GAME2005 – Game Physics

Assignment 2

Projectile Motion, Circular Motion, Free body diagrams and Newton's Laws

Due week #7 (Friday October 23, 2020) @ midnight.

Value 10%

Maximum Mark: 100

Overview: Please complete all questions sections of the assignment with your group members. The best way to complete the assignments is to complete as much of the work as possible on your own. Then, get together with your group members to compare what you have and share ideas, submitting the best assignment possible.

Your group will choose one of the questions to use when developing a short simulation with C++ and the SDL framework.

Instructions :

Part 1: Physics Problem

1. Consider a metal loot crate, at the top of a frictionless ramp. If the mass of the loot crate is 12.8kg and the ramp has a rise of 3m and a run of 4m, then compute the following.
    a) Compute the **free body diagram** of the loot crate a time 0. (i.e. when the loot crate is at the top of the ramp.) (5 Marks)
    b) Compute the **net force** and the **acceleration** of the loot crate at time 0. Given the frictionless surface what do we know about the acceleration as the object moves down the ramp? (5 Marks)
    c) Consider the loot crate as it leaves the ramp and moves onto a at surface that now has some friction. Compute the **free body diagram** for this situation. If coefficient of kinetic friction is 0.42 (steel on steel), calculate the new **net force** and acceleration. (5 Marks)

d) If we assume that the force of friction is **constant** after this point, how long will it take for the loot crate to stop moving? At what distance in meters will the loot crate stop? (5 Marks)
e) Include a **short document (report)** that includes a **diagram** that illustrates the problem and your solution. Ensure you include appropriate labels and **show your work** (10 Marks)

Part 2: Physics Simulation

2. You will use **C++ and the SDL Framework** to create a scene which simulates the motion of the "particle" in the problem from Part 1.
    a) Your application should include a **Start Scene** with **labels** that show Team members' names and student IDs. A **button** or other control will allow the user to go to the Play Scene where all the fun happens (5 Marks: GUI)
    b) Your Play Scene should include appropriate assets for the Physics Simulation. You should include a background image or Tile-Map (10 Marks: GUI)
    c) Choose an **appropriate scale** for your scene (i.e. pixels per meter – PPM). Add appropriate variables and **data structures** (10 Marks: Functionality)
    d) Move the asset that represents the "particle" in the scene according to the problem described above. Let the user "activate" the scene with a button or other control (10 Marks: Functionality)
    e) Use appropriate **label objects** in your scene to show **key statistics** which may include mass, position, velocity, acceleration, force, etc. (you may use ImGui for this as it has been included with your template). (5 Marks: GUI, 5 Marks: Functionality)
    f) Allow the User to **change the variables** (e.g. width and height of the ramp, mass of the loot crate, coefficient of kinetic friction, etc.). Update your Display Accordingly. (10 Marks: Functionality)

Part 3: Video Demonstration

3. Create a Short Video presentation with your favourite screen capture and streaming tool (OBS Recommended) and upload it to Blackboard. You must also include a short PowerPoint (or Google Slides) **Slide Deck** that includes a **single slide** to start your video (10 Marks: Video Demo)
    a) The first (and only) Slide of your Slide Deck must include a **current image** of you and your partner(s) (no avatars allowed) that is displayed appropriately on the page. You must also include your **Full Name(s)**, **Student ID(s)**, the **Course Code**, **Course Name**, and your **Assignment information**. (2 Marks: video)
    b) You will demonstrate each of your app's **Scenes**. Your UI must be **clearly visible** (2 Marks: Video)
    c) You will describe the **code** and **functionality** of your application (2 Marks Video).
    d) **Sound** for your Video must at an appropriate level so that your voice may **be clearly heard**. Your Screen should be **clearly visible** (2 Marks: Video).
    e) Your Short Video should run no more than 5 minutes (2 Marks: Video).

Part 4: Version Control

4. Share your files on **GitHub** to demonstrate Version Control Best Practices

a) **Create** an appropriately named repository on GitHub (1 Marks: Version Control)
b) Your repository must include your code and be well structured (2 Marks: Version Control).
c) Your repository must include commits that demonstrates the project being updated at different stages of development – each time a major change is implemented (2 Marks: Version Control).

Note: Your project will not be accepted without your video demo

Evaluation Criteria

Feature	Description	Marks
Physics Problem	A short report has been created for your physics problem. The math works and does not contain any errors. A diagram accompanies your problem and is labelled appropriately.	30
Physics Simulation UI	UI Controls meet the application requirements. Display elements are deployed in an attractive manner. Appropriate contrast is applied to application UI Controls and any background colours applied so that all text is legible.	20
Physics Simulation Functionality	Your Simulation works without errors. Controls are available for the user to modify the initial values and restart the simulation with those values.	35
Version Control	GitHub commit history demonstrating regular updates.	5
Video Presentation	Your short video must demonstrate your app working in the simulator and discuss each of your designs	10
Total		**100**

SUBMITTING YOUR WORK

Your submission should include:

1. A MS Word or PDF document that shows your work for your Physics Problem.
2. Include the Name and StudentID of each team member at the top of your document.
3. A link to your working GitHub repository for your simulation
4. A zip archive of your project uploaded to Blackboard
5. A link to your Video Demonstration.

This assignment is weighted **10%** of your total mark for this course.

Late submissions:

- 20% deducted for each additional day late.