Intermediate Computer Graphics Midterm

Roles

Kyra Trinidad (100784182)

- Programmed functional game loop
    - Coded in collisions, win/loss conditions, and game loop updates
    - Loaded in models and textures
- Changed default shader to rework lighting conditions in-game
- Answered parts of each question on this pdf

Carolyn (Car) Wong (100781520)

- Created 3D models and textures
- Editing video
- Loaded background, win and loss screen
    - Programmed win and loss screen
- Answered various questions

Anthony Brown (100748594)

- Wrote description for game and answered question 1

Brick Breaker

The game we have chosen was brick breaker. It is a single-player game. The playable character is a rectangular paddle that the ball bounces against. This paddle determines the speed and angle of the ball depending on where it hits the platform. If the ball hits closer to the edge of the paddle, it moves faster and at a larger angle compared to hitting the centre of the paddle. The 'enemies' that you must defeat are spherical bricks located around the playing field. These 'enemies' can be destroyed by being in contact with the constantly moving ball. Using collision detection, the ball can both bounce against the rectangular platform and destroy the bricks. When all bricks are destroyed, the player will win. If the player misses the ball with their paddle at any point before all the bricks are destroyed, the player loses and that will become the loss condition.

1. Select the playable character and use it to explain the graphics pipeline stages associated with Vertex shader, Geometry Shader, and fragment shader.
    - The playable character would be our rectangular paddle. The mesh is made using Blender. The vertices in the model are connected and form triangles between each other. These vertices are then sent to the vertex shader and vertex buffer objects can store all these vertices in the GPU's memory.
    - The Geometry shader is run on the points on the playable character and it discards or can output more primitives than it came in. Mainly was used when trying to draw simple geometry. It can be used to discard vertices that aren't seen. Because the camera is orthographic in our game, you don't see half the vertices of the rectangular prism.

- Using the fragment shader gave the playable character more colour and depth values. It takes the colour of the texture that was applied to the paddle and outputs it. In the fragment shader, you can use the Blinn-Phong model and apply appropriate lighting to make the colours and shading look more realistic.

2. Explain how the Phong lighting model allows you to create a metallic feel for objects within the game.
    - The Phong lighting model contains emissive, ambient, diffuse, and specular lights. The values of these parameters can be changed to make a model appear as a certain material. When looking at the material table in the slides we can see that the brass material has higher ambient, diffuse, and specular. When looking at the shininess parameter, it is higher than most of the other metals.
    - If you have a suitable material based on its ambient colour, you can up the specular value by multiplying it by a certain factor which will change how light is reflected off the object.

3. Explain what approach allows you to create a winter feel using Shaders
    - Colour grading can be used to create a winter feel. Using a LUT we can apply a post-processing effect that makes the scene have cool tones. Because winter is a colder season, using cooler tones in the scene will evoke a sadder and colder mood. In Photoshop, we can apply adjustment layers. You can change the hue and saturation to get the scene looking bluer. We can also lower the saturation of the scene to make the scene less lively and blend together more.

4. A dynamic light that gives the effect of changing the scene (e.g., day passing, seasonal changes, etc.). This includes proper light behaviour when moving away or closer to objects.
    - To have dynamic light that changes we could have the light change from a darker more blue colour to indicate a winter environment to a brighter more yellow colour that indicates a summer environment. This would happen by changing the RGB values of the light from more Blue to a mix of red and green.

5. Explain how you implemented the shader for this Midterm and indicate why this choice was made.
    - In this midterm, we used Blender, as a way to envision the game with a toon shader. A diffuse and glossy BSDF was used. We then used a colourRamp to modify the shading. The shading was turned from linear to a constant meaning that there is a hard break between the colours.
    - To do toon shading on the coding side, we would have implemented an extra shader. We would've used a lookup table that maps out the changes in light intensity and the cutoff between each step in intensity.

- This enhances the game by making the visuals more interesting than just regular Phong shading. It is a cute arcade game and having a simple cartoony shader makes the game look more visually appealing.