Computer Graphics

COMS30115

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1 Candidate Numbers

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2 Extensions

Raytracer

- Phong Shading
- Path Tracer
    - Imperfect reflections
- Photon Mapper
    - Area lighting
    - Spot lighting
    - Reflection & Mirrors
    - Refraction & Glass
    - Soft shadows
- Spheres
- Object loading from .obj files
- Full camera movement with LookAt

Rasteriser

- Full Homogenous Clipping
- Fan Triangulation algorithm
- Optimal Triangulation algorithm
- Object loading from .obj files
- Full camera movement with LookAt

As well as extending the raytracer and rasteriser, we created a raycasting renderer. The raycasting renderer is inspired by Wolfenstien 3D, building up a 3D scene from the intersection and distance data of rays cast in 2D space. The key features of our raycasting renderer are listed below.

Raycaster

- Minimap
- Fisheye correction
- Distance shading
- Floor and Sky
- Full camera movement with LookAt

3 How to Run Code

Firstly, navigate to the top level directory of the submission.

3.1 Path Tracer

```
> cd pathtracer/
> make -B && ./Build/skeleton b n
```

where b = integer number of bounces, n = integer number of samples at each bounce.

Try $b = 1$, $n = 32$. This should take 5-10s.

3.2 Photon Mapper

```
> cd raytracer/
> make -B && ./Build/skeleton n r
```

where n = integer number of photons to emit, r = integer number of photons in radiance estimate.

Try $n = 20000$, $r = 100$. This should take 10-15s.

3.3 Phong Shading

```
> cd raytracer/
> make -B && ./Build/skeleton
```

3.4 Rasteriser

```
> cd rasteriser/
> make -B && ./Build/skeleton t f s
```

where t = whether to triangulate (boolean; 0 or 1), f = whether to fill - wireframe or solid (boolean; 0 or 1), s = demo triangle or full scene (boolean; 0 or 1).

Try $t = 1$, $f = 1$, $s = 1$.

3.5 Raycaster

```
> cd raycaster/
> make -B && ./Build/skeleton w h
```
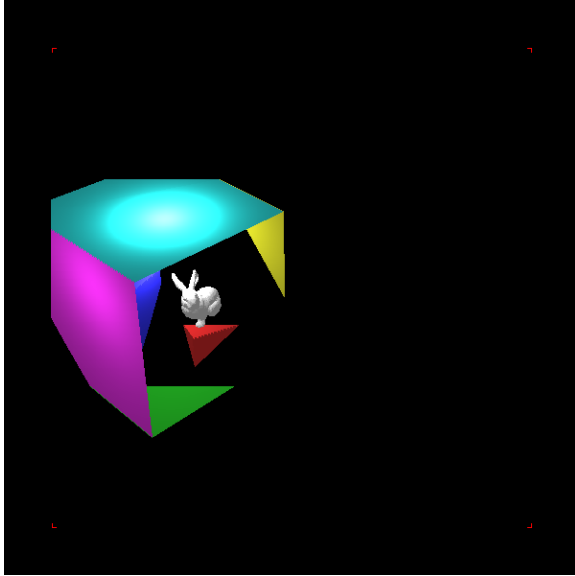
where w = screen width (px), h = screen height (px).
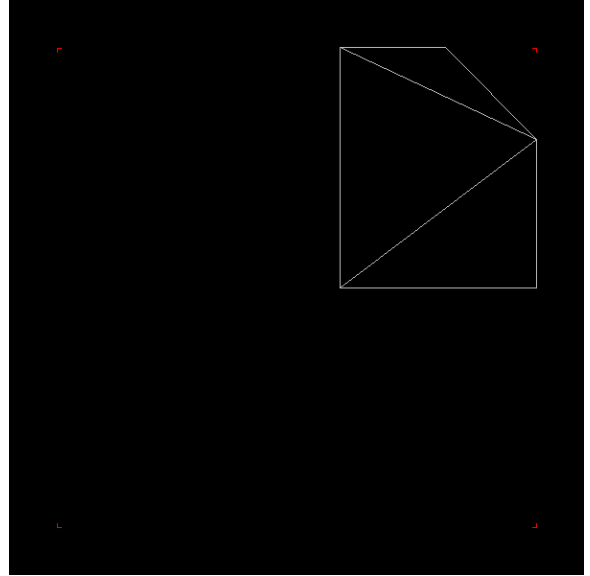
Try $w = 600$, $h = 600$.

4 Gallery

4.1 Rasteriser

Demonstration video: https://www.youtube.com/watch?v=RgAZK1vxCeg

(a) Clipping to both left and far planes

(b) Demonstration of optimal triangulation

Figure 1: Rasteriser clipping examples

4.2 Path Tracer
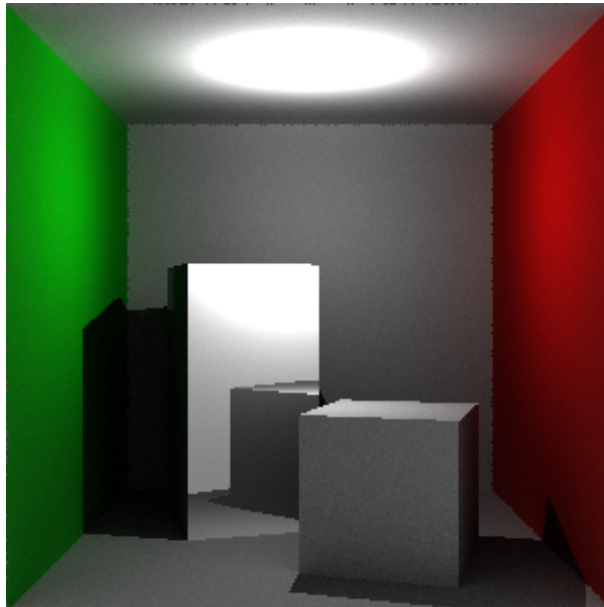

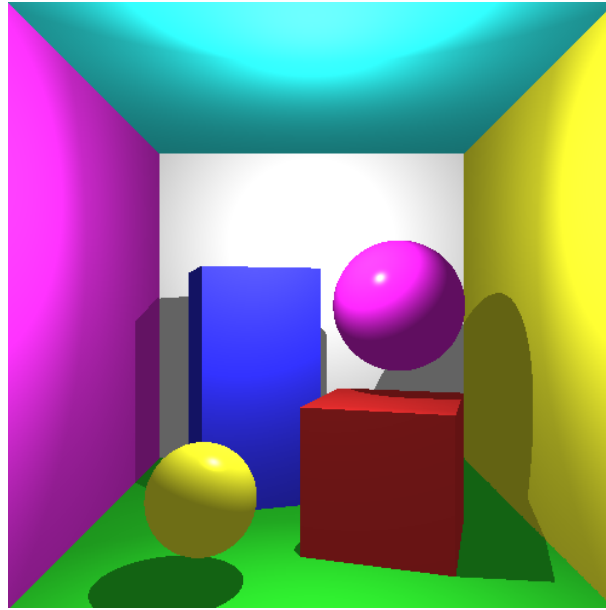Figure 2: Path tracing with the tall block as an imperfect mirror
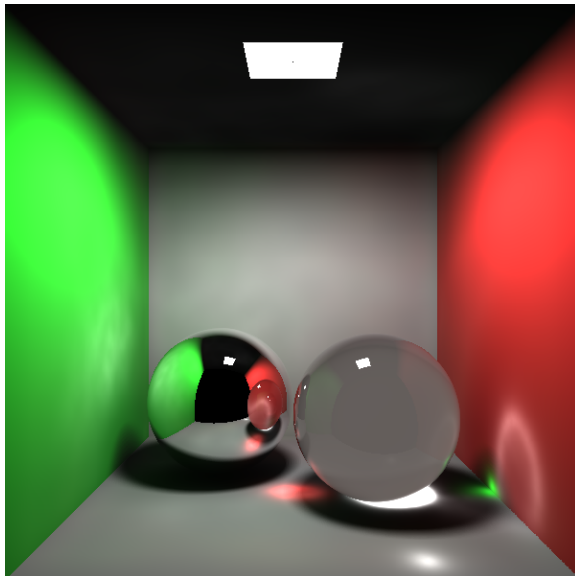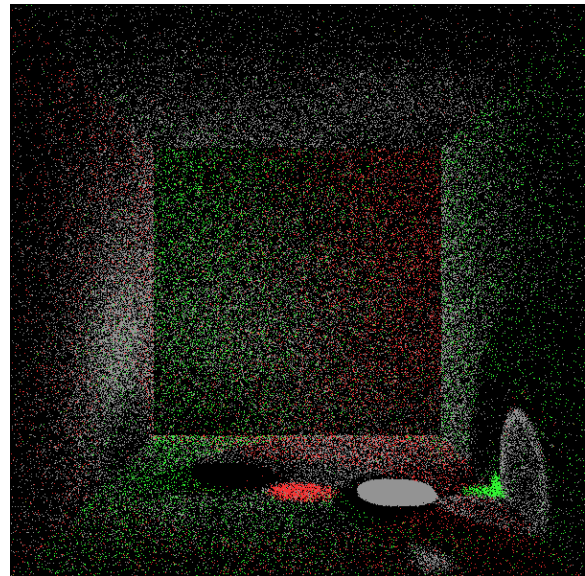
4.3 Phong Shading

Figure 3: Phong example
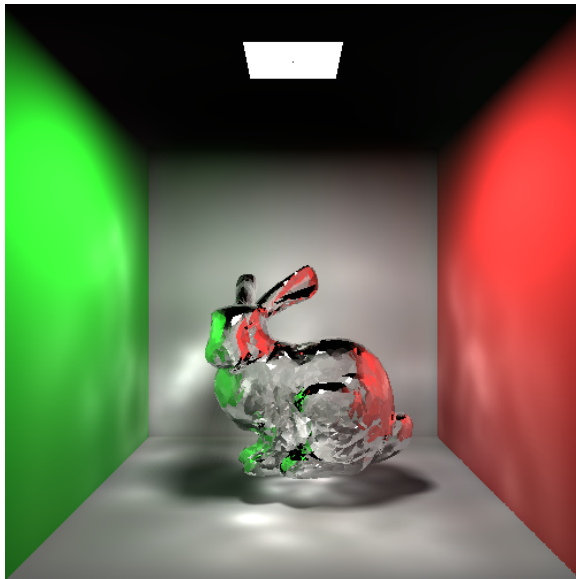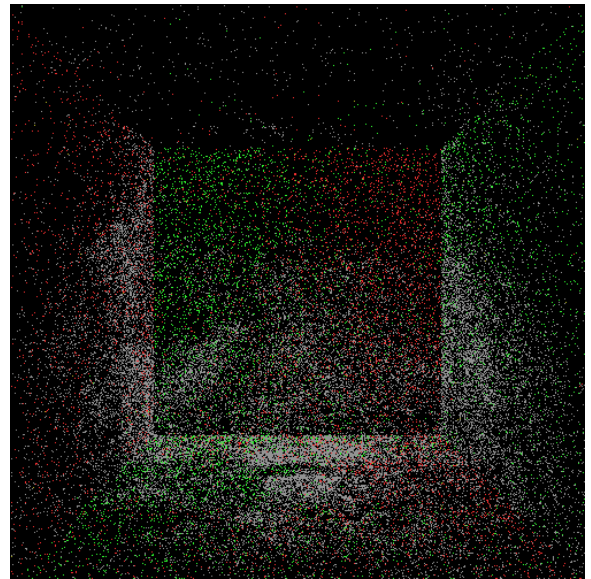
4.4 Photon Mapper

(a) Render

(b) Corresponding Photon map

Figure 4: Photon Mapper with glass and chrome balls

(a) Render

(b) Corresponding Photon map

Figure 5: Photon Mapper with a glass Stanford bunny
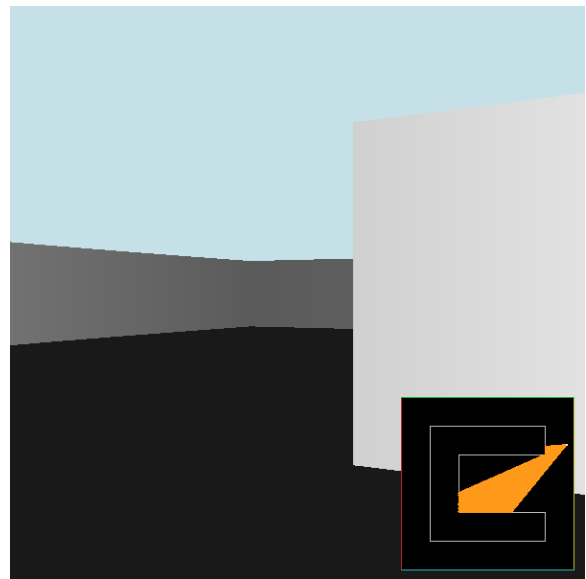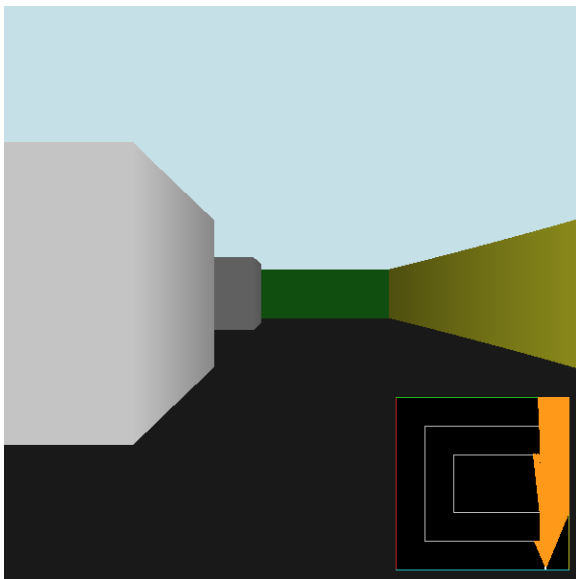
4.5 Raycaster

Demonstration video: https://www.youtube.com/watch?v=gmD1RMafxK0

Figure 6: Raycaster snapshots