CSC0049 Advanced Computer Graphics
Assignment 1

Due: March 25
(-10% for each day late)

The goal of this assignment is to build a simple ray tracing program. It is separated into two parts, each with its own due date. This assignment is Part A.

- Part A (Assignment 1): You will build the ray generation and ray-object intersection functions in this part. Your tasks are the following.
  1. Read in the input file, which contains these lines:
     - ✓ Eye position: E x y z
     - ✓ Output Image: O ULx ULy ULz URx URy URz LLx LLy LLz LRx LRy LRz
     - ✓ Resolution: R w h
     - ✓ Sphere: S Ox Oy Oz r
     - ✓ Triangle: T x1 y1 z1 x2 y2 z2 x3 y3 z3

     Where:

     The output image is a rectangle defined by the upper-left corner (ULx, ULy, ULz), upper-right corner (URx, URy, URz), lower-left corner (LLx, LLy, LLz), and the lower-right corner (LRx, LRy, LRz).

     (Ox, Oy, Oz) is the origin of a sphere with the radius = r, and

     (x1, y1, z1), (x2, y2, z2), (x3, y3, z3) are the vertices of a triangle.

     Note that the input file may contain multiple spheres and triangles.
  2. Ray Generation: Determine the position of each screen pixel, then generate a ray from the eye position to each pixel.
  3. Ray-object intersection: Determine whether a ray intersects the objects (which are the spheres and triangles defined by those lines starting with S or T in the input file.)
  4. Output image: Draw an image of black and white pixels, where the black means no intersection is found and the white means at least one intersection is detected. The PPM image library is provided on the course website. You may also use other image format such as JPEG, PNG, or BMP if you prefer them to the PPM format.

  These modules require many 3D vector operations. Therefore you're advised to use a 3D vector or matrix library (of your own choice) or to build your own.

  In Part B (Assignment 2), we will extend the program in Part A to produce a color image. The detail will be announced in the next Assignment.

- Please name your programs "hw1" and submit it on Moodle (https://moodle2.ntnu.edu.tw/course/view.php?id=22736) . If you submit multiple files, then please pack your source files in a single ZIP or RAR file for the upload.