Assignment

Assignment - Task

- Title
  - Develop from scratch an interactive 3D game
- Task
  - The aim of the assignment is two fold: (a) develop a small game engine in C++ and (b) develop the graphics and physics components for an interactive 3D game
    - These components should that cover the general motion of a rigid body in three dimensional space, including issues of collision of bodies and their subsequent motion

Game Engine - Task

- Task
  - The aim of the game engine component is to implement from scratch a set of computer graphics classes that will be used for
    - Modelling the scene of the game
    - creating the physics components of different interactive computer games

Game Engine - Specification

- Based on the vector theory you should implement a 3D vector class in C++ which will be used as a basis for the rest of the course
- Based on the matrices theory you should implement a 3×3 matrix class in C++ which will be used as a basis for the rest of the course
- Finally you should implement a ray class in C++

Game Engine - Minimum Implementation

- The basic implementation should include the following:
  - A 3D vector class, which you can call TVector, with three components (x, y and z)
  - A 3×3 matrix class, which you can call Tmatrix, with a two-dimensional array (i.e. double _Mx[3][3])
  - A Ray class which will be based on the vector and matrix class

Game Engine - Minimum Functionality

- Unit vector (for vector class)
- Magnitude of a vector (for vector class)
- Invert a vector (for vector class)
- Add two vectors (for vector class)
- Subtract two vectors (for vector class)
- Dot product vector (for vector class)
- Cross product vector (for vector class)
- Addition (for matrix class)
- Subtraction (for matrix class)
- Multiplication (for matrix class)
- Transpose (for matrix class)
- Inverse (for matrix class)
- Calculate distance between two rays (for ray class)
- Calculate distance between a ray and a point (for ray class)

Game Engine - Extra Features

- Extra credit will be given for adding more features to the classes
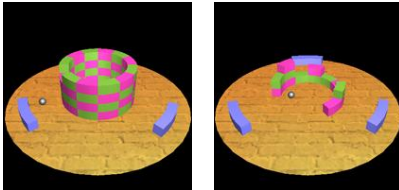
Game Specification

- The traditional 2D Breakout is one of the first interactive video games available on personal computers
- The main idea is to knock down a set of 2D bricks using a 2D racket and a ball moving at constant speed
- As soon as the ball collides with a brick then it vanishes
- The goal of the game is to make all bricks disappear from the game arena
- To increase the level of difficulty and game-play, later versions make use of multiple rackets and balls and vary the speed of the ball

Game Specification .

- The 3D Breakout, a cylindrical wall that consists of 3D bricks, exists in the middle of the simulation area

Game Specification ..

- A single player controls three curved bats, each positioned at an angle of 120 degrees to each other
- The bats can move clockwise or anticlockwise using the keyboard arrow keys as input
- The cylindrical wall is situated in the middle of the circle and is constructed by twelve bricks in such a way that it looks like a shaft
- The main idea of the 3D game is to knock down all the 3D bricks and 'destroy' the well

Game - Graphics Minimum Implementation

- Colour
  - Bats, Ball and Bricks of the well
- Manipulate the scene
  - Rotate, translate and scale
- Change camera positions
  - Perspective view, top view and ball view
- Transparency
  - Bats and bricks of the well
- Add lighting to the game
  - Ambient light, diffuse light and specular light
- Record the score
- Texturing
  - Ground

Game - Graphics Extra Features

- Appropriate gaming scenario
- Logo introduction page
- Increase/decrease the speed of the ball
- Use of textures to the bricks and bats
- Add sound
- Special effects

Game - Physics Minimum Implementation

- Construct from scratch a gaming environment
  - Three bats
  - One well
  - A ground
  - One ball
- A real-time simulation of a ball
- Collision detection between:
  - Ball-bats
  - Ball-well
  - Ball-Invisible wall

Game - Physics Extra Features

- Extra credit will be given for adding more features to the game
- Some ideas for improvement include the following:
  - Friction
  - Weight
  - Make the ball bounce
  - Gravity
  - Deformations

Report Structure

- Title page
- Contents
- Abstract (or summary)
- Introduction
- Background theory
- Methodology and results
- Conclusions
- References
- Appendices