Computational Photography
Assignment #6: HDR
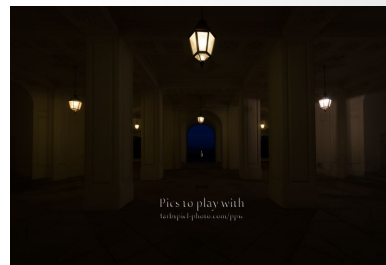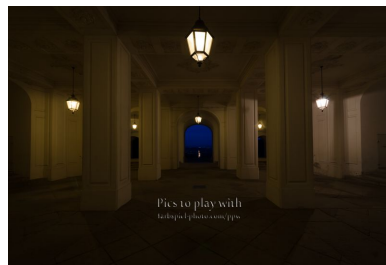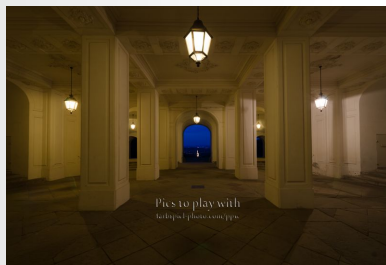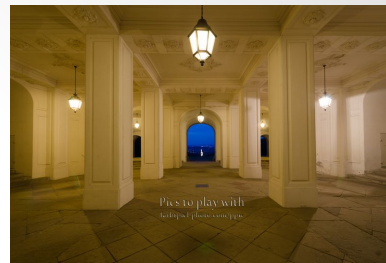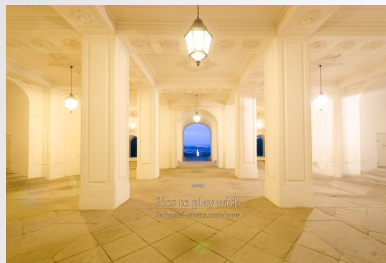
Ronak Patel
Spring 2019

Result from Example Input

- Did you get a good result? If yes/no, what specifically were you happy/unhappy with? Be detailed.
  - Yes, the results were good, it was similar to the output shown in the lectures. The lighting in the scene was sufficient to preserve the details of the photo.

HDR Image Components Thumbnails

- **Exposure Times: [1s, 2s, 4s, 8s, 15s, 30s]**
- **ISO: 100**
- **Aperture: f/8**

Images were taken from this webpage, only the first 6 images were used:
https://farbspiel-photo.com/learn/hdr-pics-to-play-with/hdr-pics-to-play-with-into-the-open

Final HDR Image

HDR Image Requirements

- Discuss the camera setting requirements for an HDR image set in general. What settings should be the same for all images? Why?
  - Similarly, camera setting such as focal length, ISO speed, and f-stops should remain the same to provide even comparisons for log exposure construction.

- What is the relevance of the number series (-2, -1, 0, 1, 2) for the exposure times for an HDR image set? Did your images follow this exposure relationship? Explain using your image exposure times.
  - The relevance of the number series for the exposure times allows for lights at different intensities to be captured and combined for HDR processing. The number series represents how the exposure times are factored from one another, with 0 being the middle image (which should the the image which most closely represents the actual scene seen through the human eye) More specifically, the exposure time bracket mentioned above allows for enough variation in the light captured to reduce noise and to produce a final output which combines exposure information. The exposure times used in my image set were (1, 2, 4, 8, 15, 30), which align the number series above since the exposure times are generally increasing by a factor of 2.

- What else besides camera settings must be controlled for an HDR image set?
  - In order to produce a good final output from HDR, it is necessary for all images to be aligned and to have a static scene and camera when taking the photo. This allows for an fair intensity value comparison when constructing the response curves and radiance maps. Similarly, the light sources for the photograph must remain the same.

Discussion of Results

- How well does your HDR output represent the input image set? Discuss!
  - The HDR set represents the input image set well. We can see a more "realistic" photo which represents a wider range of luminosities. The final output looks less "surreal" which better imitates the human eye. However, the photo still seems brighter than it should be.
- What worked well? Be specific.
  - The final artifact had much dimmer, almost reddish hue which I believe represents it's "true" color more. Details in the photo were preserved and the pixel colors seemed to be accurately derived from the source images.

- What did not work well? Be specific. Were there any problems you couldn't solve? What were they? If you had more time, how would you solve these problems?
  - The final HDR image seemed a little too bright. Using a wider range of exposures which included more low exposure times would have resulted in a better image. If more time was available, I would have found multiple image sets to process and compare and contrast the outputs. This could have helped me better understand the effects of larger and smaller exposure brackets and exposure times steps. Furthermore, I would have attempted to implement a tone mapping algorithm for further processing.

- Reflect on the project: Knowing what you do now (at the end), if you were to start over, what would you do differently and how would you go about doing it?
  - I would take more time to understand the math for the matrix values when computing the response curve. Even after reading the paper and watching the lectures, the math within the implementation details provided in the comments of the code were difficult to grasp intuitively. Furthermore, I would experiment with exposure bracket lengths and exposure time steps to hone in on a better HDR artifact.

Resources

1. Hermmann, K. (2014, August 21). HDR Pics to play with: Into the Open. Retrieved March 20, 2019, from https://farbspiel-photo.com/learn/hdr-pics-to-play-with/hdr-pics-to-play-with-into-the-open