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Graphics Coursework 3
MSc CGVI 2016-17
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Ques 7
For making the quantitative measurements , we can do comparisons between the Ground Truth Image and the the rendered images that we have got from our path tracer.
As such there is no ground truth image for the scene we are trying to render, but assuming that all the programming and mathematical logic is correct in our renderer, if we allow it to render the 3D scene for infinitely large amount of time (very long time for practical reasons), then the close to perfect image that gets rendered may be treated as Ground Truth Image.
Shown Below is the ground truth image for the rendering task for this practical. It was rendered for 43000 iterations.
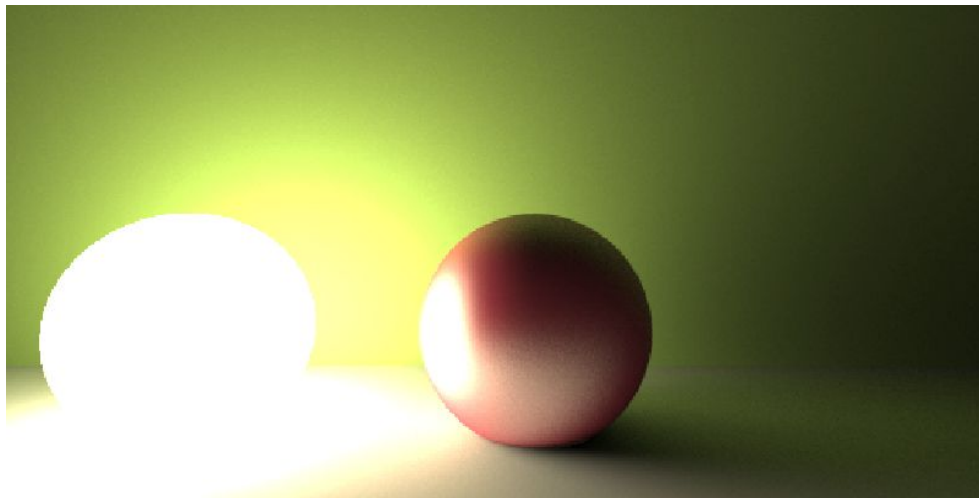

Figure 1 Ground Truth Image

The metrics that can be used to measure the performance of path tracer are
   1) Difference of Pixel RGB Intensities between Ground Truth and rendered image
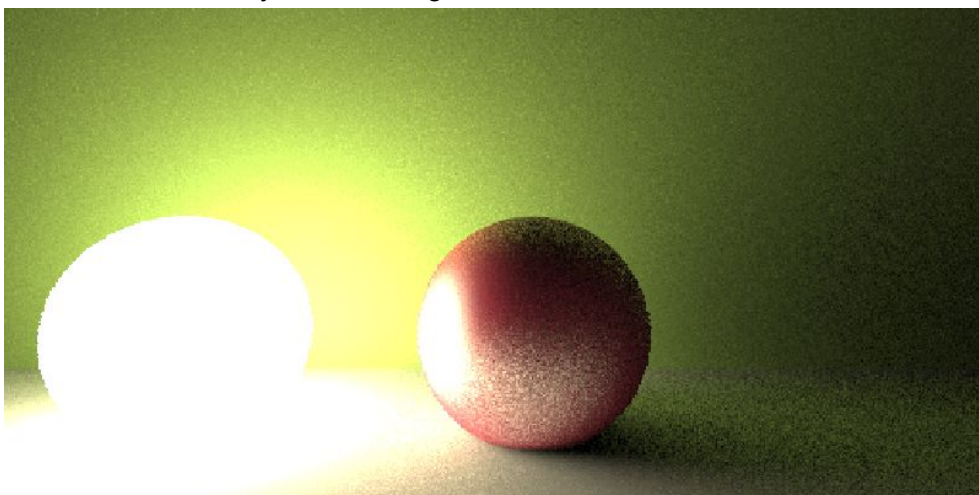   2) Difference in Luminosity of both images

Image after 1000 Samples

Other metrics that can be used to compare the path tracer performance are
1) Samples per second
2) Total time of rendering

Since we have been implementing improvements in stages to our path tracer, we can compare the performance at each step in following ways:

1) Halton Sampling
Since this step is used to sample the rays using a deterministic pattern than being random, it helps in quicker convergence and lesser noise. We can compare the ith frame and see the difference between random sampled and normal sample image.
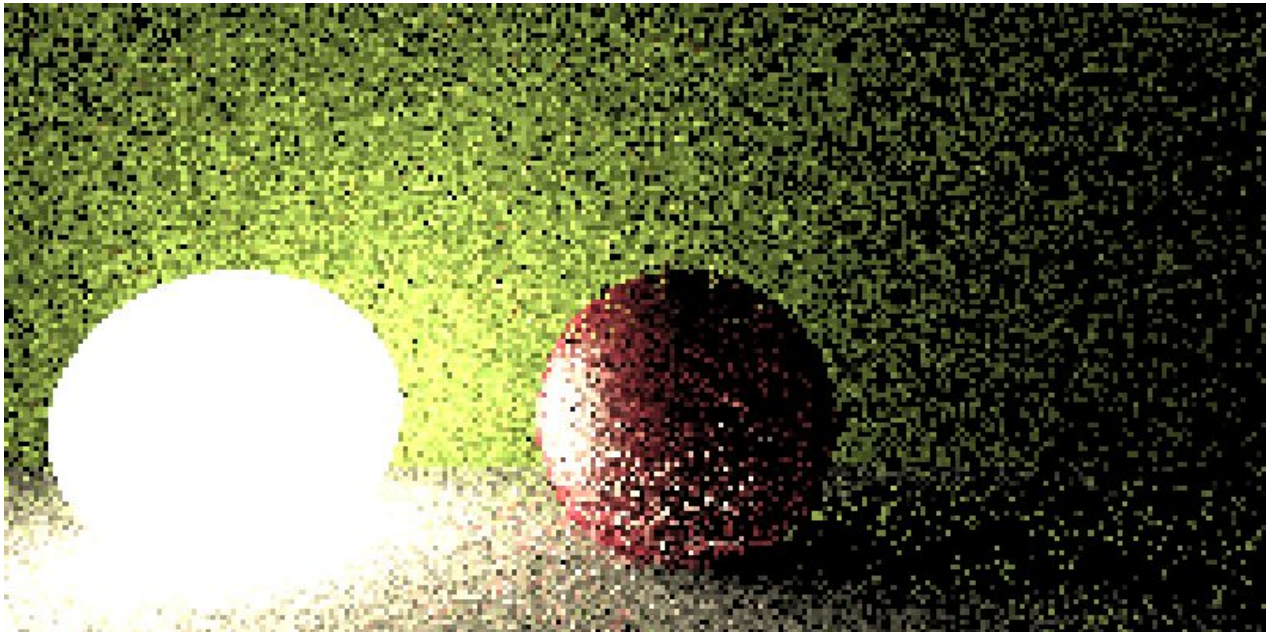
Random Sampled Image after 100 iterations
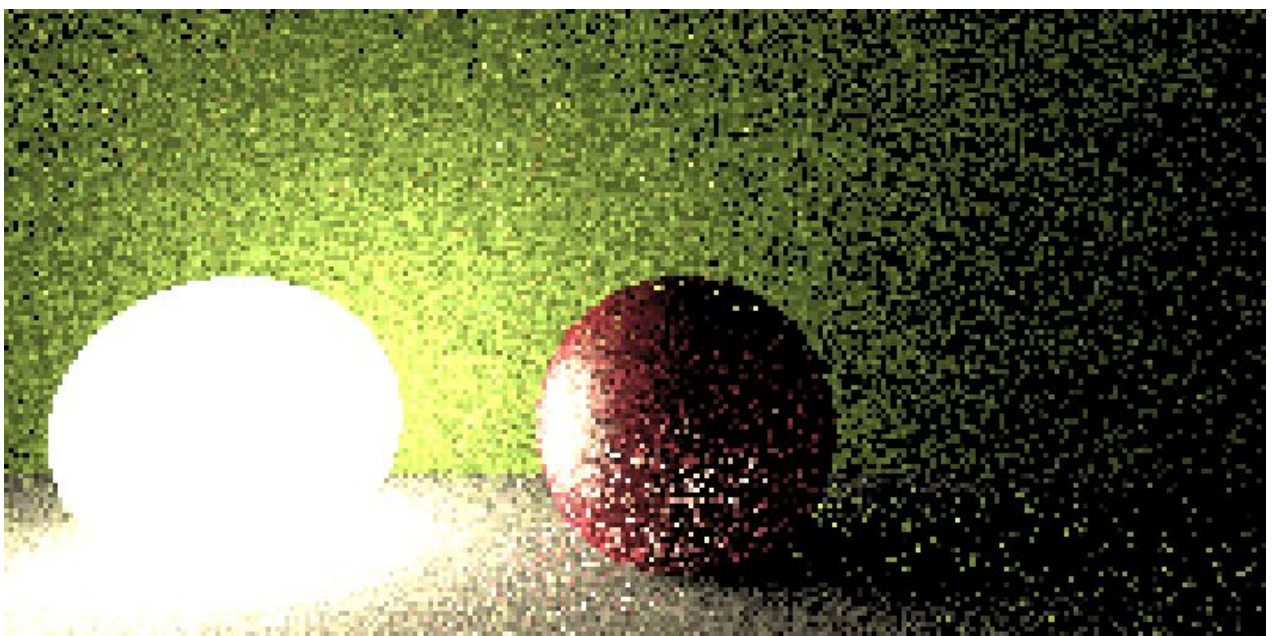
Halton Sampled after 100 frames

2) Importance Sampling

The performance of this step can be measured by observing faster convergence of brighter areas in lesser number of iterations. We detect the rays going in darker areas and reverse their direction to make them go to brighter areas where more sampling matters more than dark areas.
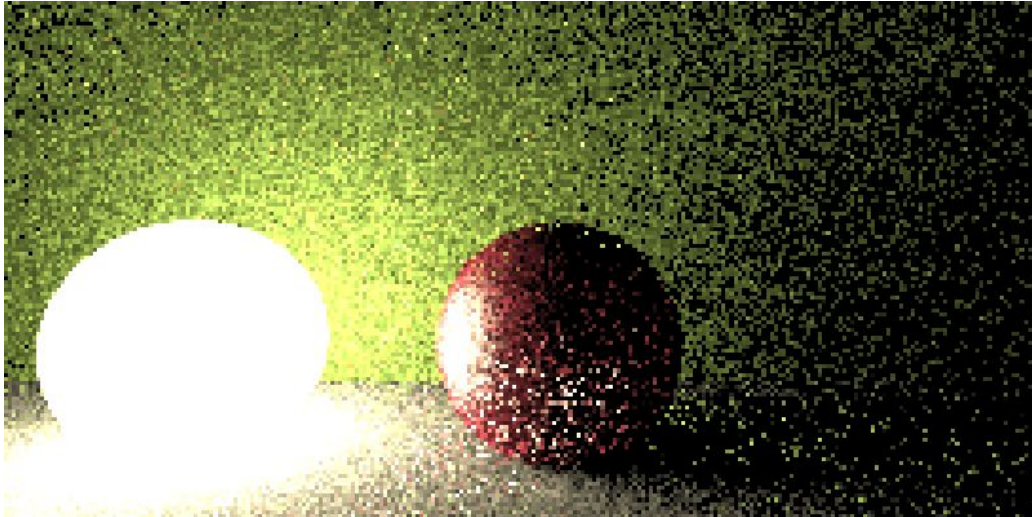

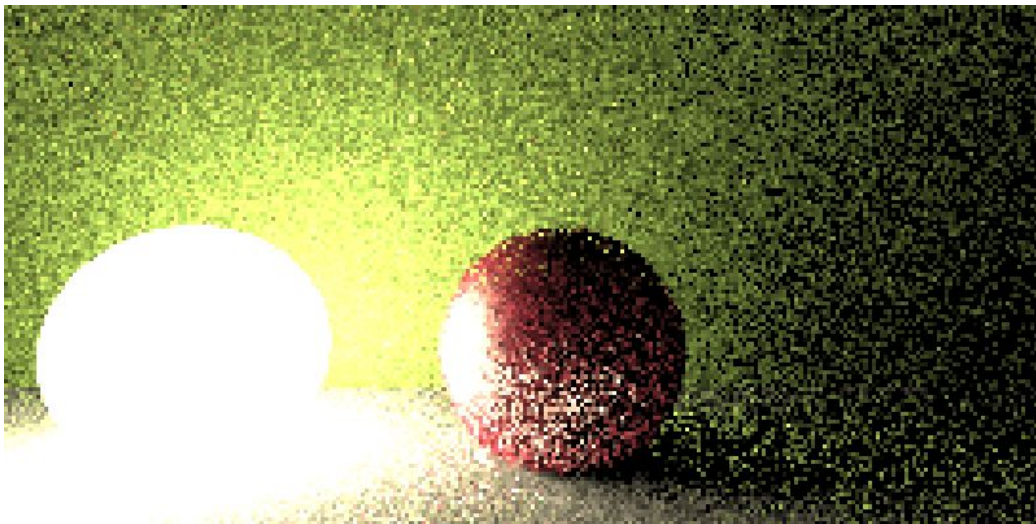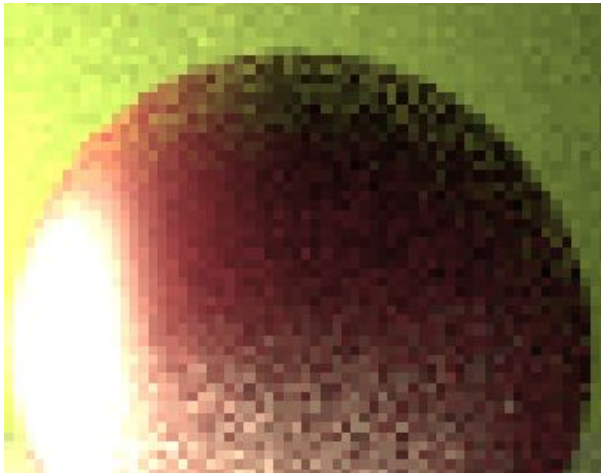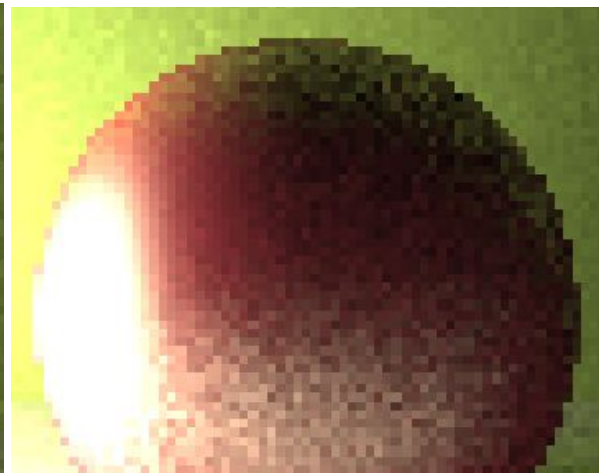Image after 98 Samples Without Importance Sampling

Image after 98 frames with Importance Sampling

3) Anti aliasing

Performance of Antialiasing can be done by comparing the antialiased image vs the aliased image. Metric is samples per pixel required to achieve similar level of antialiasing.

Anti Aliased   Aliased Image
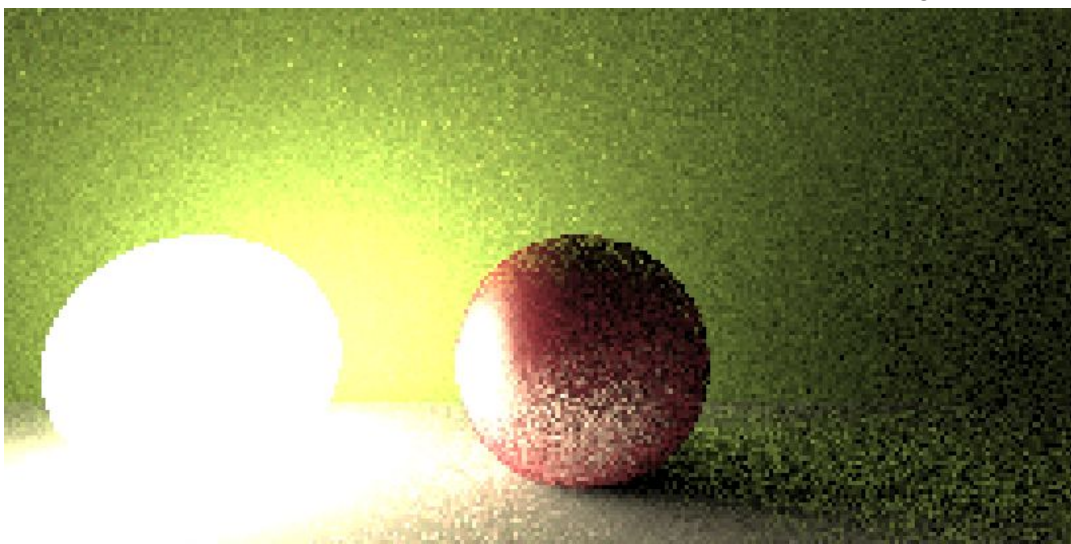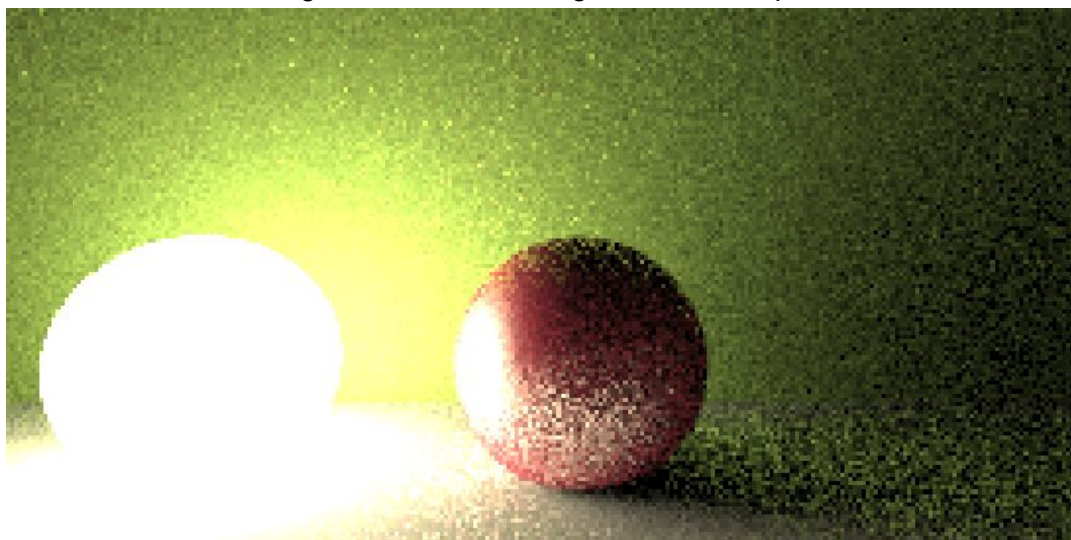

Image without antialiasing after 500 samples

Anti Aliased Image after 500 Samples