

# Problem Set 4

Due 5:30PM on Monday, December 5, 2011.

Type your answers for the following questions in a word processor; we will accept Word Documents (.doc, .docx), PDF documents (.pdf), or plaintext files (.txt, .rtf). Before the due date, place the file into your "**Pset 4**" folder in the Dropbox folder we shared with you from project 1.

1. (5 points) What are two advantages of JPEG over RAW?
2. (5 points) Which color space should you employ for general use?
3. (5 points) Why is white balance measured in degrees Kelvin?
4. (5 points) List two reasons why batteries in digital SLRs tend to last longer than those in compact digital cameras.
5. (5 points) Why is calibrating your monitor important?
6. (5 points) What is a tone curve and why is it necessary?
7. (5 points) Many digital cameras are advertised as having a crop factor. What does this mean? What are some of its advantages and disadvantages?
8. (5 points) Assume you have two sources of light: incandescent light at an approximate color temperature of 3000 K, and the sun with an approximate color temperature of 6000 K. Which source produces warmer tones? If you take two properly-exposed photographs of a white sheet of paper, one photo in each scene, with your camera set at a white balance of 4500 K, in which photo would the paper appear warmer?
9. (10 points) Photons hit a photodiode in the sensor which causes an increase in voltage. The job of an analog-to-digital converter is to sample this data and convert it to a digital value. What are the differences between 8-bit, 10-bit, 12-bit, and 14-bit ADCs? More specifically, how do the number of ADC bits impact the dynamic range and tonal range of an image? Be sure to reference sensor linearity.
10. (10 points) It is commonly said that compact digital cameras have a larger depth of field than digital SLRs. Explain why this is inaccurate.
11. (10 points) What is the main cause of purple fringing in compact digital cameras? Digital SLRs?
12. (10 points) Explain in a few sentences the major theoretical advantages and disadvantages of Foveon X3 sensors versus sensors that use Bayer filters or other color filter arrays. Your response should include all of the major functions of a sensor: resolution, noise, and light gathering performance. You may use a diagram, but it can only act as a complement to your explanation and not as a replacement for one.

13. (10 points) What is dynamic range? Define it technically (with an equation) and in layman's terms. Be sure to mention how dynamic range is impacted by pixel size, ISO, and quality of the sensor's electronics.
14. (10 points) A CCD or CMOS sensor that uses a color filter array (*e.g.*, a Bayer filter) will typically have the following layers: photodiode, low pass filter, color filter array, microlens, and electronic/sensor well. What does each layer do and how does each positively or negatively impact image quality?