

Pinball Game

Introduction

Pinball is a very famous game; even before computers! It used to be a purely mechanical game with a lot of effort put in it (till this very day!). With the rise of computers and video games, a whole [family](#) of Pinball video games were developed. There are plenty of free online web-based Pinball games you may try to get familiar with the game before continuing to read the document; e.g., **Pinball: Space Adventure**.

Project Scope

The project is a simplified 2D game with minimal graphics, e.g., the first round lane of motion with the spring is not required. Any advanced aesthetic looks are not required but will be rewarded with bonus marks. Only two control buttons are required (in addition to the exit action). The motion simulation is done by dividing time into small frames and applying the classical equations of motion for one particle under uniform acceleration (see [here](#)) during these frames. No advanced dynamics background is needed.

Components

Following are the definitions of the components we will be using in our Pinball game project!

Ball

A metallic ball bouncing around hitting various objects. The game is over when the ball is down the drain (outside the bottom limit of the game in video games).

Flippers

Two controllable levers that can kick the ball back up whenever encountered. The speed and direction of the kick differ depending on the speed and position of both the flipper and the ball when kicked.

Obstacles

Obstacles are what we are going to call everything else that the ball can collide with. Each collision may have an effect on the ball and increase/decrease the score by some factor.

Walls/Ceilings		
Wall Given	Vertical thin long (takes up the whole game height) obstacle off which the ball bounces	Reflects the ball's horizontal speed component
Ceiling	Horizontal thin long (takes up the whole game height) obstacle off which the ball bounces	Reflects the ball's vertical speed component
Bumpers		
Pop bumpers	Round obstacles with some radius off which the ball bounces	Reflects the ball's speed component perpendicular to the point of collision
Thrust bumpers	Round obstacles with some radius and a speed boosting factor off which the ball bounces	Reflects and boosts the ball's speed component perpendicular to the point of collision
Vibranium bumpers	Round (with a Vibranium coating) obstacles with some radius off which the ball bounces	Absorbs the ball's kinetic energy (makes the ball under gravity as if it was still)
Kickers/Slingshots		
Kickers/Slingshots	Right angle-shaped obstacles off which the ball bounces	Reflects the ball's speed component perpendicular to the side of collision
Rollovers		
Speed boosters	Round buttons with some radius on which the ball steps	Boosts the ball's speed in its moving direction
Collectables	Characters of the string "CIE 202" on which the ball steps	Lights up and increases the score (no effect on the ball)

Targets		
Score multipliers	Special-looking obstacles of any aforementioned type (bumpers, kickers/slingshots, rollover, etc.) with an associated multiplier	Multiplies the score besides its normal effect
Bullseye	Special-looking obstacles of any aforementioned type (bumpers, kickers/slingshots, rollover, etc.)	Increases the score with a value depending on the exact point of collision (the closer to the center, the better) besides its normal effect
Routers		
Switches	Line segments or arcs	Allows the ball to go through them one time only, bounces off them after that
Gates	Line segments or arcs	Allows the ball to go through them in one direction and bounces off them in the other direction
Ramps	Tilted surfaces	Makes the ball to roll over them
Lanes	Two parallel surfaces separated by exactly the ball diameter	Makes the ball go through them from one side to the other
Portals	Two gates	Teleports the ball from one gate to the other
Extras		
Magnets	Round magnetic bumps	Applies a force to the ball from nearby positions to collide with it

Captive Balls **Bonus**

Captive balls are still balls that start moving when hit by the ball and act as extra balls. Handling them will need some thought but they will give the game much more excitement!

Team Formation

Teams consist of 3-4 students.

3-member teams are required to implement 13 of the non-given obstacles; implementing more will be rewarded by bonus grade.

4-member teams are required to implement all 15 of the non-given obstacles.

Grading

Grade Distribution

[5%] **Check-in** weekly with one of the TAs to avoid time drifts.
Please choose a suitable time during office hours to do so!

[25%] **Phase 1 Requirements**

[14%] **Drawing** obstacles; **7** for 3-member teams and **8** for 4-member teams.

[1%] **Drawing** the live score.

[3.5%] **Reading** the layout configuration from a file.

Includes the obstacles and initial position and velocity of the ball.

[3.5%] **Reading** user input and controlling the flippers.

[3%] **Detecting** “Game Over” and **displaying** the final score.

[40%] **Phase 2 Requirements**

[12%] **Drawing** more obstacles; **6** for 3-member teams and **7** for 4-member teams.

[14%] **Detecting** collisions between the ball and the drawn obstacles + the flippers

[14%] **Change** the ball’s course of motion after each collision.

[10%] **Adhering to OOP concepts.**

[5%] **Presentation and demo.**

[15%] **Individual Assessment**

[5%] **Teamwork** including peer review (template below)

[10%] **General Discussion** at the end of the project

Penalties

Undoubted plagiarism	x 0.0
Non-working / Unreachable code	x 0.5
Crashing code	x 0.8
Memory Leaks	x 0.9
Deferring a phase 1 requirement to phase 2	x 0.5

Peer Review Template

	Rate each element 5(best) to 1(worst). To be filled by each member			
	Group member Name	Group member Name	Group member Name	Group member Name
Attends group meetings regularly and arrives on time.				
Contributes meaningfully to group discussions.				
Completes group assignments on time.				
Prepares work in a quality manner.				
Demonstrates a cooperative and supportive attitude.				
Contributes significantly to the success of the project.				
You would work with him again				
Comments				