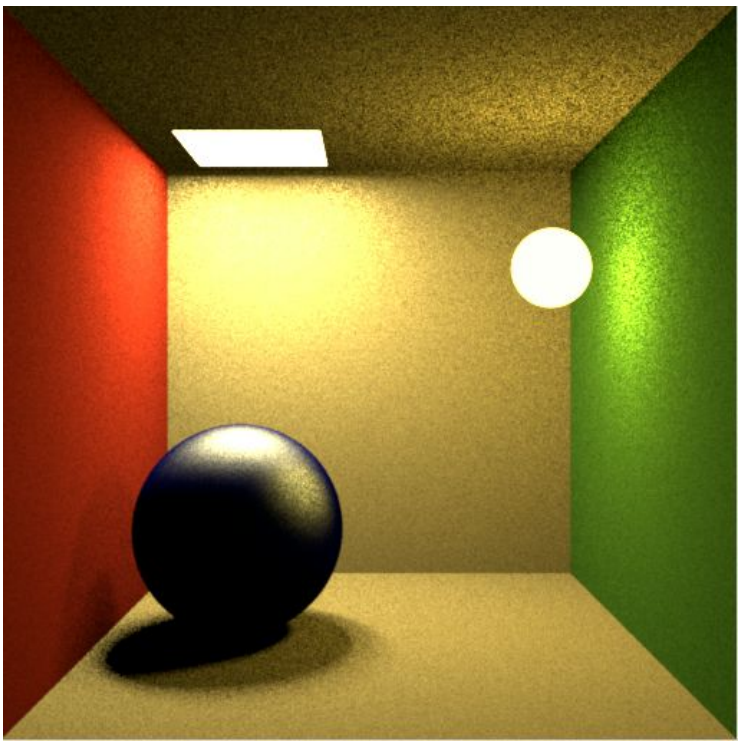
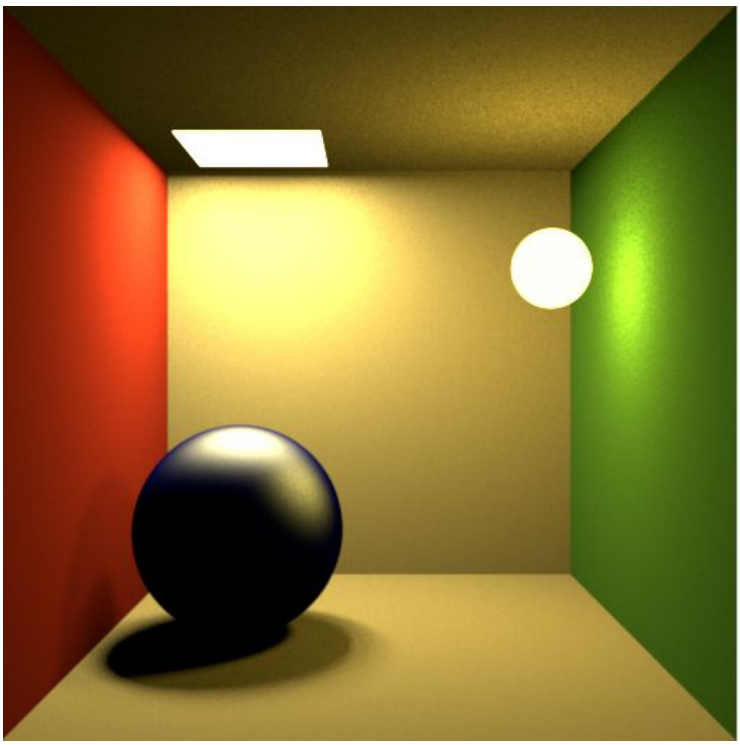
exercise 3.2

Screenshot with 32 samples



We can see the power of light area sampling when we render the scene with 512 samples, the image is really smooth.



exercise 3.3

3.3.1
left = area
right = directional

3.3.2
from top to bottom: goes from almost mirror (very reflective) to medium gloss to almost totally diffuse material. We can see that the close panes are specular because the reflexion looks really similar to the lights (almost same size) and the last pane is really diffusing the light.

3.3.3
Area sampling randomly chooses one out of all the lights at disposition and computes the reflection equation. Since there is no reflection on the top plate for any other than the big light, the low sampling rate creates artifacts, because of the size of the reflection and the fact that the smaller lights could be chosen.
On the right (directional) image, the artifact on the left of the down plate is due to the fact that we sample in random directions (or pseudo random with preference sampling) at each point the pixel ray intersects. So since we have a smaller chance to hit the little light at farther distance, we have to use a lot of samples per pixel to converge to a good looking solution, or, use area sampling.

3.3.4
Simple averaging would produce artifacts where there were none before (for example: right of the top plate: the big light would be less sampled on averaging, producing artifacts and reducing the general quality). A more suitable "mix" of the two methods would be to choose a method given the material properties of the surfaces. For example, high gloss / mirror: area sampling, diffuse surface: directional sampling.