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**HW 6**

**Establishing variables:**

Designating variables was mostly straightforward: The number of satellites is the length of the input PRN array; the number of CA code periods is the number of milliseconds in the data length; the sampling interval is the inverse of the input sampling frequency; the total number of samples is the data length times the sampling frequency; the number of samples in a code period is the total number of samples divided by the number of code periods; the sample index vector ranges from 1 to the total number of samples; the time vector is each sample index multiplied by the sampling interval; the Doppler adjusted code rate array is found by multiplying the initial CA code chipping rate by the carrier Doppler frequency divided by the L1 band carrier frequency and adding that to the initial CA code chipping rate; and the noise power is the Boltzman constant multiplied by the equivalent noise temperature.

**Creating the signal:**

First, the carrier was generated for each PRN in the following fashion:

where is the L1 band carrier frequency, is the specific SV’s Doppler frequency, *t* is the time vector and is the phase offset. The signal’s amplitude was then calculated, as it relates to the signal power in the following way:

where is the signal power and *A* is the amplitude. Having the user input carrier-to-noise ratio, , amplitude could be calculated by,

where is the noise power. Navigation data bits were generated in a random fashion. At a rate of 50 Hz, a 1 or -1 would be produced. CA code was the generated and sampled for each satellite using the CASamples program previously developed. This code was then multiplied by the navigation data bits and shifted according to the initial code phase. Together with the signal amplitude, this sequence was used to modulate the carrier in order to transmit information. The signal would then be in the form:

where *i* is the corresponding satellite and *C* is the shifted CA code/navigation data sequence. Gaussian noise could then be added to this modulated signal. The signal was also scaled to the ADC bit range.