Transmission

CS500 – Project4

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Contents:

Changes to Algorithm:

In this project, I added refraction to the path tracing algorithm as such the following functions were changed to add the functionality.

```
Vector3f SampleBrdf(Vector3f Wo, Intersection& i)
float PdfBrdf(Vector3f Wo, Vector3f Wi, Intersection& i)
Color EvalScattering(Vector3f Wo, Intersection i, Vector3f Wi)
```

In addition, a variable Wmis was introduced to the overall path tracing algorithm. The variable represents the MIS weights and is used as a product when pounding path colour to the total colour.

```
C += W * Wmis * EvalRadiance(Q);
```

Beer's Law:

The Beer's law, relates the attenuation of light to the properties of the material through which the light is travelling.

It is calculated as follows:

```
float r = exp(i.t * log(i.object->mat->Kt.x()));
float g = exp(i.t * log(i.object->mat->Kt.y()));
float b = exp(i.t * log(i.object->mat->Kt.z()));
```

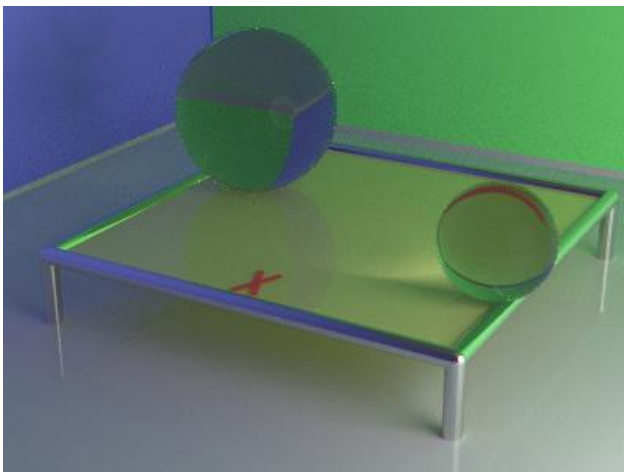
or

```
Color(1.0f, 1.0f, 1.0f);
```

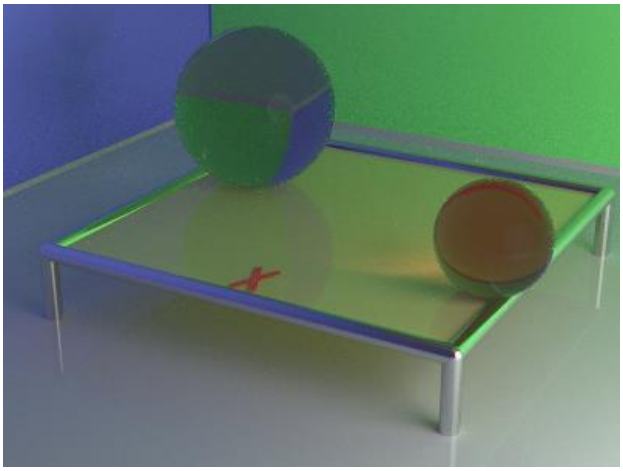
where i.t is the distance along the ray and Kt is the transmission colour. It is multiplied with the product of `Et` term for `EvalScattering`.

The following images use the MIS weights.

Without Beer's Law



With Beer's Law



MIS weights:

Multiple importance sampling weight, accounts for the probability which generated the path compared to the probability of any other ways that path could have been generated.

It is calculated as following:

```
Wmis = (p * p) / (p * p + q * q);
```

Where p is the probability of the path we get from `PdfBrdf` while q is calculated differently for Explicit and Implicit light connections.

Explicit Light Connection:

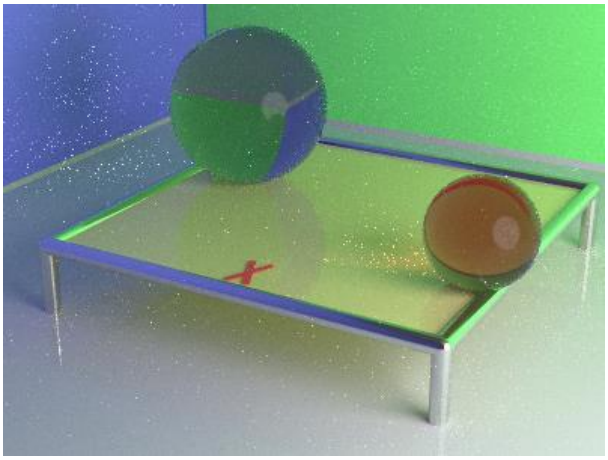
```
float q = PdfBrdf(Wo, Wi, P) * RussianRoulette;
```

Implicit Light Connection:

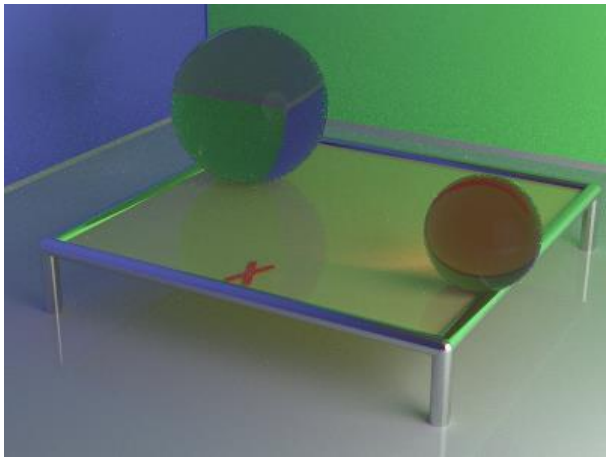
```
float q = PdfLight(Q) / GeometryFactor(P, Q);
```

introducing MIS weights helped reduce the number of fireflies in the output.
The following images use the Beer's Law.

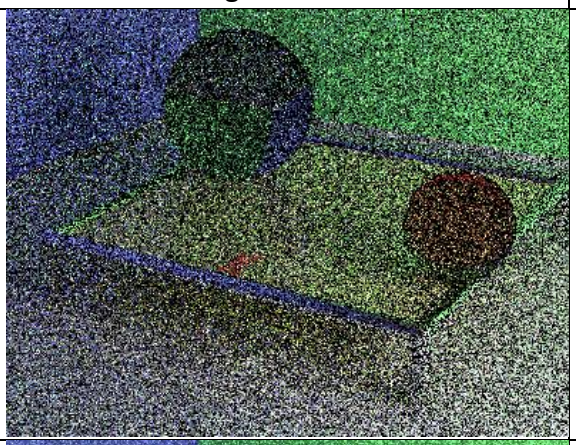
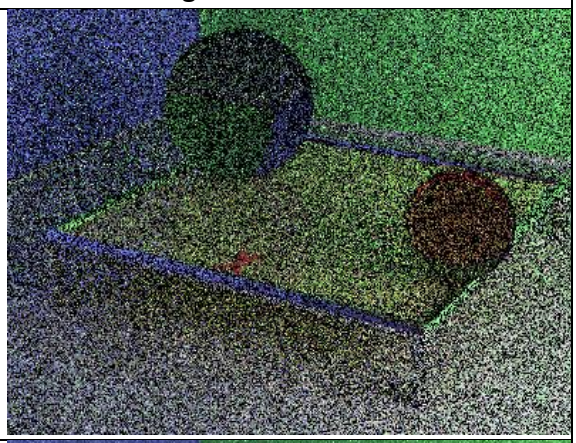
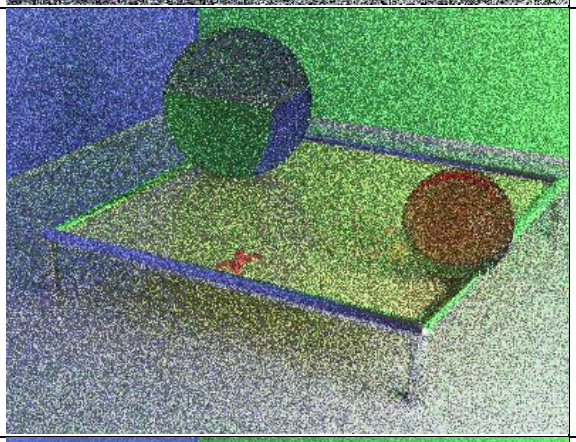
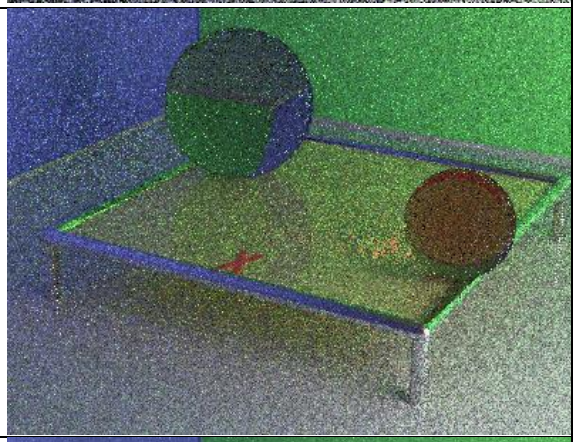
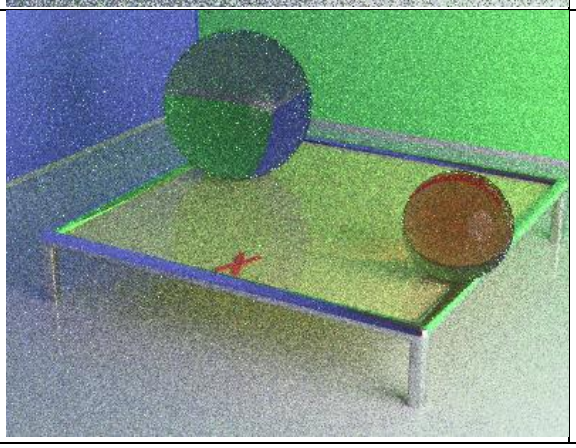
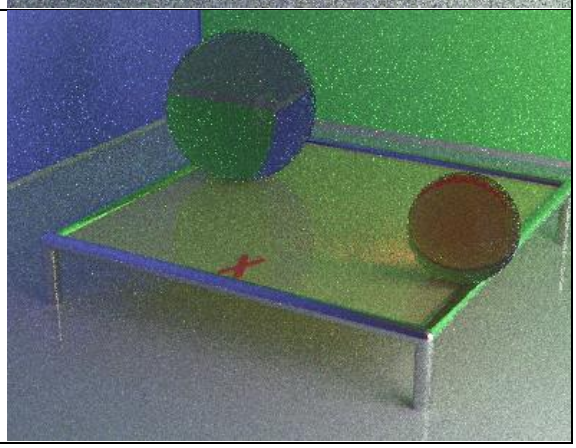
Without MIS weights

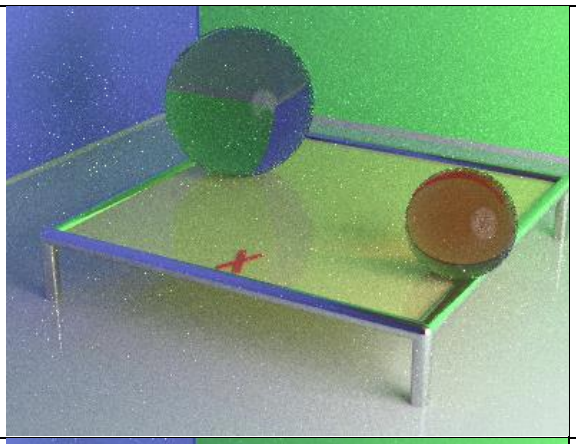
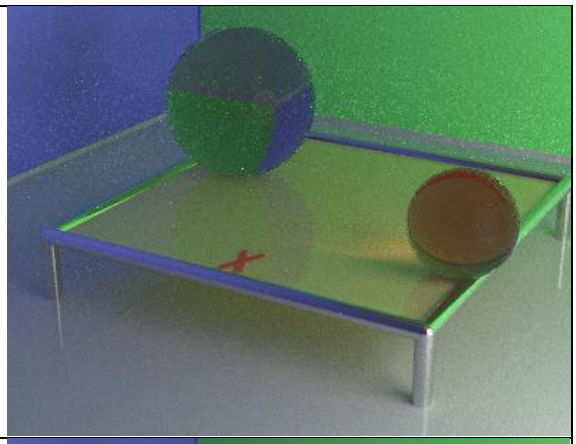


With MIS weight



Output:

Pass	Without MIS weights	With MIS weights
1		
8		
64		

512		
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