CSE 333/533 - Monsoon 2022
Assignment 5: Advanced raytracing
Due date: 11:59:59, 22nd Dec. 2022

Note: This is a bonus assignment and is completely optional to attempt.

In continuation with the previous assignment, we will enhance the raytracer to include textured primitives and raytrace implicit surfaces.

1. Texture mapping is an inexpensive way to add realism to your objects. Texture map at least one primitive supported by your raytracer. The objects will still be shaded as per your shading model (except that the object colour will be replaced by the texture colour at any surface point). [Hint: use parametric texture mapping for objects like sphere, cylinder, etc. and a suitable projection based texture mapping otherwise.]

[Functionality: 20 marks, Code quality and doc: 5 marks, Total: **25 marks**]

2. Implement raytracing of implicit surfaces. Create a class ImplicitSurface derived from class Object that implements an implicit surface S with the equation:
   $S = \{(x,y,z) | 2y(y^2 - 3x^2)(1 - z^2) + (x^2 + y^2)^2 - (9z^2 - 1)(1 - z^2) = 0\}$
   (see: https://en.wikipedia.org/wiki/Implicit_surface)

   The class should implement a function `float value(Vector3D p)` that will return the implicit function value for a given point coordinate $p(x,y,z)$. You need to use this function for raytracing the zero levelset of the implicit surface. For calculating ray-implicit intersection, you may use a suitable numerical method (e.g., see https://members.loria.fr/Olivier.Devillers/seminaires/Slides/2021-D1-Days/Aydinlilar.pdf)

[Functionality: 20 marks, Code quality and doc: 5 mark, Total: **25 marks**]

Deliverables (as a single zipped file **Assignment05_<studentID>.zip)** containing:
- C/C++ code (make sure to upload full code and do not include any intermediate object files, delete any other temporary files).
- 2~3 page PDF Report written with with **Latex/MS Word**. Use the acmlarge option (single column) (see sample-acmlarge.tex if writing with Latex). Include screenshots within the report itself (and DO NOT attach separately).
- A 2-minute demo video showing details of your submission and results.

Total marks for this assignment: 50 marks

Note: Your code should be written by you and be easy to read. You are NOT permitted to use any code that is not written by you. (Any code provided by the TA can be used with proper credits within your program and report)