1. Download the data file ersdata.hw3 from the class web page. The format is the same as in the file for homework 2 (line length 10,218 bytes, header 412 bytes), but this time there are 10,100 lines worth of data.

The parameters of the radar are as follows:

Chirp slope:	$4.189166 \cdot 10^{11}$ Hz/s
Pulse length:	37.12 μs
Sample rate fs:	18.96 MHz
PRF:	1679.9 Hz
Range r0:	830000 m
I,Q average values:	15.5
Platform velocity:	7550m/s
Wavelength:	0.0566 m

(a) Plot the azimuth spectrum of the data averaged over all valid range bins. (You should range compress either on-the-fly or first, although you can get the azimuth spectrum directly from the raw data).

(b) Determine the Doppler centroid using the spectrum in (a) and also the average phase change method.

2. An unfocussed SAR processor

(a) Calculate the parameters of an unfocused processor for the radar in (1). Evaluate the azimuth resolution, pulse spacing at the spacecraft, and output pixel spacing (a flat-earth approximation is fine). How long would each burst have to be? How often need we repeat if the antenna is 10 m long?

(b) Calculate the single-patch unfocused image from the first few lines of the file. Be sure and correct for the Doppler centroid, and display the result with zero displacement from the boresight at the center of the patch.

(c) Determine the patch to patch spacing if we want to process all of the data (in pixels).

(d) Write a multi-looked unfocused processor and create an image from the full ersdata.hw3 data set. Can you begin to identify parts of the image?

(Note: You might try to also take "range" looks in your final image to get approximately square pixels– it will look much more pleasing).