

This is a sample exam only.

Faculty of Information Technology, Monash University.

FIT3094 AI for Gaming

Part A. Multiple Choice.

Answer all questions from this part of the paper.

One mark is allocated per correct answer.

No marks are deducted for an incorrect answer in this section.

Q1. An AI System is a system that:

- A. Thinks like a human
- B. Acts like a human
- C. Thinks rationally
- D. Acts rationally
- E. All of the above

Q2. The first Artificial Neural Network computer was built in which decade?

- A. The 1950s
- B. The 1970s
- C. The 1990s
- D. After the year 2000
- E. None of the above

Q3. Which of the following statements is *true* about L-Systems when they are used to generate tree models?

- A. They can be interpreted as instructions for a “turtle” moving on a page
- B. They consist of an axiom, alphabet and one or more production rules
- C. They consider a tree to consist of modules, possibly attached to a subtree
- D. They are a developmental model of tree growth
- E. All of the above

Q4. In which kind of L-System would the following production rule appear?

$$X_i \rightarrow X_{i+1} \text{ where } X \in \{ A, B \} \text{ and } i \geq 0$$

- A. A stochastic L-System
- B. An L-System incorporating a delay mechanism
- C. A parametric L-System
- D. An L-System incorporating an environmental mechanism
- E. None, this is not a valid L-System production rule

- Q5. A billboard polygon can be used to:
- A. Display a texture map at a location within 3D space
 - B. Eliminate the need to render complex 3D models
 - C. Show a coherent view of a 3D object
 - D. All of the above
 - E. None of the above
- Q6. In a game such as *Soul Caliber* or *Street Fighter*, in which game play is usually restricted to movement on a central platform, complex backgrounds can be pre-rendered and texture mapped onto which of the following shapes?
- A. The sides, bottom and top of a cube
 - B. The inner surface of a hemisphere
 - C. The inside walls and top of a cylinder
 - D. A large polygon
 - E. All of the above
- Q7. Which of the following search algorithms would be *unsuitable* if the location of the goal was not known?
- A. Dijkstra's algorithm
 - B. Depth first search
 - C. Breadth first search
 - D. A* search
 - E. None of the above would be suitable
- Q8. What is one potential problem when running a breadth first search on a problem that has a very large search space? The program may:
- A. Venture too deeply into the search space without finding the goal
 - B. Run out of memory due to the large number of nodes at a particular level
 - C. Terminate unsuccessfully before completely exploring the search space
 - D. Be unable to compute an admissible heuristic for some locations in the search space
 - E. None of the above.
- Q9. Which of the following statements is *true* concerning a search for a goal on a 2D grid world in which an agent can travel anywhere in its *Moore* neighbourhood?
- A. The straight-line distance between two points is an admissible heuristic
 - B. The city-block distance between two points is an admissible heuristic
 - C. The value zero is an admissible heuristic
 - D. All of the above
 - E. None of the above because the Moore neighbourhood allows diagonal movement

- Q10. What aspects of biological evolutionary processes are implemented in evolutionary computation by employing a simulated roulette wheel?
- A. inheritance
 - B. reproduction
 - C. selection
 - D. mutation
 - E. crossover
- Q11. When ELIZA is told by a user, "I am hungry", what is the most likely response? (Hint: What does ELIZA know about the world? How does the software work?)
- A. Why don't you get something to eat?
 - B. Me too!
 - C. How long have you been hungry?
 - D. I'm sorry, I don't know the word "hungry"
 - E. Tell me about your mother.
- Q12. A suitable fitness function for evolving a controller for a space ship to assist it to avoid being shot by a player in a 3D game would be:
- A. The number of bullets successfully avoided by the ship
 - B. The number of bullets the ship successfully lands on the player
 - C. The number of seconds the ship survives before being hit
 - D. The minimum distance between the ship and the player's avatar
 - E. The number of times the ship is hit by the player's bullets
- Q13. The solution space for a problem tackled by evolutionary computation is often visualised as a:
- A. Height map
 - B. Search tree
 - C. Fitness versus time plot
 - D. Fitness landscape
 - E. 2D grid
- Q14. Which of the conditions below will be true of a bounding box pair if they indicate a collision between them?
- F. The X extents of the bounding boxes will overlap.
 - G. The Y extents of the bounding boxes will overlap.
 - H. The X and Y extents of the bounding boxes will overlap.
 - I. Neither the X or Y extents of the bounding boxes will overlap.
 - J. Either the X extent or the Y extent, but not both, will overlap.

- Q15. Which of the following are *not* general properties of flocking behaviour as exhibited by biological birds? Flocking behaviour is:
- A. Aggregate motion of the flock members
 - B. Polarised motion of the flock members
 - C. Dependent on the number of flock numbers
 - D. Emergent from the local behaviour of the flock members
 - E. A behaviour specified in a “bottom up” fashion by the flock members

Part B. Detailed answer.

Answer all questions from this part of the paper. Approximate marks you would receive on a real exam for questions like those shown are given in [brackets].

Q1. ----

- (a) Explain the differences between the goals of AI as the field is commonly practiced in academic research and as it is applied to computer game design and production. [4]
- (b) Dualism is the idea that mind and matter are made of different “stuff”. What is a commonly cited problem with this idea? [2]
- (c) Newell and Simon were responsible for publishing the Physical Symbol System Hypothesis. What is this and what does it mean? [4]
- (d) In what way does Artificial Life adopt a “bottom up” approach? How does this differ from Artificial Intelligence’s typical approach? [4]
- (e) Claude Shannon believed that chess was an ideal game for AI to tackle. He gave four reasons for this. What were they? [6]

Q2. ----

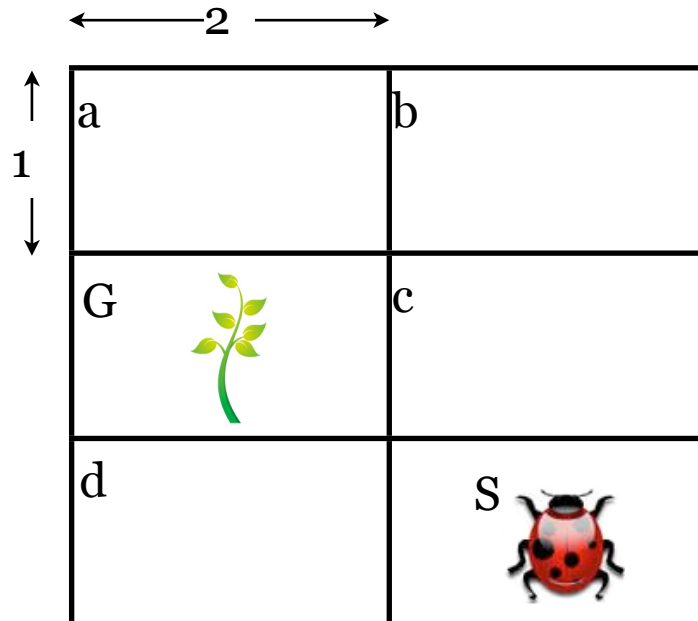
- (a) What is meant by a software agent having a “behavioural cycle”? [3]
- (b) Draw a flow-chart illustrating the cycle for a purely reactive (non-learning) agent and its important components. [7]

Q3. ----

- Draw a diagram illustrating a suitable feed-forward, fully connected neural network to control a ghost in the game of *Pacman*. [5]

Q4. ----

- (a) Write the algorithm for conducting a *breadth first search*. (Hint: use Open and Closed lists like those discussed for the A* search in the lecture notes.) [5]
- (b) Conduct a complete A* search on the following world (for this practice question, look up the algorithm in your notes), from the start position S to G, the goal. Assume that the ladybird can move from any cell into its adjacent cells in the *Moore* neighbourhood. [6]



- (c) When you have finished, trace back the complete shortest path that the A* algorithm has identified. [2]

Q5. ----

- (a) In pseudo code (*not* a programming language), write the basic evolutionary algorithm. [10]
- (b) Draw a separate, clearly labelled diagram, showing the processes that generate a single offspring from two parents. [5]

Q6. ----

- (a) Write a simple C++ class method from a 2D vector class to give the dot product of two vectors. [3]
- (b) Explain how to use this method as part of your calculation of the angle between two vectors. What other methods would be useful in this calculation?

[3]

Q7. ----

- (a) Explain how Reynold's flocking algorithm can be extended to allow the flock to move in the direction a programmer directs. Draw a diagram to illustrate how you would calculate the vectors this extension would require. [4]
- (b) Explain how to extend Reynold's flocking algorithm to allow the flock to flee from a predator. Draw a diagram to illustrate how you would calculate the vectors this extension would require. [4]

Q8. ----

Design and draw a finite state machine for a non-player character in an interactive game of computer-tag. The game works as follows:

Two characters run around in an empty space. One of the characters is "it". This character must catch (tag) the other character. If the other character is caught, they become "it". A newly caught character must stop, count to 10, then commence chasing their opponent.

The computer controls one character and a human controls the other. After 60 seconds of chasing, if the "it" character has not tagged their opponent, a sound plays that indicates that the "it" character who is chasing instantly becomes the character who is fleeing. Include in your FSM a strategy for making the most of your knowledge about the 60 second role reversal.

[10]

Notes: This exam is for practice and revision purposes only. It follows the same basic format as the final exam for FIT3094. It is a guide to the kind of questions you will be asked.

This paper is *not* intended to indicate all of the material you are expected to know. This is contained in the lecture material, the assignment and tutorial exercises, the notes you took in class during lectures and the readings referenced in these notes and on the lecture slides.

Study hard!