Quiz 3 due 5/9/25

1

a) $V = 300 m/s$ $f_t = 1GHz = 1 \times 10^9 Hz$

$c = 3 \times 10^8 m/s$

$$f_d \simeq \frac{2 v f_t}{c}$$

$$f_d \simeq \frac{2 \cdot 300 \cdot 1 \times 10^9}{3 \times 10^8} = \frac{6 \times 10^{11}}{3 \times 10^8} = 2000 Hz$$

$f_d \simeq 2 kHz$

b) $\Delta f = \frac{1}{T}$

$\Delta f = 2 kHz$

$T = \frac{1}{\Delta f} = \frac{1}{2000} = 0.0005 s = 0.5 ms$

c)

$f_s = 2GHz = 2 \times 10^9$ $T = 0.5 ms$

$N = f_s \cdot T = 2 \times 10^9 \cdot 0.0005 = 1 \times 10^6 = 1$ million samples

Yes it is practical

2.

a) $R = \frac{c}{2k} \Delta f$

$R = \frac{cT}{2}$

$\Delta f = k \cdot T \rightarrow T = \frac{\Delta f}{k}$

$R = \frac{c}{2} \cdot \frac{\Delta f}{k} = \frac{c}{2k} \Delta f$

$R = \frac{c}{2k} \Delta f$

b) $\Delta f = 25 MHz$

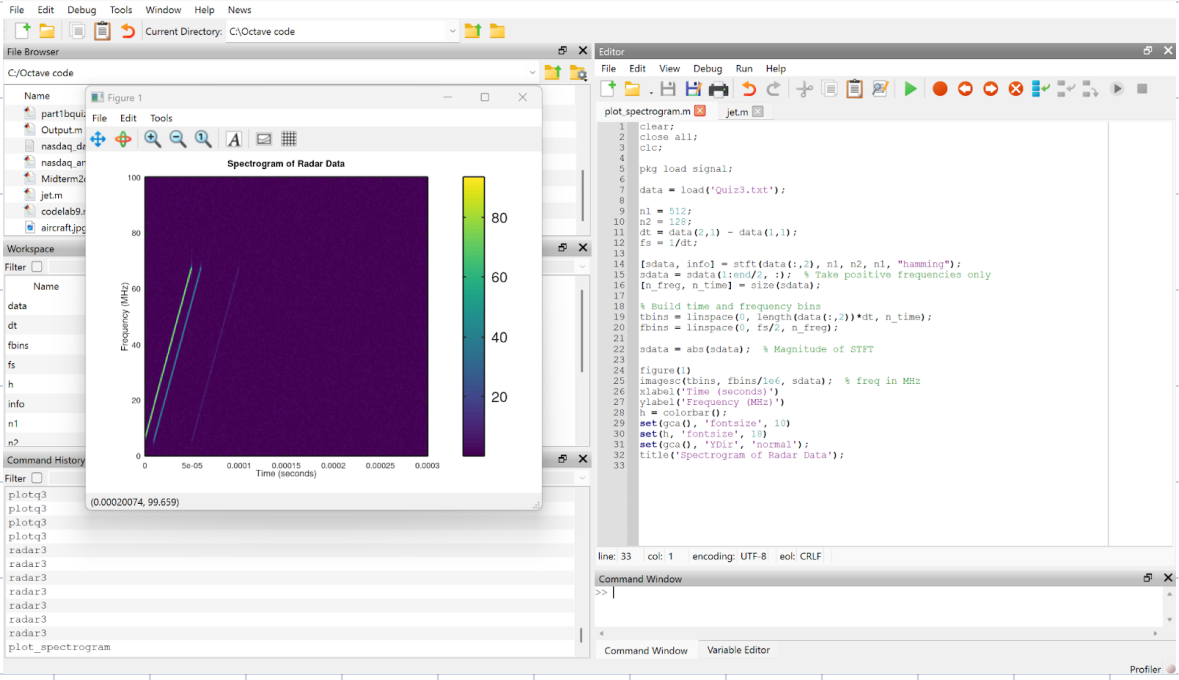
$k = 1 MHz/\mu s$

$c = 300 m/MHz$

$$R = \frac{300}{2 \cdot 1} \cdot 25 = \frac{300}{2} \cdot 25 = 150 \cdot 25 = 3750\,m$$

$$R = 3.75\,km$$

3



4.

$$\text{Range} = \frac{c \cdot \Delta t}{2} = \frac{(3\times10^{8}) \cdot (10\times10^{-6})}{2} = 1.5\,\text{km}$$

First aircraft is 1.5 km

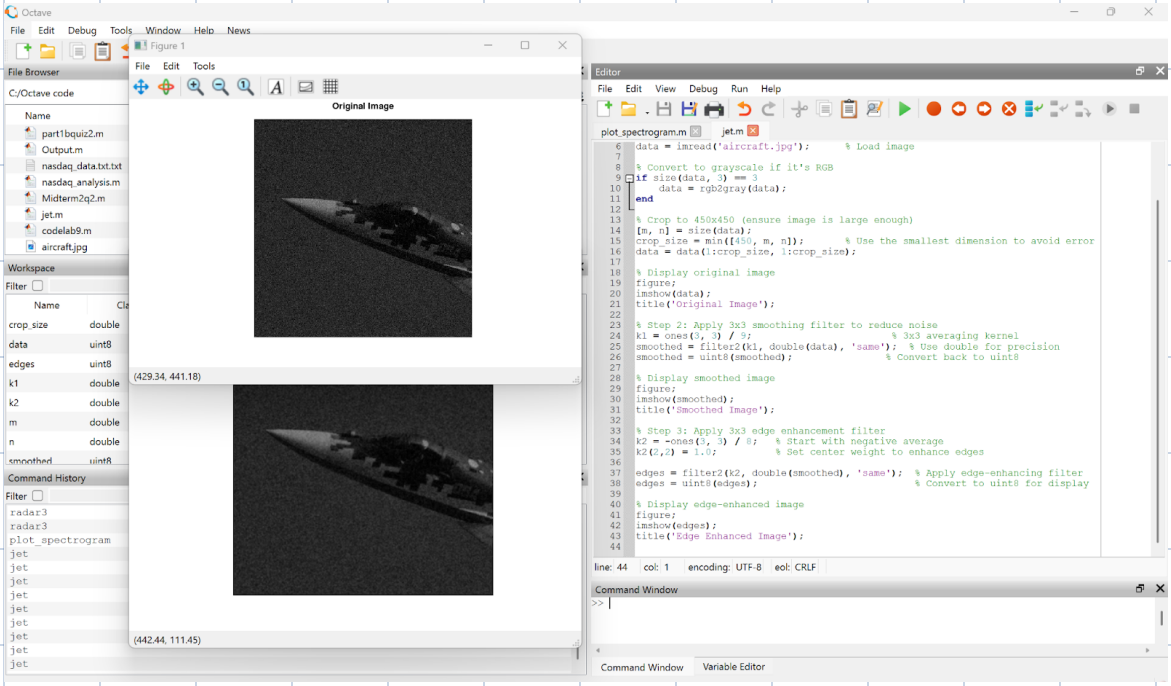
Second one

$$\text{Range} = \frac{(3\times10^{8}) \cdot (20\times10^{-6})}{} = 3.0\,\text{km}$$

2

Scudu aircraft is at 3.0 km

Linear Image processing



Number is 54

Sukhoi Su-57