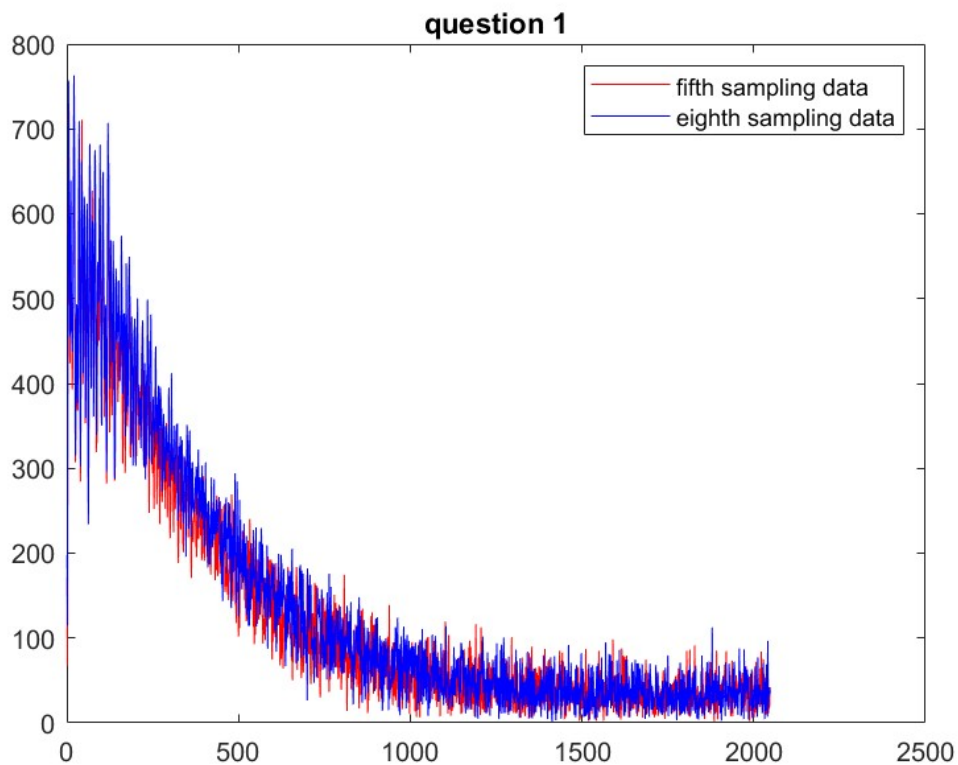


Matlab Homework 1

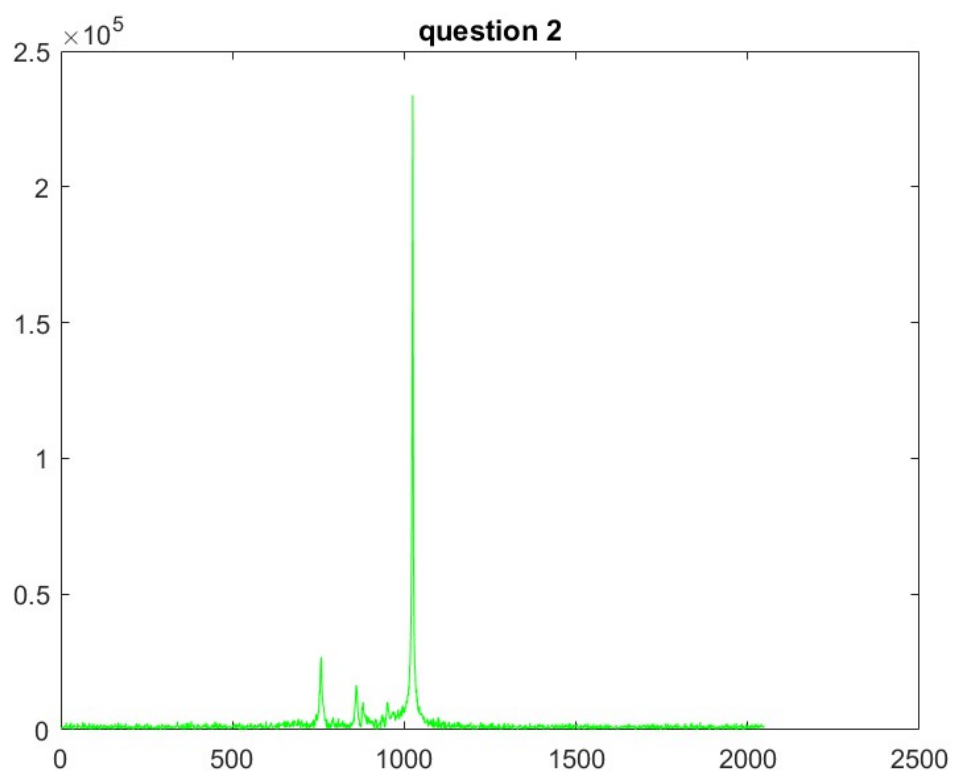
醫工二 B812110004 葉芸茜

已知 MRS_FID.mat 是一組取樣點為 2048 個時間點，重複 17 次採取的一維數位訊號數據：

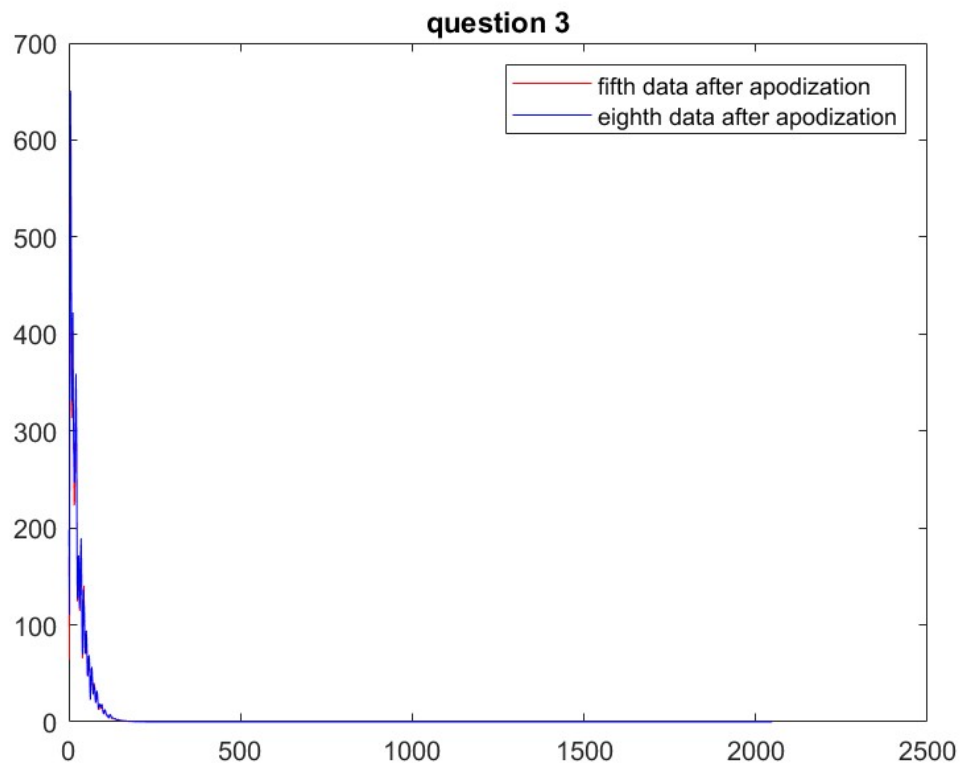
Q1. 請將 MRS_FID.mat 的第五次採樣數據和第八次採樣數據，用 plot 畫出，並且將兩組數據用 hold on 的指令，畫在同一個 Figure 上，不同次採樣數據必需要用不同顏色畫出



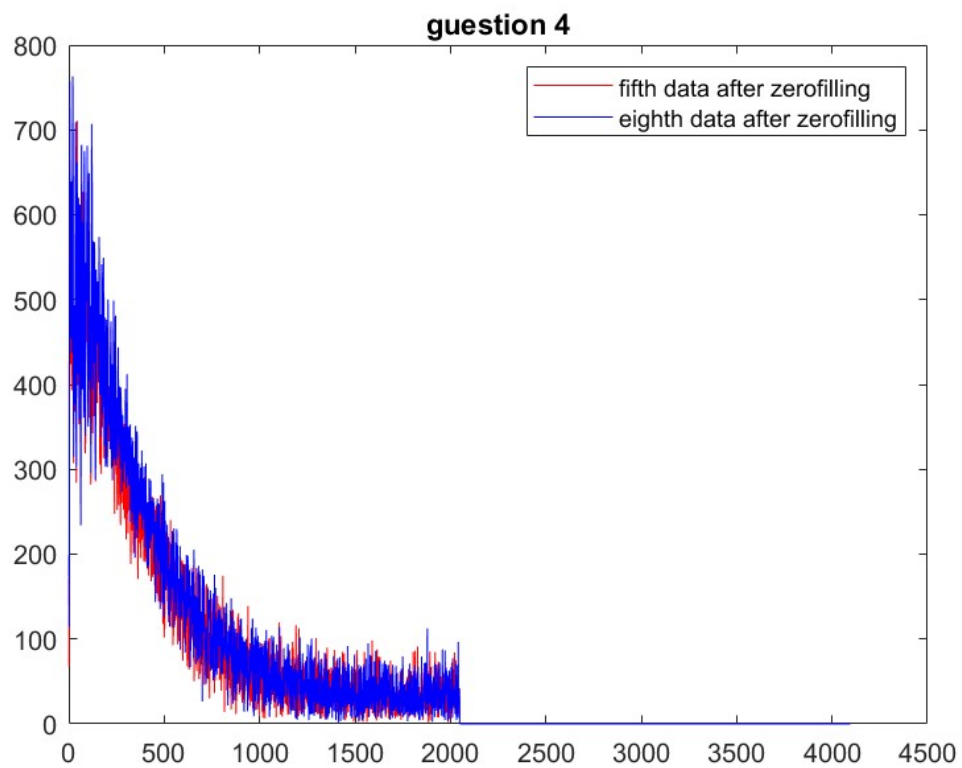
Q2. 承 Q1，請將第五次採樣數據和第八次採樣數據平均後，用 FFT 的指令轉成頻譜，並且用 plot 畫出



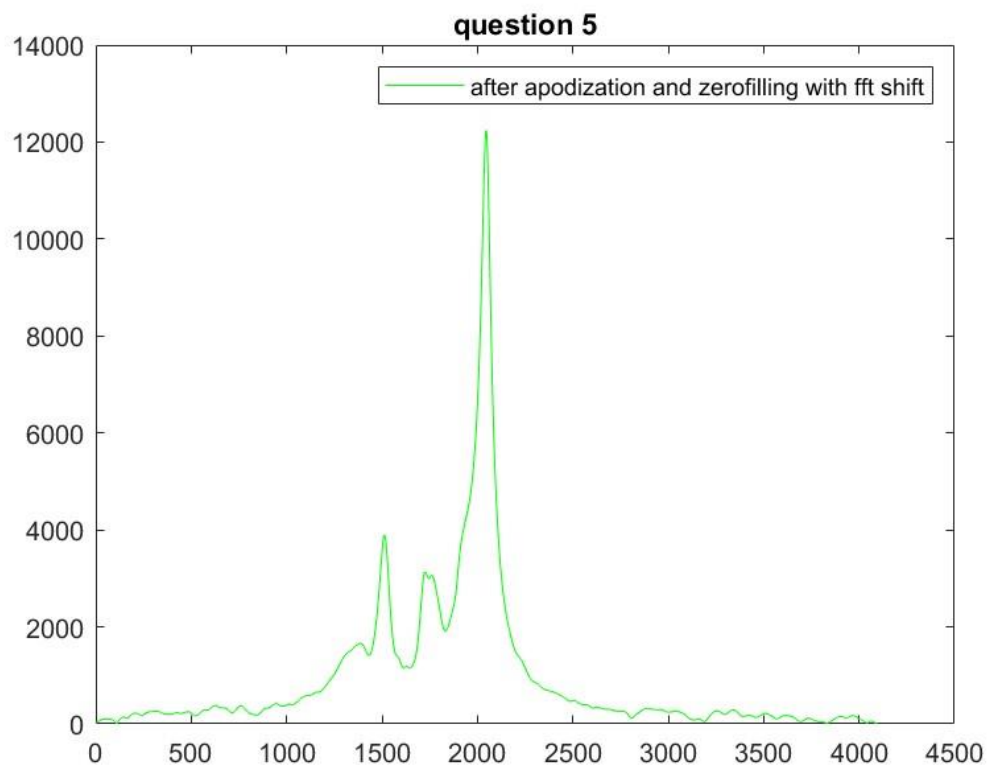
Q3. 承 Q1，請將第五次採樣數據和第八次採樣數據分別經過 apodization 處理後，用 plot 畫出，並且將兩組處理後的數據用 hold on 的指令，畫在同一個 Figure 上，不同次採樣數據必需要用不同顏色畫出



Q4. 承 Q1，請將第五次採樣數據和第八次採樣數據經過 zero-filling 處理後，用 plot 畫出，並且將兩組處理後的數據用 hold on 的指令，畫在同一個 Figure 上，不同次採樣數據必需要用不同顏色畫出



Q5. 承 Q1，Q3 與 Q4，請將第五次採樣數據和第八次採樣數據依序先經過 apodization 處理，再經過 zero-filling 處理後，請將兩組處理過的採樣數據平均後，用 FFT 的指令轉成頻譜，並且用 plot 畫出



程式碼：

```
load MRS_FID.mat;

xx = real(MRS_FID) + i .*imag(MRS_FID); % xx=MRS_FID, 2048x17
[nr, num_cols] = size(xx);
exp_Hz = 30; %Exponential apodization value in Hz unit (0.5 is recommended
for in vivo data)
dwell_time=4.0000e-04;%the time between 2 points of the FID.
new_num_rows=nr*2;
BW=2500;
ppm_Hz=123.2624; %% 123.2624 Hz/ ppm if on resonance freq of water is
123.2624 MHz for 3T at the moment of MRS data acquisition
ctr_ppm=4.68; %% water resonance freq=4.68 ppm

xf_apd_5=zeros(nr,num_cols);
xf_apd_8=zeros(nr,num_cols);
xf_zf_5=zeros(new_num_rows,num_cols);
xf_zf_8=zeros(new_num_rows,num_cols);
xf_apd_zf_5=zeros(new_num_rows,num_cols);
xf_apd_zf_8=zeros(new_num_rows,num_cols);

%% print original data(fifth & eighth) %%
x_5 = xx(:, 5);
x_8 = xx(:, 8);

figure(1);
plot(abs(x_5), 'r');
hold on;
plot(abs(x_8), 'b');
legend('fifth sampling data', 'eighth sampling data');
title('question 1')

%% mean(fifth & eighth data) %%
new_data = mean((x_5 + x_8)/2, 2);
figure(2);
plot(fftshift(abs(fft(new_data))), 'g');
title('question 2')
```

```

%% start, apodization %%
num_rows = length(x_5) % = length(x_8)
T2 = 1/(pi*exp_Hz);
tp=0:(num_rows-1);
tp=tp.*dwell_time;
filter_func = exp(-tp./T2);
filter_func=filter_func';

%%% (fifth data) %%%
x_apd_5 = x_5 .* filter_func;

%%% (eighth data) %%%
x_apd_8 = x_8 .* filter_func;

figure(3);
plot(abs(x_apd_5), 'r');
hold on;
plot(abs(x_apd_8), 'b');
legend('fifth data after apodization', 'eighth data after apodization');
title('question 3');
%% end, apodization %%

%% start, zerofilling %%
%%% (fifth data) %%%
x_zf_5 = [x_5; zeros(new_num_rows-num_rows, 1)];

%%% (eighth data) %%%
x_zf_8 = [x_8; zeros(new_num_rows-num_rows, 1)];

figure(4);
plot(abs(x_zf_5), 'r');
hold on;
plot(abs(x_zf_8), 'b');
legend('fifth data after zerofilling', 'eighth data after zerofilling');
title('question 4');

```

```

%% end, zerofilling %5

%% apodization & zerofilling %%
%% (fifth data) %%
x_apd_zf_5 = [x_apd_5; zeros(new_num_rows-num_rows, 1)];

%% (eighth data) %%
x_apd_zf_8 = [x_apd_8; zeros(new_num_rows-num_rows, 1)];

mean_apd_zf = mean((x_apd_zf_5 + x_apd_zf_8)/2, 2); %mean
xf_apd_zf_single = fftshift(fft(mean_apd_zf)); %fft

figure(5);
plot(abs(xf_apd_zf_single), 'g');
legend('after apodization and zerofilling with fft shift');
title('question 5');
%% end %%

```