INF5350

Obligatory exercises following lecture #5

Please submit latest 11-Oct-2019 to Tohid (tohidm@ifi.uio.no)

1. Explain the difference between temporal noise and fixed pattern noise
2. Give an example of FPN that is signal dependent
3. If dark FPN (at zero light) represents fixed offsets in a sensor, then how is it possible that the FPN average offset value across the whole image is zero?
4. List the temporal noise sources in CMOS image sensors
5. Can you think of a temporal noise source that appears in the image as horizontal lines?
6. A sensor is illuminated with 400kphotons/s/pixel. Camera exposure time is 1ms. What is the signal/noise ratio at the pixel input? What is the rms noise?
7. When the light level onto a sensor increases, then the input noise increases, i.e. the histogram of #photons gets wider. Nevertheless, the SNR is improving. Explain why.
8. Propose a method to compensate (remove) PRNU in a camera
9. Calculate S/N ratio at positions A, B, C, and D in below figure. Assumptions:
   1. PD has accumulated 10 photo-electrons and 5 dark current electrons
   2. Transfer gate (TX) lag is zero
   3. Conversion gain, CG=90uV/e-
   4. Source follower gain, G=0.85
   5. Source follower noise, Nsf=200uV rms
   6. ADC is 12bit, Vref is 1V, and ADC noise is dominated by quantization noise

