

Problem Set 4

Due 11:59PM on Friday, April 26, 2013.
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Please either type your answers to the following questions in a word processor; we will accept Word Documents (.doc, .docx), PDF documents (.pdf), or plaintext files (.txt, .rtf), or write out your answers to the problems on a sheet of paper, scan it, and submit the scanned document as a PDF. Please place the file into your "**Problem Set 4**" folder in the submission tool prior to the due date.

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) Explain what a crop factor is. What are the implications of having a small or large crop factor?
8. (5 points) Assume you have two sources of light: an 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? Consider taking a properly-exposed photograph of a white sheet of paper in each of these two lighting situations with your camera set at a white balance of 4500 K; in which photo would the white sheet of paper appear warmer?
9. (10 points) Photons hit a photodiode on the sensor and this causes an increase in voltage. The task of an analog-to-digital converter (ADC) 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 does the number of ADC bits impact the dynamic range and tonal range of an image? Be sure to reference sensor linearity.
10. (10 points) Explain why the notion that compact digital cameras have a larger depth of field than digital SLRs is somewhat oversimplified.
11. (10 points) What is the main cause of purple fringing in digital SLRs?
12. (10 points) Explain (in a few sentences) what are the major theoretical advantages and disadvantages of the Foveon X3 sensor compared to 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 only to complement, not replace, your explanation.

13. (10 points) What is dynamic range? Explain it in layman's terms and define it technically (with an equation). How is dynamic range affected by pixel size, ISO, and the 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? How does each layer impact image quality?