**Blasteroids Design Document**

**Summary**

*Blasteroids* is a successor to the classic arcade game Asteroids. It includes a handful of new features, such as powerups, while still maintaining the original game’s classic look and feel. A ship controlled by the player flies around shooting at asteroids that randomly shoot across the screen. The aim of the game is for the player to reach a highscore before losing all their health points from colliding with asteroids. They are assisted by randomly spawning powerups that assist them. Both the game and the highscore database are portable, allowing players to easily share their scores.

**Game Mechanics**

Each object in the game contains two Vector2s representing position and velocity. The movement of objects in the game can be emulated by updating their position based on their velocity. Objects also contain a rotation value that represents the rotation of the object in the game world in degrees. For the sake of simplicity, each object contains a radius value that represents a circle in the game world. This circle is used for all collisions between objects, meaning that basically every object is a circle.

**Player**

The player is the only object to have an acceleration value. This value is increased when the user holds the forward key and decreased when they hold backward key. The player’s rotation value is increased and decreased using the left and right keys. By changing the values of the player’s velocity based on the acceleration and rotation values, the player can fly around the screen in any direction.

The player’s location is set to the opposite side of the screen if they pass an edge, creating an endless loop effect.

**Asteroids**

The asteroids are all initialised at the start of play in an array. Asteroids can be small, medium, or large. This size is used to determine most of the asteroid’s other characteristics, such as starting velocity, deflection from shots, and health points.

When hit by a shot, the asteroid loses a health point. If the asteroid’s health points reach zero, the player’s score is increased based on the asteroid’s size and the asteroid is respawned again after a period, making the game endless.

When an asteroid is spawned, its starting position and velocity is set randomly, but there is a 100-unit buffer based on the player’s position to stop asteroids from spawning too close to the player. The asteroids also endlessly loop across the screen like the Player.

**Shots**

The player can create shots by pressing the shoot key. These shots travel at a set speed in the direction the player was facing when they pressed the shoot key. Shots are initialised into a vector with a maximum size of twenty. If there are already twenty shots and the player attempts to shoot, the oldest shot will be replaced. Without a limit on how fast the player can shoot, this rewards players who time and aim their shots rather than shooting wildly as fast as they can. If a shot reaches the edge of the screen, it is removed. If a shot collides with an asteroid, it changes the asteroid’s velocity as if being knocked by the shot, which can help players escape head-on collisions with asteroids.

**Powerups**

There are three different kinds of powerups, each with a different benefit for the player. They spawn intermittently during play, with one of each type being able to spawn. While during gameplay it may appear like there are many powerups spawning, there are only three powerups that are initialised at the beginning of play. When a powerup is collected, it simply is respawned at a different location after a period.

* **Health** – When collected, increases the player’s health by one point if their health isn’t at the max.
  + The health powerup can help struggling players who often take damage but aren’t as helpful for careful players who don’t often take damage.
* **Boost** – When collected, increases the player’s movement speed for a few seconds.
  + The boost powerup can help players escape if they are in danger of being pinned down by a group of asteroids.
* **Bomb** – When collected, spawns a group of shots in a ring around the player.
  + The bomb powerup is a great way to damage a lot of asteroids at once and boost the player’s score.

**Highscores**

**Input**

The player can save their score to the highscore database after each game. They can input a three-character name to save their score with, reminiscent of highscores on old arcade machines. A highscore can only be saved if it beats an existing score in the database.

**Highscore struct**

Highscores are saved in a HighScore struct, containing a string for name and an integer for score. When the player wants to view the existing scores, the scores and connected names saved in the database are saved into a HighScore vector for easy access. When the player wants to save their highscore, the score is written into the database in the binary format.