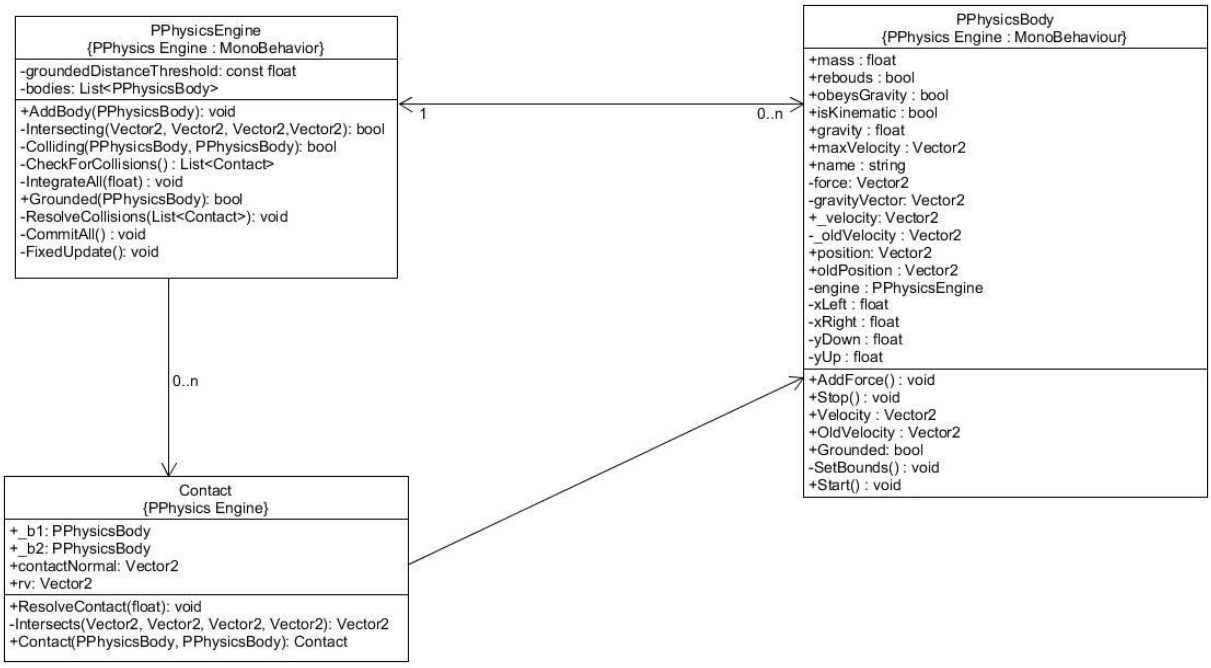
Student Name: Mohammed Hamada Gasmallah Student ID: 10042860

Assignment 3, Part 3 Report

CISC486

1. **Provide a class diagram for your physics engine. The diagram should show the key classes in the engine and their attributes and operations. Show only the engine itself - do not include the sample platformer game. Provide a brief explanation in English text of the structure of the class diagram.**



Above is my UML diagram made in UMLet for the PPhysicsEngine made within Unity. Note that I have added signifiers for the multiples that are within each calss. The 0..n for the Contact dependency in PPhysicsEngine is from the List<Contact> that is generated and the 0..n for the PPhysicsBody dependency comes from the List<PPhysicsBody>.

2. **Does your engine use an explicit or implicit Euler approximation for computing integrals? Briefly explain how this is implemented in the code.**

My engine uses the implicit Euler approximation for computing integrals. The implicit Euler approximation is also known as the Backwards Euler Method. This is implemented in the code by the Integrate loop which is called with a float deltaTime. This deltaTime multiplies the acceleration and modifies the velocity before modifying the position. This implies that we are using y(n+1) and not y(n). This is the implicit Euler approximation.

3. **For the purposes of collisions, all entities are treated as an axis-aligned bounding box. Explain how your algorithm would change if you were to add the possibility of using a bounding circle to represent bodies. Sketch an algorithm showing how collision response would be computed. Explain how the collision normal would be determined. Provide a diagram if that helps in your explanation.**

To allow the use of using bounding circle to represent bodies I would need to use the equation for a circle to be able to determine whether a collision has occurred or not. Using this, we could then extrapolate to find the first intersection point from the circle and the other body. Finding this point is critical to determining the hit normal which will allow us to properly represent the way the collision would be computed. The figure below can be used to help visualize the problem.