number of crossings. Use Depth-First search with and without the option "Search Options, Pruning, Loop Detection". Is the search different with or without loop detection? Why or why not? How many nodes are expanded by Depth-First Search with loop detection? (5).

iv. Run Breadth-First search to try and find a solution that involves the minimum number of crossings. Use Breadth-First search with and without the option "Search Options, Pruning, Loop Detection". Is the search different with or without loop detection? Why or why not? How many nodes are expanded by Breadth-First Search with loop detection? (5).

v. Define an admissible heuristic and add its value to the nodes in your state space. Include a screenshot of your graph that shows the heuristic values. (5)

vi. Run A* with loop detection to find a solution that involves the minimum number of crossings.

vii. Verify that A* with loop detection expands all nodes *n* with $f(n) <$ the minimum number of crossings. (3)

viii. Verify that A* expands no node with $f(n) >$ the minimum number of crossings. (3)