Protocol Optical Engineering 2017 - Daniel

I chose the optical system camera and the exam started off with me bringing my own camera out and showing it to Mr. Stork. He then proceeded to ask questions about cameras:

- Draw the schematics of a camera.
  - I started to draw the most simple camera, the pinhole or camera obscura.
- Focal length of pinhole camera?
  - distance from hole to film
- Problem with Pinhole?
  - very large f-number (around f/500) make exposure very long and it is impossible to take pictures of people
- What do you do to circumvent this?
  - We use a lens to do imaging. I drew scheme of camera with lens and how an object is imaged, all important rays (one chief and two marginal)
- What do the aperture values mean on the camera?
  - f/2, f/2.8, f/4 etc all have a factor of sqrt(2) between them in order to half the light intensity. The diameter is decreased by sqrt(2) and thus the area that is illuminated is halved (pi*R^2)
- What is the minimum f-number possible?
  - I said the highest in production is an f/0.95 and wasn't sure if you could make this larger. Then I argued that the minimum when considering NA = n*sin(a) would be f-number = 1/(2*NA) = 1/(2*1) = 0.5 in air. However, when increasing the diameter of the lens to infinity the maximum f-number would be 0.
- Increase Numerical Aperture in microscopy?
  - immersion lens
- Aspherical lens what does it mean?
  - I said that with one spherical lens it is impossible to image something perfectly, so aspherical lenses are used. He said that in a special case it is possible to image something perfectly with a spherical lens.
- What can be imaged perfectly with a spherical lens?
  - He gave me the hint that it is easier to understand with a spherical mirror. When i drew it, I thought that maybe a point light source could be imaged perfectly. He said yes, but where to put it? It turns out at 2f distance from the mirror the light is perfectly reflected back into the point light source.
- Where would one use such an alignment?
  - In microscopic light sources one can get double the light intensity when putting the light source in a spherical mirror arrangement to the point 2f.