**WINTER EXAMINATIONS AY 2014-2015**

**Question 2**

**(a) Mathematics and in particular vector mathematics would be used throughout games. Given the following situation:**   
Vector3 roguePosition = new Vector3(3,4,5);   
Vector3 victimPosition= new Vector3(1,3,1);   
Vector3 rogueForward = Vector3.normalise( new Vector3 (-3,1,-4));   
Vector3 victimForward = Vector3.normalise( new Vector3 (-6,4,1));

**(i) How far is the rogue from the victim? (2 Marks)**   
 = 4.583

**(ii) Derive the vector “rogueToVictim” (2 Marks)**  
roguePosition(3,4,5) - victimPosition(1,3,1) = (2,1,4)

**(iii) Determine, by appropriate use of a scalar dot product, whether the rogue is behind the victim. (3 Marks)**  
victimForward.rogueToVictim  
 v.u = (-6\*2)+(4\*1)+(1\*4)  
 = (-12)+(4)+(4)  
 = (-4)  
rogueToVictim and victimForward are facing opposite directions, so the victim is facing the rogue.

**(iv) Determine, by appropriate use of a scalar dot product, whether the rogue is facing the victim. (3 Marks)**  
rogueForward.rogueToVictim  
 v.u = (-3\*2)+(1\*1)+(-4\*4)  
 = (-6)+(1)+(-16)  
 = -21

The rogueForward and rogueToVictim are facing opposite directions.

**(v) In World of Warcraft, the class rogue has a move called “Backstab” To be able to use this move the following three conditions must be satisfied. • The rogue must be behind the victim • The rogue must be facing the victim • The rogue must be within 3 yards of the victim. Can the rogue backstab the victim? (2 Marks)**   
The Rogue is 4.583 units away, not behind the Victim and not facing the Victim. However the Victim is in a much better position to backstab the rogue.

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

**(i) What is Frame Rate Independence? Why is it important? (2 Marks)**  
Frame Rate Independence is when a process in a game or similar software runs at the same speed regardless of the frame rate on the machine running it. This helps prevent software from running too fast on powerful machines, and much to slow on weaker machines.

**(ii) Give two reasons frame rates could differ for a game. (2 Marks)**   
A more powerful machine may run a game significantly faster. Or a sudden amount of background tasks may slow the machine.

**(iii) What are the physical rules governing motions that are used to ensure Frame Rate Independence? (3 Marks)**  
Delta Time is primary method of ensuring frame rate independence by adjusting the amount variables are changed relative to time.

**(iv) Illustrate (code or pseudo code) how Frame Rate Independent motion could be implemented (4 Marks)**

IF(shouldGoForward){   
 goForward();  
}  
  
goForward(){  
 transform.position = vector3.forward\*deltaTime;  
}

**(v) Illustrate how forces could be applied to an object, giving justification with reference to the appropriate physics formula. (2 Marks)**V = u+at.  
Using a vector of (0,-9.8,0) or a Vector.Down\*9.8 approach you can simulate acceleration due to gravity.

Velocity += Vector.Down\*9.8\*DeltaTime;  
This velocity vector can then be applied to a transformation.