Name (netid): Taha Wasiq (twasiq2)
CS 445 - Project 4: Image Based Lighting

Complete the claimed points and sections below.

Total Points Claimed	**[150] / 210**
Core	
1. Recovering HDR maps	
a. Data collection	[20] / 20
b. Naive HDR merging	[20] / 10
c. Weighted HDR merging	[15] / 15
d. Calibrated HDR merging	[15] / 15
e. Additional HDR questions	[10] / 10
2. Panoramic transformations	[10] / 10
3. Rendering synthetic objects	[30] / 30
4. Quality of results / report	[10] / 10
B&W	
5. Additional results	[20] / 20
6. Other transformations	[10] / 20
7. Photographer & Tripod removal	[ ] / 25
8. Local tone-mapping operator	[ ] / 25

1. Recovering HDR maps

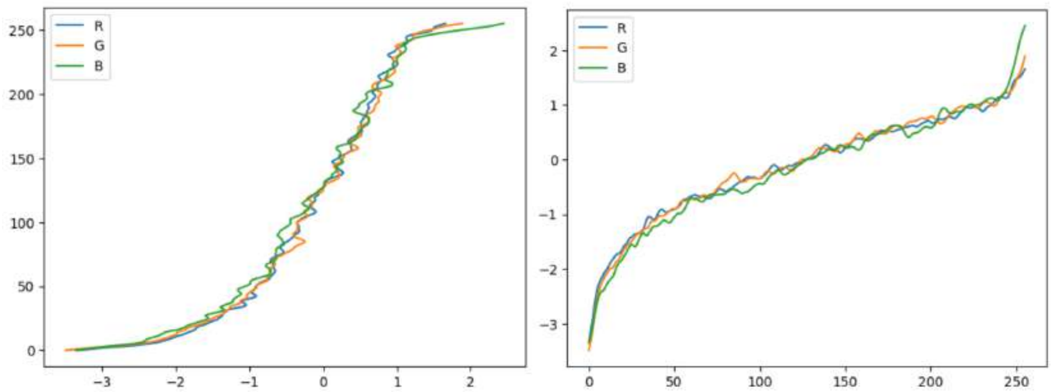
Include

- (a) Your LDR images (if you took your own)

- (b) Figure of rescaled log irradiance images from naive method

- (d) Figure of rescaled log irradiance images from calibration method

- (d) Plots of g vs intensity and intensity vs g



- (b-d) Figure comparing the three HDR methods


Naive


Weighted


Calibrated

- (b-d) Text output comparing the dynamic range and RMS error consistency of the three methods

```
naive:          log range =  7.422       avg RMS error =  0.306
weighted:       log range =  7.54        avg RMS error =  0.294
calibrated:     log range =  5.028       avg RMS error =  0.248
```

- (e) Answers to the questions below

Note if you claim credit for data collection, you must use your own images for parts 1-3

Answer these questions:

1. **For a very bright scene point, will the naive method tend to overestimate the true brightness, or under-estimate? Why?**

   The naive method overestimates the brightness of very bright scene points.
   This is because it equally averages the irradiance from all exposures — including overexposed pixels where values are saturated (clipped to 1.0 in LDR space). These clipped pixels artificially inflate the average, leading to an overestimation of brightness.

2. **Why does the weighting method result in a higher dynamic range than the naive method?**

   The weighted method slightly improves dynamic range by emphasizing well-exposed pixels and downweighting saturated and dark values. This improves reliability in both shadows and highlights, allowing the HDR merge to better preserve extremes.

3. **Why does the calibration method result in a higher dynamic range than the weighting method?**

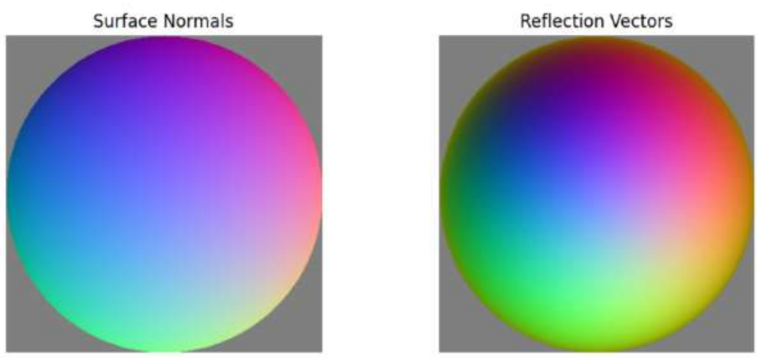
   In my results it does not. The Calibrated method has lower log range than both naive and weighted methods, but it has the lowest RMS error. This reflects the Calibrated methods ability to more accurately capture real-world lighting.

4. **Why does the calibration method result in higher consistency, compared to the weighting method?**

   Calibration results in higher consistency because it estimates a response function g(z) and applies it across all exposures, correcting for nonlinearity in the camera sensor. Instead of assuming LDR values are proportional to irradiance, it models a more accurate mapping.

2. Panoramic transformations

- The images of normal vectors and reflectance vectors

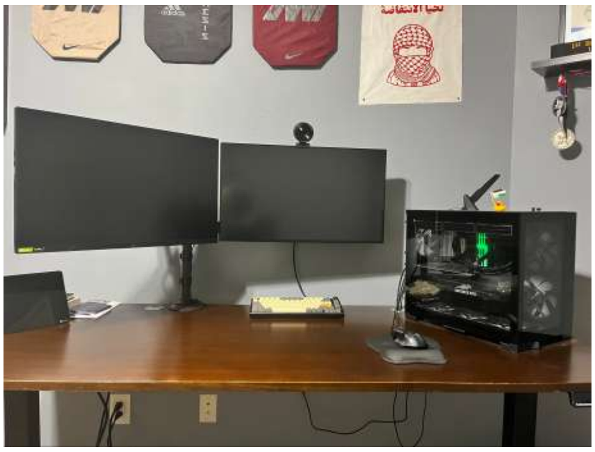
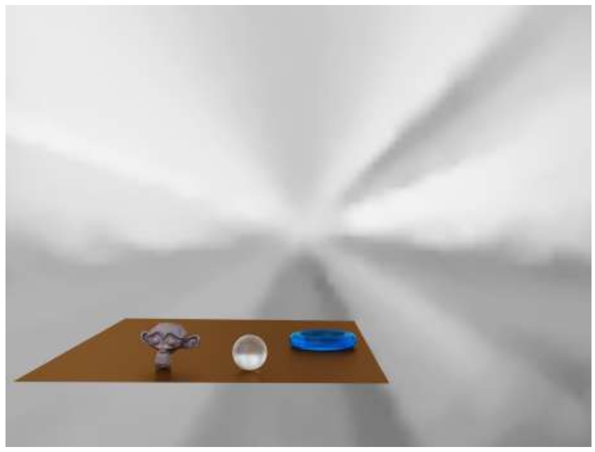
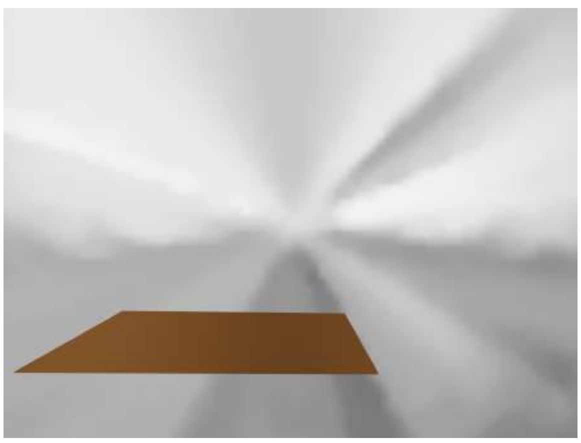
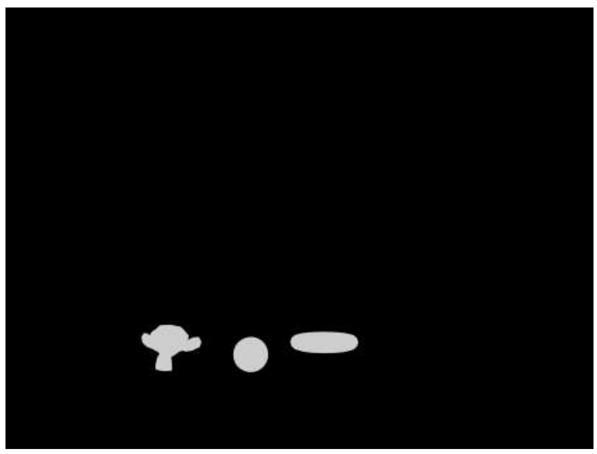


- The equirectangular image from your calibration HDR result

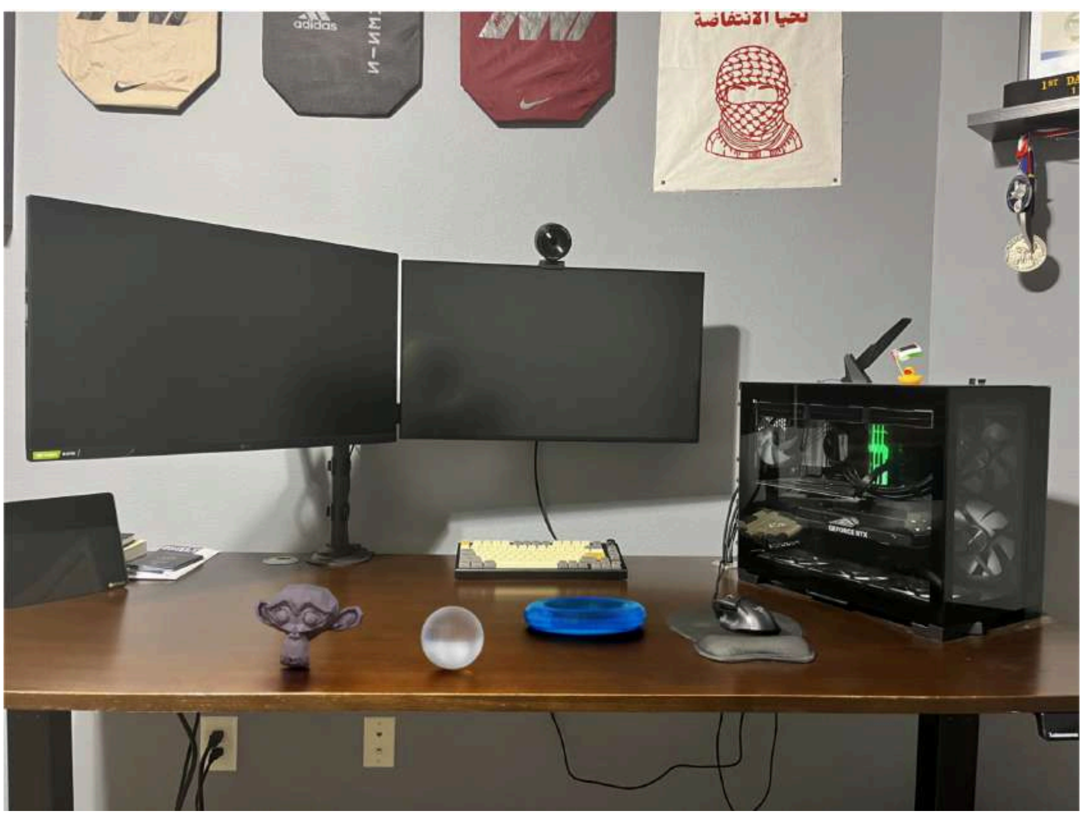
3. Rendering synthetic objects

Include:

- Component images: (1) Background image; (2) Rendered image with objects; (3) Rendered image with local geometry (e.g. support plane); (4) Rendered mask image

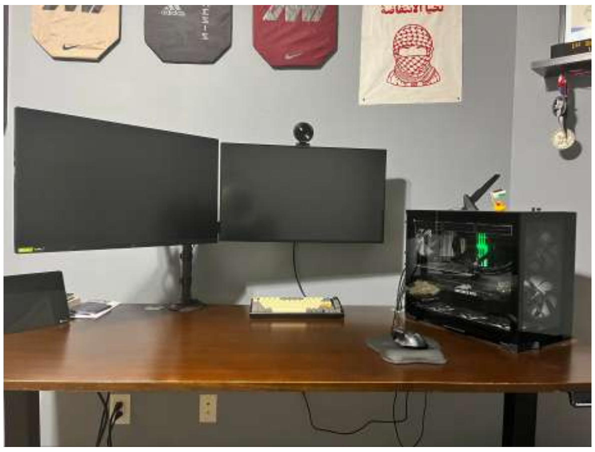
- Final composited result

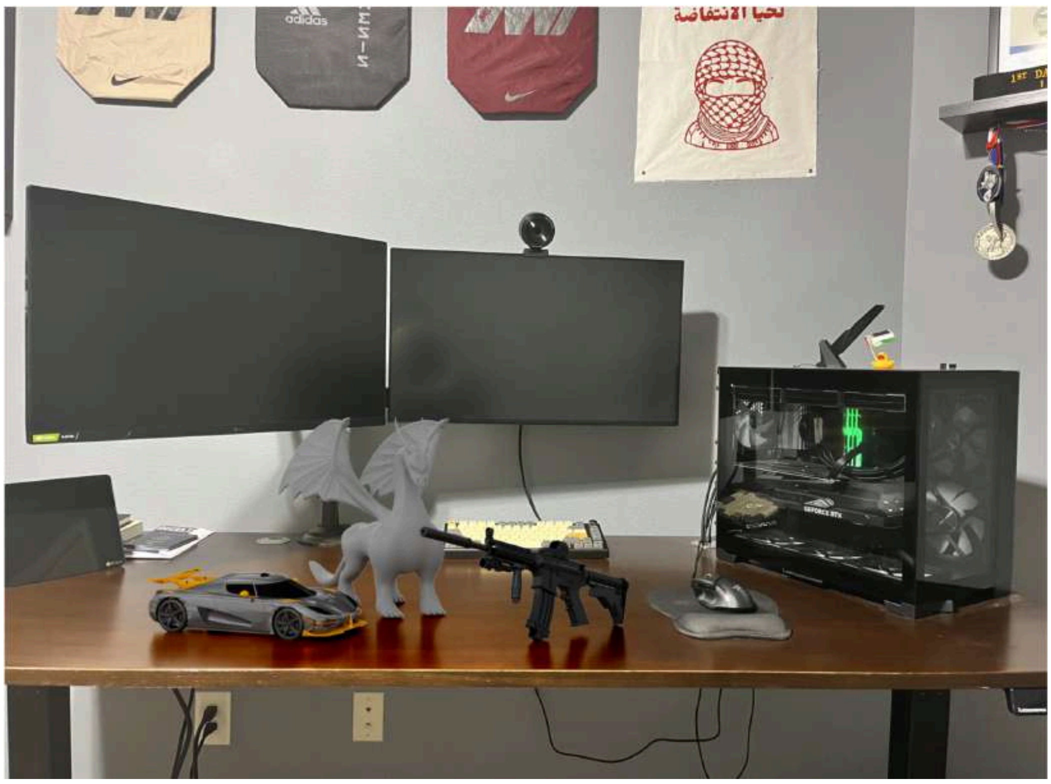


5. Additional results (B&W)

Include background image and final composited result image for: (10 pts each)

- New objects, same environment map





- New environment map, same objects

6. Other transformations (B&W)

Include (10 pts each)

- Angular environment map

Angular Map (Tone-Mapped)

Acknowledgments / Attribution

List any sources for code or images from outside sources

https://free3d.com/3d-model/dragon-27353.html

https://free3d.com/3d-model/koenigsegg-agera-72095.html

https://free3d.com/3d-model/m4a1-33156.html