EEE3030 MATLAB Exercise 2

1. Using the file Ch2_demo.m as a guide, generate a discrete time signal in MATLAB which is the sum of two cosine waves with the following parameters and then calculate and plot the FFT coefficients (magnitude).

Sampling frequency (fs)	32 Hz
Frequency 1	8 Hz
Amplitude 1	1.0
Frequency 2	10 Hz
Amplitude 2	1.0
Signal/FFT window length	8
FFT window function	Rectangular

2. Why aren't you able to clearly resolve the two frequency components? (there are two reasons).

3. Increase the FFT length to achieve a frequency resolution of 1 Hz and then calculate and plot the FFT coefficients (magnitude). What do you notice about the spectrum now?

4. Generate the DFT matrix for the above transform (using the expression in the notes & slide 25 of the slides). **Hint:** You will need to use two nested for loops for k and n and the exp() function.

5. Calculate the DFT output for the same signal samples as part 3 and verify that you get the same result as the FFT. **Hint:** This is simply the product of the DFT matrix and the input sample vector.

6. Increase the FFT/DFT length to 1024 and compare the time taken to compute the DFT and FFT. **Hint:** You should repeat each calculation 1000 times and use the "tic" and "toc" functions in MATLAB to measure the execution time e.g.

```
tic
for i=1:1000
        y = fft(x);
end
toc
```