What will be on the final exam?

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Trichromatic theory (1 of 2)

- interaction of light with matter
  - understand spectral power distributions (SPDs), multiplying illumination × reflectance wavelength-by-wavelength
- color response
  - basis for color discrimination, meaning of a metamer
  - monochromats versus dichromats, trichromats, N-chromats
  - understand the tristimulus sensitivity functions and how one computes ρ, γ, β from them and a stimulus spectrum
    - you won't need to perform calculus derivations on the exam
- 3D colorspace
  - how one plots ρ, γ, β for a spectrum or mixtures of spectra
  - understand the spectral locus and gamut of perceivable colors

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Trichromatic theory (2 of 2)

- reproducing colors using primaries
  - understand how the color matching experiment works
  - understand trichromatic matching functions (including negative values) and the gamut of reproducable colors for a given set of primaries
  - effect of pure (single-wavelength) versus impure primaries, the effect of adding extra primaries
- additive versus subtractive mixing
  - when is additive mixing relevant, and when is subtractive?
  - which spectra are best for additive/subtractive primaries?
  - effect of moving the primaries around, adding extra primaries
    - don't worry about printing via the Neugebauer equations

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Applications of color

- cylindrical color systems
  - linear versus circle versus rainbow, extra-spectral purples
  - meaning of scales for hue, saturation, and lightness/value
- chromaticity diagrams
  - construction and properties of the of rg(b) and xy(z) spaces
    - for xy(z), know the matching functions are all-positive
  - what is color temperature and correlated color temperature?
  - how is white balancing performed in digital photography?
    - know the gray-world method for auto white balancing
  - procedure for obtaining the xy coordinates for a real object
  - what is a device gamut, and how is gamut mapping done?
    - don't need to know the details of L*a*b*, YIQ, YCbCr, sRGB, rendering intents, but understand what they are
    - memorize the Calvin and Hobbes cartoon on color ;-)

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Light and reflection

- radiometry versus photometry
  - understand the distinction, and the luminous efficiency curve
- the four measures of radiance
  - know their definitions, and units (watts, steradians, m^2)
    - don't worry about photometric units with their odd names
  - don't worry about the examples we gave, but be able to reason about new problems we may pose along these lines
- reflection of light
  - meaning of the terms diffuse, specular, albedo, microfacets
  - be able to reason about mirror reflections (perspective, focus)
  - be able to interpret (or sketch) a goniometric diagram
  - meaning of terms retroreflectivity, anisotropic reflection, BRDF, BSSRDF (don't worry about Fresnel equations)

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Photographic lighting

- taxonomy of light sources
  - spatial versus angular extent, point versus extended sources, parallel versus diffusing sources, umbra versus penumbra
- studio lighting
  - know the terms floodlight, spotlight, barn doors, diffusers, main/key, fill, accent/rim, grazing, brightfield, darkfield
    - don't worry about the bas-relief ambiguity
- flash
  - effects of flash placement, fill-flash, flash-plus-ambient
  - relationships of flash duration, shutter speed, aperture, ISO
  - understand guide numbers, 2nd curtain sync
  - how do digital cameras meter for flash photography?
  - understand problems with flash and flash color temperature

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In-camera image processing

- demosaicing
  - linear interpolation and its problems (moiré)
    - don't worry about median filtering of chrominance
- tone mapping
  - dynamic range vrs contrast ratio vrs image contrast
  - be able to compare gamma transform, histogram equalization
    - don't worry about details of HDR tone mapping
- denoising and sharpening
  - roughly understand bilateral filtering and unsharp masking
- compression
  - what is JPEG, EXIF, and RAW?
  - what are the steps in JPEG compression?
    - don't need to know formulas or detailed algorithms

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Panoramas

- what assumption underlies panoramic mosaicing?
  - rotation around the center of perspective
- what are the steps required to stitch a panorama?
  - find correspondences, compute transformation, warp, blend
- understand perspective versus cylindrical projection
  - for perspective, reprojecting to a common picture plane simulates having had a wide-angle camera in the first place
  - for cylindrical, project onto a cylinder to create a panorama, then reproject to a plane for display

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