INSTITUTE OF TECHNOLOGY TRALEE

AUTUMN EXAMINATIONS AY 2017-2018

MODULE TITLE
Games Development

Module Code SWDV 61007
CRN 43979

External Examiner(s): xxxxxxxxxxxx

Internal Examiner(s): Dr. Robert Sheehy

Duration: 2 Hours

Instructions to Candidates: Please answer 4 questions

Question 1

(a) Mathematics and in particular vector mathematics would be used throughout games. Given the following situation:

```
Vector3 roguePosition = new Vector3(50,2,-20);
Vector3 victimPosition= new Vector3(62,-1,-16);
Vector3 rogueForward = Vector3.normalise( new Vector3 (8,1,-4));
Vector3 victimForward = Vector3.normalise( new Vector3 (7,4,-4));
```

(i) Derive the vector "rogueToVictim"

(2 Marks)

(ii) How far is the rogue from the victim?

(2 Marks)

(iii) Calculate the vectors rogueForward and victimForward.

(3 Marks)

(iv) Determine, by appropriate use of a scalar dot product, whether the rogue is behind the victim.

(3 Marks)

(v) Determine, by appropriate use of a scalar dot product, whether the rogue is facing the victim.

(3 Marks)

(b) Frame rates are a key consideration when implementing movement, and in particular keeping movement Frame Rate Independent

(i) What are the physical rules governing motions that are used to ensure Frame Rate Independence?

(3 Marks)

(ii) Illustrate (code or pseudo code) how Frame Rate Independent motion could be implemented

(4 Marks)

(iii) Illustrate how forces could be applied to an object, giving justification with reference to the appropriate physics formula.

(2 Marks)

(iv) Describe how the following could be implemented.

- Gravity
- Wind Resistance
- Explosions

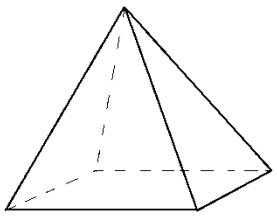
(3 Marks)

Question 2

A Pyramid is required for a game.

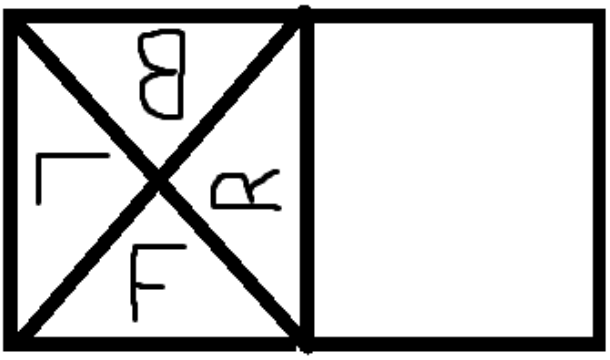
(a) Derive a vertex and index lists for the pyramid pictured.

(b) Please ensure that you state and comply with any conventions for the definition of the vertices and the faces.



(10 + 2 Marks)

(c) The model above is to be textured and the image is to be split up in the manner the diagram below describes.



(i) Describe in words what this will do to the model .

(1 Mark)

(ii) Derive the data required for the mesh to do this.

(12 Marks)

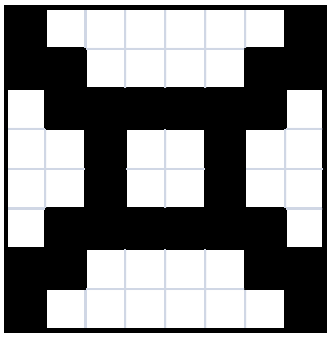
Question 3

(a) BIOT was used to determine collisions between sprites.

(i) What was BIOT?

(1 Mark)

(ii) The following sprite would have been stored in numeric form, derive these numbers.



(3 Marks)

(iii) Draw the sprite represented by the following bytes.

0 , 1, 66, 254, 66, 1, 0, 0

(3 Marks)

(iv) If the top left pixel of the sprite in part (ii) was placed at (100,105) and the sprite from part (iii) was placed at (105,107), illustrate on graph paper whether BIOT would detect a collision between them.

(3 Marks)

(b) Axis Aligned Bounding Boxes (AABB) are not an accurate a means of detecting collisions.

(i) Describe why AABB's are not accurate and outline their use in collision detection within a modern games engine.

(5 Marks)

(ii) The following table outlines the positions and ranges of the AABB's for 3 objects, a player and 2 enemies. Apply the Sort and sweep algorithm to determine if a collision has occurred.

(10 Marks)

	Ship	Asteroid	Missile
X	305	100	95
+-	14	5	2
Y	-145	-150	-160
+-	3	5	10
Z	220	230	232
+-	10	5	2

Question 4

(a) Artifical intelligence (A.I.) can be useful in describing behaviours of Non-Playing Characters (NPC's) in games. The implementation of A.I. is usually separated into sensing, thinking and acting sections. If we intend to implement a Finite State Machine (FSM) to deal with the thinking section…

(i) What is an FSM?

(2 Marks)

(ii) Discuss, with sample code, the implementation of a FSM referring to, with examples, the sensing, thinking and acting phases of the AI.

(6 Marks)

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(iii) What are Hierarchical FSM's and Markov Models? What advantages do these have over FSM's?

(2 Marks)

(b) The AI used in games like Chess and Draughts would be seen as a Search Problem

(i) Classical or theoretical Search problems, use a **Search Tree**, **Utility Function** and the **Min Max Algorithm**. Describe how these work to determine the best move.

(5 Marks)

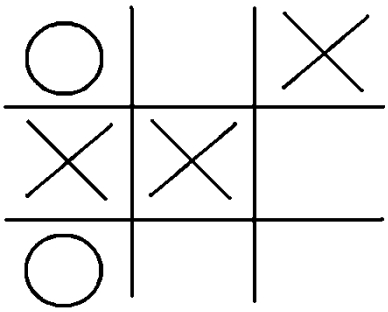
(ii) The classical approach is not feasible in practice, why?

(1 Mark)

(iii) In practice, an **Evaluation Function** is used at a specific **Ply Depth** instead of the utility function, describe how this could be used to determine the best move.

(5 Marks)

(iv) Construct the next layer of the Search Tree for this unfinished game, assuming the AI is playing O's and complete two of the branches. Apply Min/Max to those branches.



(4 Marks)

Question 5

(a) Contributing to, and managing, a group project can be a challenging problem. Describe workflow of a typical setup for a project on a public Git repository. Please address the following.

- Initial Setup.

(4 Marks)

- Typical Work session.

(4 Marks)

- Management of project after completion of work session.

(4 Marks)

(b) Inheritance is one of the core concepts of Object Orientated Programming (OOP).

- What is inheritance?

(1 Mark)

- Give an example of how inheritance may be used in game development.

(3 Marks)

A Unity script, by default, inherits from the Monobehaviour class.

- Discuss, with examples, what that means for typical unity scripts.

(3 Marks)

- Give 3 examples of where code is typically placed in a unity script, outlining when this code is called.

(3 Marks)

- Discuss the ways that game objects can communicate with each other in Unity.

(3 Marks)