Ray Tracing Project

CS405 – Computer Graphics

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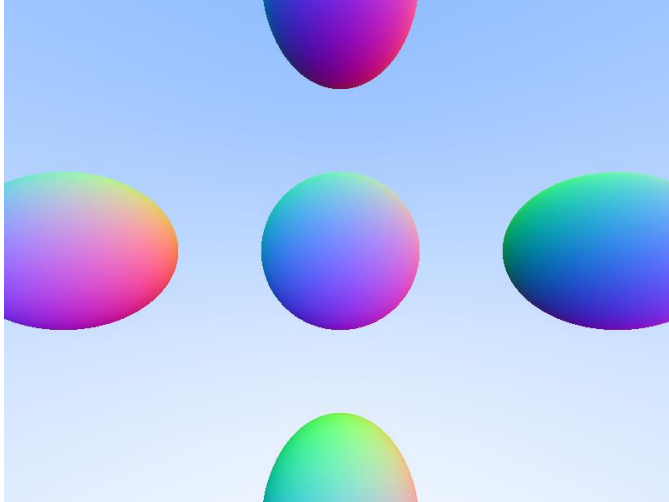
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Task 1: Basic Scene

Camera is on -> 0, 0, 0

There are 5 spheres in my scene and their locations are as follows:

Sphere1: radius -> 0.3

Sphere1: point3 -> 0, 0, -1

Sphere2: radius -> 0.3

Sphere2: point3 -> 1, 0, -1

Sphere3: radius -> 0.3

Sphere3: point3 -> 0, 1, -1

Sphere4: radius -> 0.3

Sphere4: point3 -> -1, 0, -1

Sphere5: radius -> 0.3

Sphere5: point3 -> 0, -1, -1
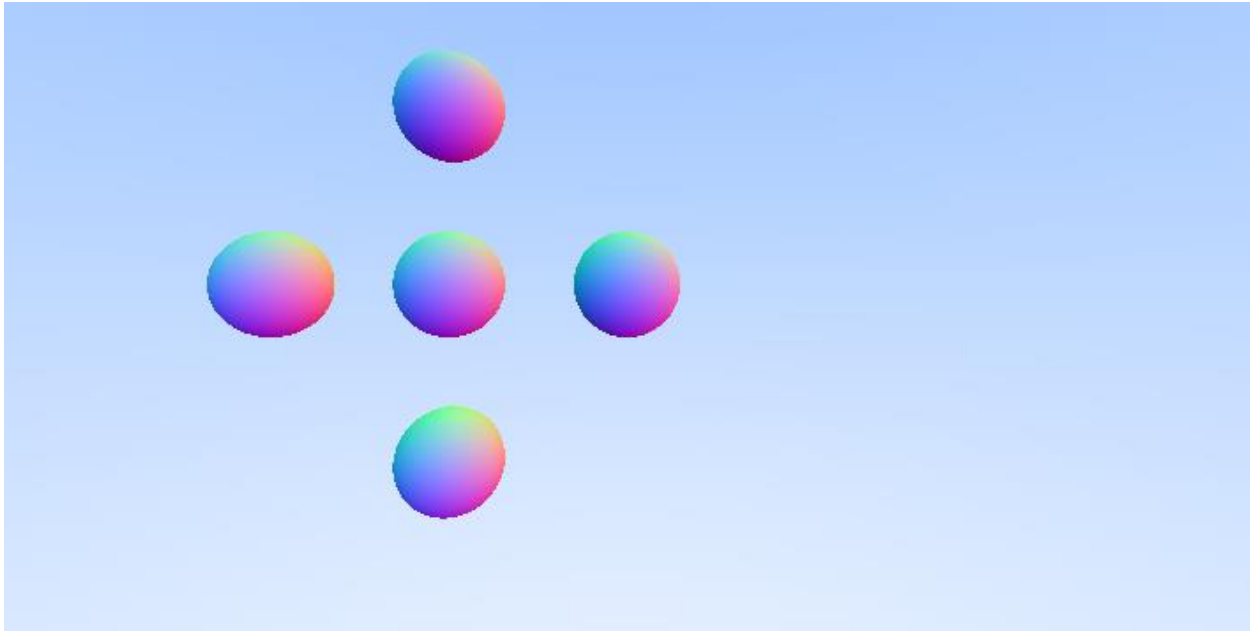
In the second scene I only changed camera angle.

All the spheres are still in the same location.

New camera is on -> 1, 0, 2
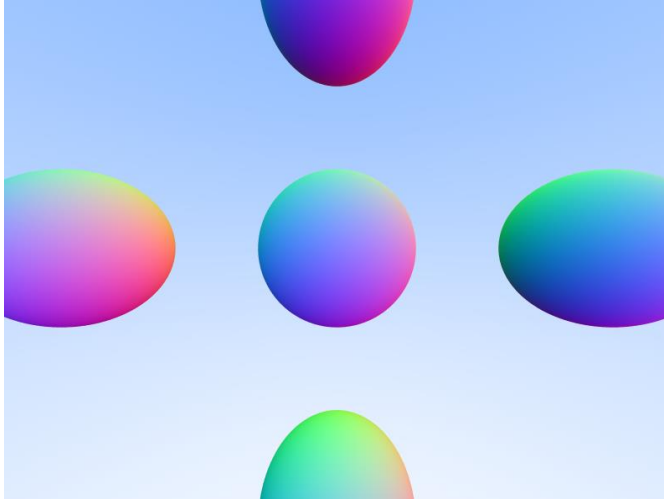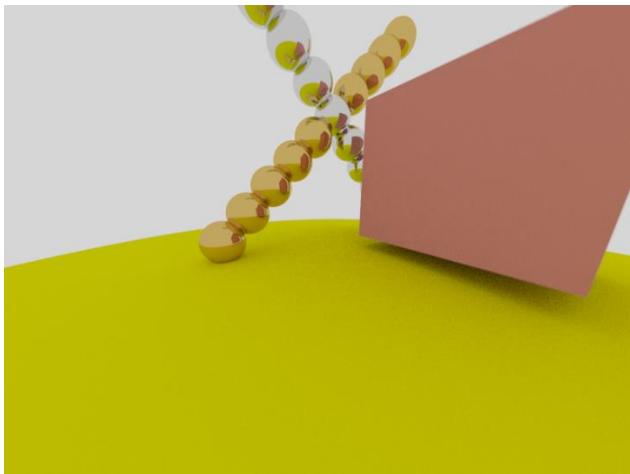
Task 2: Anti-Aliasing

Image on task 1 has not anti-aliasing.

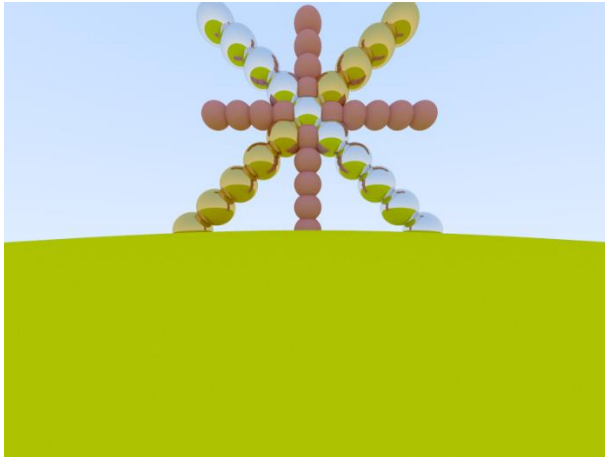This image on task 2 rendered with random algorithm.

Task 3: More Shapes

I created cube with aabb and bvh algorithms.

I found these formulas on the github link that shared (Ray Tracing the Next Week)

Task 4: Diffuse and Metal Materials

I created star shape with spheres using for loop.
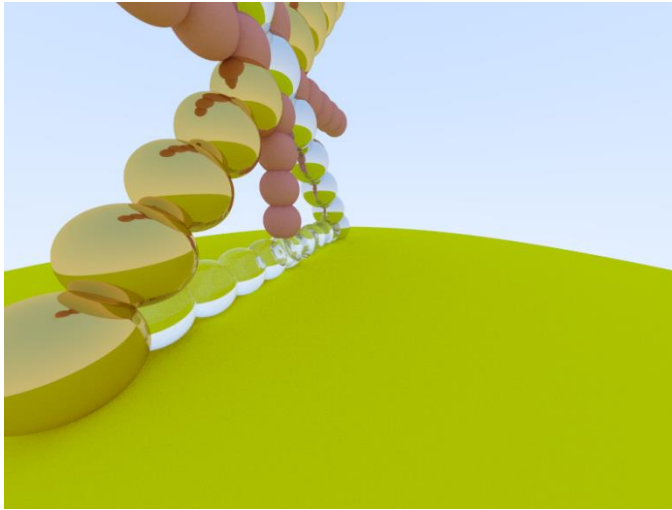
Color of the objects are:

Horizontal and Diagonal part of the star -> (0.7, 0.3, 0.3)

Left to right part of the star -> (0.8, 0.6, 0.2)

Right to left part of the star -> (0.8, 0.8, 0.8)

All the radiuses of the spheres are 0.8

Task 5: Refractions

I used the same star shape just added 8 glass spheres behind the X shape and change the camera angle.

Task 6: Lights

I created 2 renders.

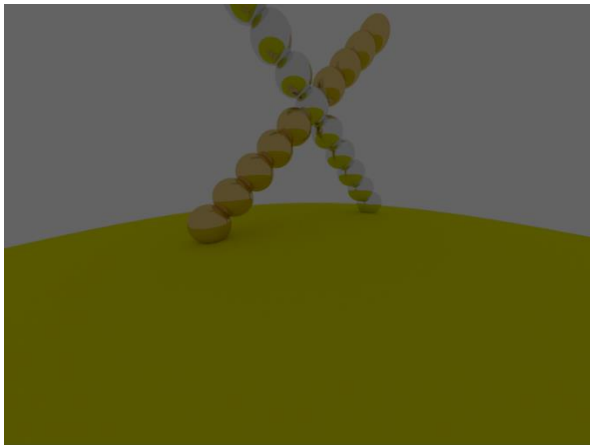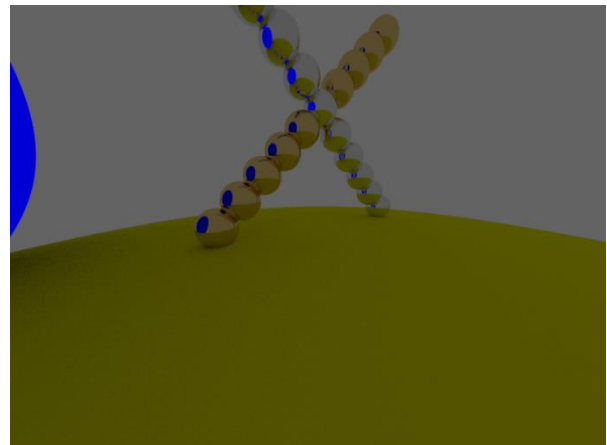<div align="center">Figure 1.</div>

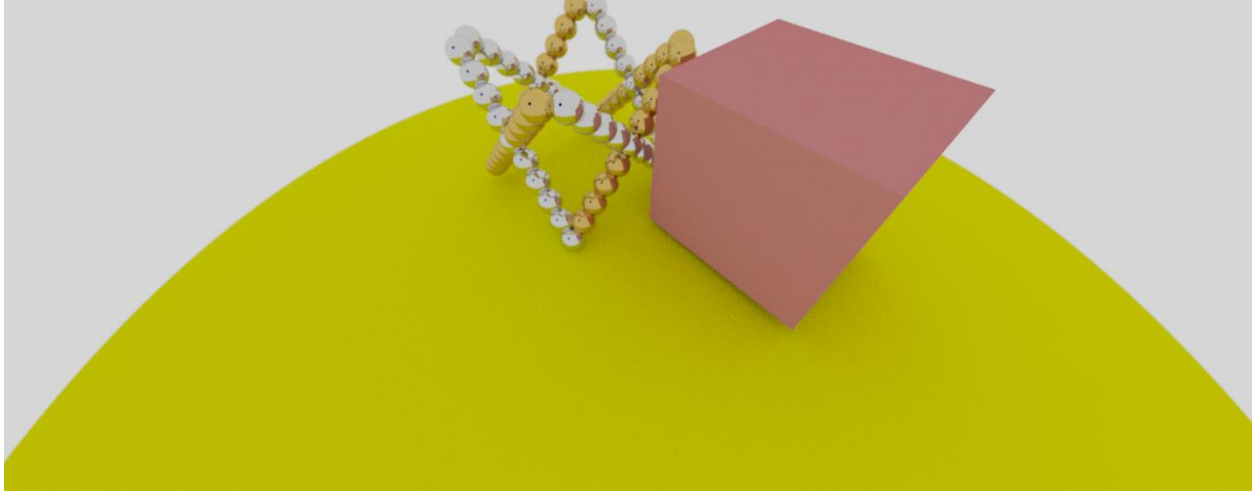<div align="center">Figure 2.</div>

In figure 1, there is no light source in the scene.

In figure 2, I added blue light source, and you can see the reflections of the light on the shape.

Task 7: Let's Get Creative!

For this task I create 1920x1080 pixel image.

I used everything I learned during the previous tasks and final scene is below.

I created 10x10x10 cube and using the spheres I created cube-like shape in 10 x 10 x 10 area.

Task 8: Questions

1) We consider n is number of triangles.

For each pixel we calculate the closest triangle and for each triangle we calculate distance according to the triangle and plane.

We could reach O(logN) time complexity for this problem

2) Image preprocessing are the steps that is done on the image before used by some activities such as model training and inference. For this operation pixels can be normalized and adjust the color, brightness, deepness etc. Computing the image means that creating color for each pixel according to the methods we use like ray tracing.

3) Resolution, Sampling Rate and if there are algorithms like anti-aliasing or blurring, they play important role in performance too.

4) Complexity of ray tracing triangle is O(logn)

We have 5 million triangles and 6000 x 6000 pixels

Answer is = 6000 * 6000 * log (5000000)

References:

1) P. Shirley, "Ray Tracing in One Weekend," [Online]. Available: https://raytracing.github.io/books/RayTracingInOneWeekend.html. [Accessed October 2020].
2) P. Shirley, "Ray Tracing the Next Week," [Online]. Available: https://raytracing.github.io/books/RayTracingTheNextWeek.html. [Accessed October 2020].