ARTIFICIAL INTELLIGENCE – CS 401- Mid Term Examination I

FALL 2010 – 29th September 2010

Course Instructor – Dr. Tariq Mahmood

Instructions: This exam consists of two sections. The first section consists of MCQs, while the second one consists of long questions. Instructions are provided in the relevant sections. The total marks are 60. Be honest and try your best.

Section 1: Multiple Choice Questions (MCQs) [16 points]

Instructions: This section contains 16 MCQs. Every MCQ has four possible answers. Mark the correct answer with a tick on the question paper. Remember that there might be more than one correct answer. Mention any assumptions you make (these are very important)

1) The Turing test:
   a) Consists of three rooms, a machine and 2 humans
   b) Consists of three rooms, and a human interrogator in one room converses with a human and a machine, each in one of the remaining two rooms
   c) Aims to deceive the human interrogator as to the identity of its conversant
   d) Is designed to test the intelligence level of machines

2) Which of the following are true?
   a) Cognitive revolution concentrated on understanding actual intelligent biological processes
   b) Cognitive revolution supports the philosophy of Behaviorism
   c) Cognitive scientists are making slow progress
   d) Cognitive science is a main component of modern AI

3) What is true about thinking rationally?
   a) It can be linked to logical rules
   b) It was first investigated by Alan Turing
   c) Logical rules can be used to represent almost every type of rational thought
   d) It requires the investigation of the purpose of thinking

4) What is true about "rationality", in the context of AI?
   a) Doing what is the "right" thing (for humans) in a given situation
   b) Doing what is the best thing (for humans) in a given situation
   c) Something which is restricted somewhat by computational limitations
   d) Acting so as to optimize the chances of acquiring a given goal

5) In your opinion, which of the following are related to AI?
   a) A scientific theory of the neural processes within the brain
   b) A medical voice recognizer in order to provide online information to patients
   c) A first person shooter (FPS) game bot that *dynamically* adapts to a human player
   d) A first person shooter (FPS) game bot that uses *hard-coded* rules for demonstrating intelligent behavior during the game

6) PEAS:
   a) Can mean an objective function, environment, actions and states
   b) Can mean a performance measure, an environment, actuators, and sensors
   c) Defines the architecture of rational agents
   d) Can be used to define any AI task

7) What is true about agent functions and agent programs?
   a) Agent functions can also be called agent strategies
   b) Agent functions map percepts to actions
   c) Agent function defines how the agent learns, while an agent program shows which action to take in each state
   d) Agent program can also be called a learning algorithm

8) Why is autonomy important for a rational agent?
   a) Because humans are autonomous
   b) Because animals learn from experience

c) Because it doesn't make sense for an agent to be intelligent and not being able to learn by itself

d) It's not very important; there can be intelligent programs which do not self-adapt

9) A stochastic environment:
   a) Is one that is deterministic
   b) Can consist of transitions into more than one state
   c) Can consist of a transition into only one state as well
   d) Can be non-deterministic as well as deterministic

10) A sequential decision process:
   a) Could involve the optimization of a performance function in order to acquire some goal in the future
   b) Could involve time steps, in which the current time step depends on the previous one(s)
   c) Is another name for episodic tasks
   d) Involves a decision at each time step

11) What's true about search problems?
   a) It's the problem of finding a sequence of moves which optimizes a performance measure
   b) It's the problem of finding a sequence of moves, based on the utilities of states which occur in the sequence
   c) It avoids loops based on the utilities of states
   d) It might fail

12) What is true about **fringe**, in the context of search problems?
   a) It's a queue that contains all possible nodes that will be generated in the next time step
   b) It's a queue that contains all possible un-expanded nodes, at a given time step
   c) An element can be inserted into the fringe, both from the back as well as from the front
   d) An element can be removed from the fringe, from anywhere within the queue

13) What is true about Uniform Cost Search (UCS)?
   a) It's an extension of Breadth-First Search (BFS)
   b) It always consists of uniform step costs
   c) It always outsmarts BFS

d) It's better than Depth First Search (DFS)

14) An iterative deepening search:
   a) Could also be called a hierarchical DFS
   b) Is always optimal
   c) Has linear space requirements
   d) Combines benefits of both DFS and BFS

15) A local search algorithm
   a) Searches for a local optimum
   b) Could get stuck at global maxima
   c) Uses limited memory
   d) May have to compromise, i.e., sometimes, even a local optimal solution might be acceptable

16) Which concepts are related to simulated annealing?
   a) It makes a temporary compromise in searching for the optima
   b) It could allow a sequence of bad moves, in order to pull itself out of local optima
   c) A decreasing temperature increases the probability of making a bad move
   d) It may be necessary to keep the temperature consistent throughout the search process.

Section 2: Long Questions [46 points]

Instructions: This section consists of two questions. Provide responses according to the number of marks assigned to a question. Make sure you mention any assumptions you are making. Your answers should be concise, clear and logical.

Q1: You are the designer of a new route finding system for a car. The driver types the desired destination, and can select a preference, e.g. fastest driving time or shortest distance. The route finder suggests a route. The driver may take the suggested route all the way, or part of the way. In the second case, the driver may ask the system for guidance again, or may go on without asking. The auto makers would like the route finder to be efficient, and to adapt to the preferences of different drivers.
   a) Develop a PEAS description for this task [5 points]
   b) What search methods would be appropriate for this problem? Motivate your answer [3 points].
   c) Would you use any heuristics? If yes, which ones? If no, why not? [3 points]

Q2 (i): Consider the following graph in which S is the start state, G is the goal state, and the integer costs have been marked on the arcs.
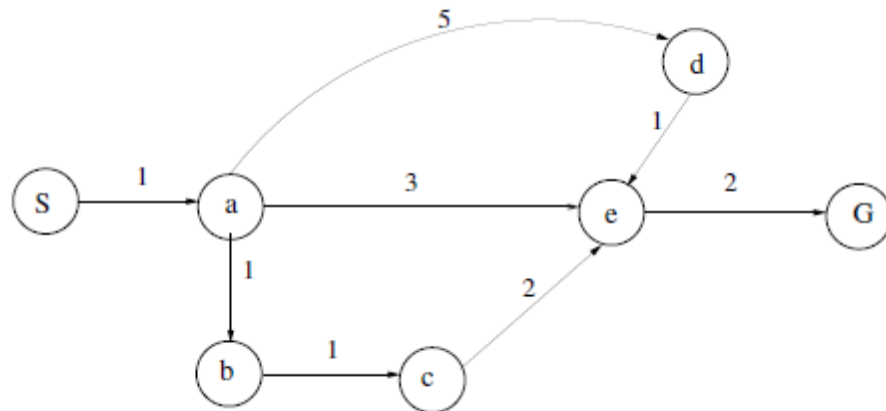
Return a possible order of node expansion for:
   a) Depth First Search [2 point]
   b) Breadth First Search [2 point]
   c) Iterative Deepening Search. Show the expansion for each iteration on a separate line [3 points]
   d) Uniform Cost Search. For this, you should show the situation of the fringe at each step of the search process [7 points]

Q2 (ii): Now consider three heuristics h_1, h_2 and h_3. The table below indicates the estimated cost to goal (h value) for each of the heuristics, for each node in the search graph (shown above).

node	h_1	h_2	h_3
S	6	6	6
a	5	5	6
b	5	4	5
c	4	2	3
d	2	1	2
e	2	1	1
G	0	0	0

   a) Which of these three heuristics is admissible and which ones are consistent? Justify your response for each heuristic separately. [9 points]
   b) Show the node order expansion using A* search for any of the heuristics that is both admissible and consistent. Clearly show all working for each step of the search process. [8 points]
   c) Show the node order expansion using greedy best first search using heuristic h2. Show all your working. [4 points]

Best of Luck