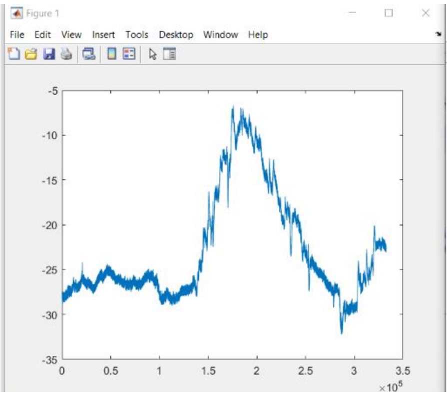
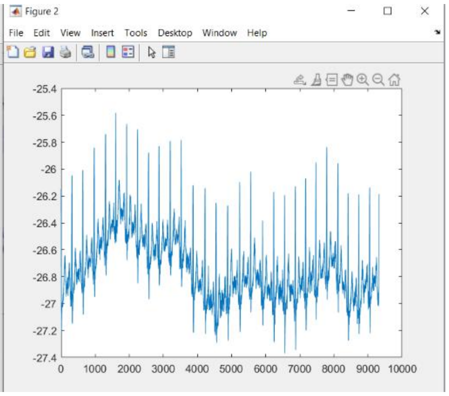
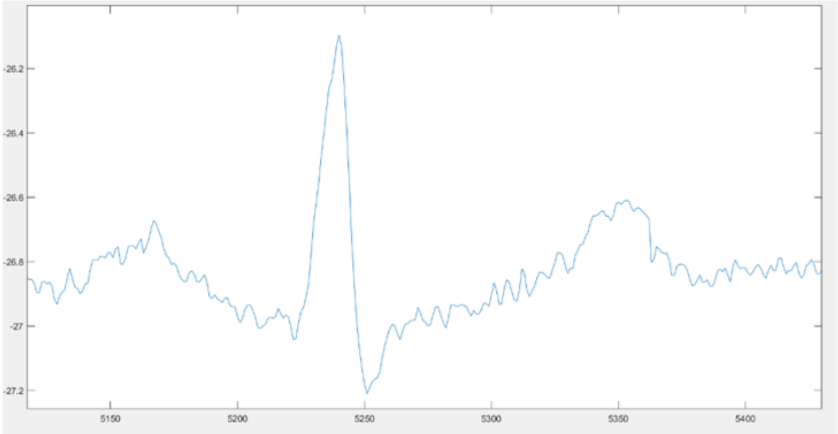
Part1



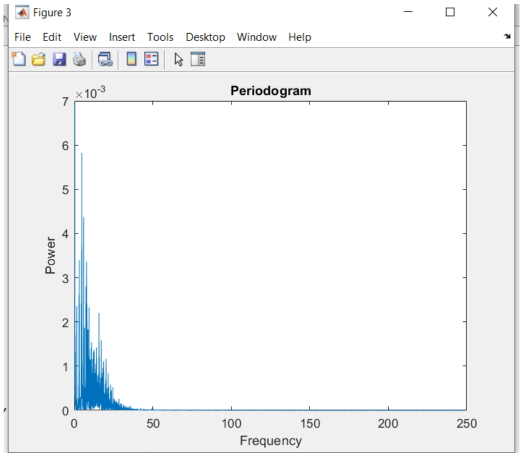


Part2

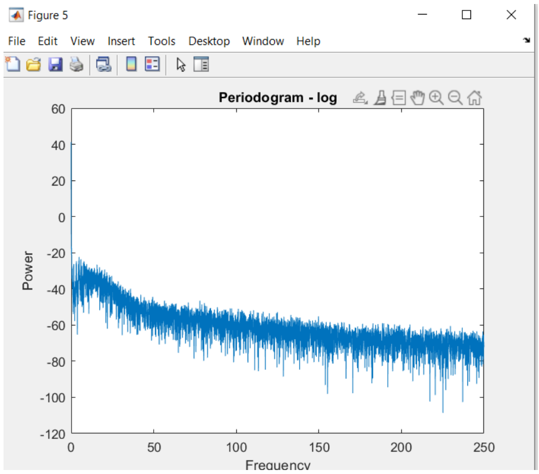


Part3

Without log10

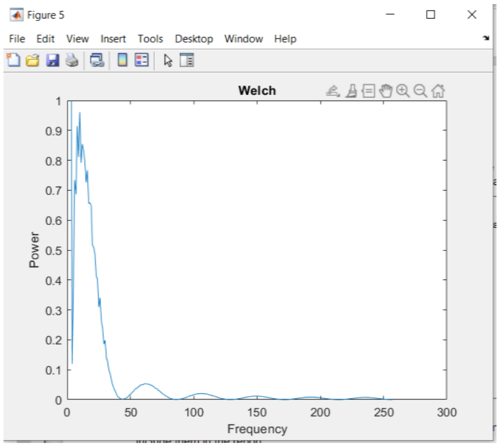


With log10

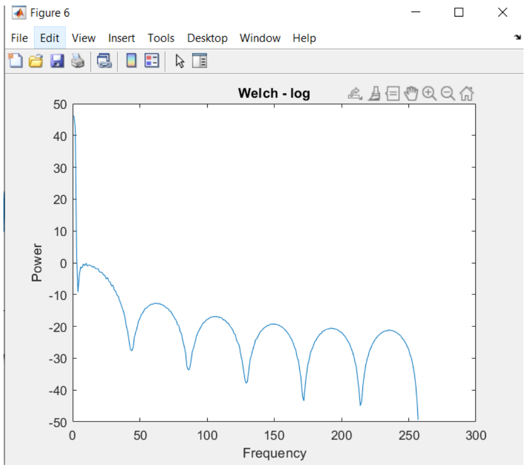


Part4

Without log10



With log10



Part5

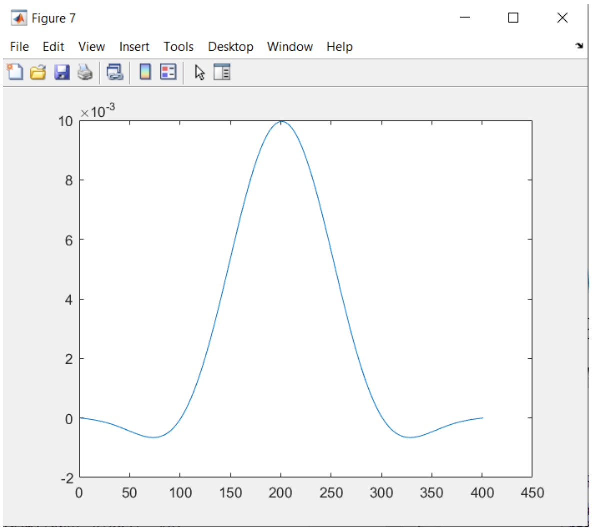
In both normal and log scales, the periodogram is relatively noisy. When comparing the Welch and Periodogram methods, Welch method averages all the Periodograms, it is evident that the Welch approach is smoother. The variance in the Welch approach is also lower.

Part6

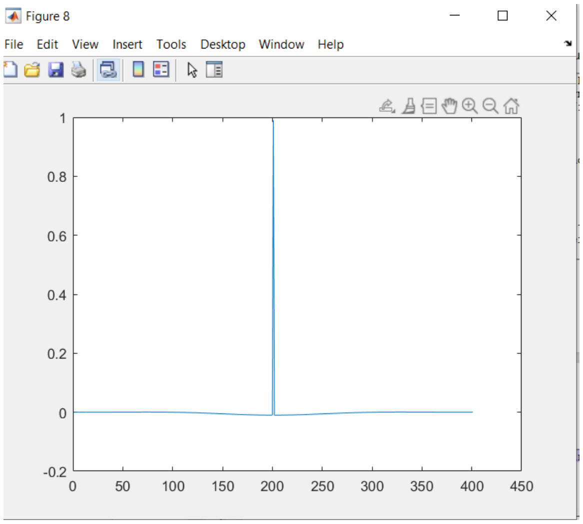
The raw data contains some noise, particularly in the low frequency range. We can notice the huge spike at the start of ECG. As a result, the spike corresponds to the noise at the beginning, the other reason could be the very strong bias/offset in the data.

Part7

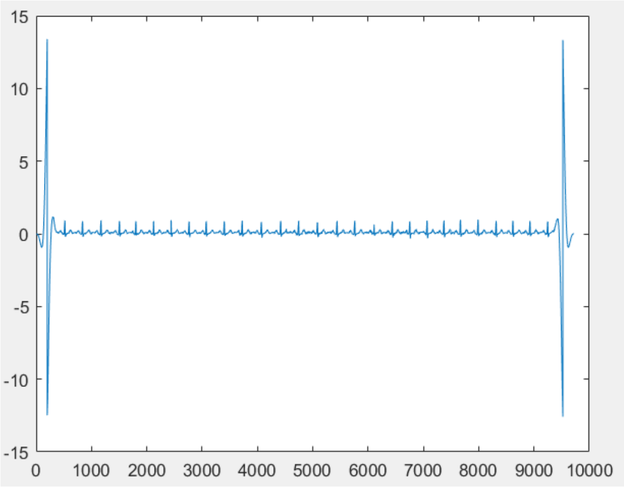
low



high



Part8

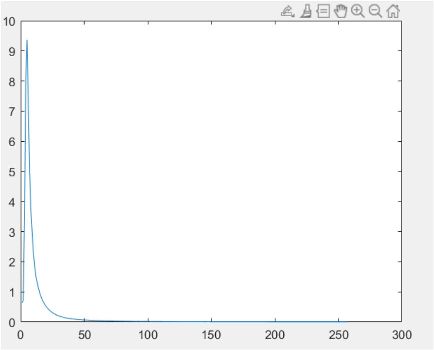


I used the high pass filter. According to the plot, we can see the ECG information clearly in the high pass filter, and the noise has been removed. The low pass filter, on the other hand, removes everything, thus we cannot gain any helpful information from the low pass filter graphic. The original low pass filter only keeps the data at around 200, we cannot get too much ECG information.

Part9

When comparing the “x_filtered_hp” with the original signal(x), it is clear to see that the “x_filtered_hp” graph has a smooth curve that displays all of the relevant data. It did a good job on wiping out the noises. It also has a small variance. Therefore, “x_filtered_hp” graph did a decent job on processing data comparing to the original signal(x).

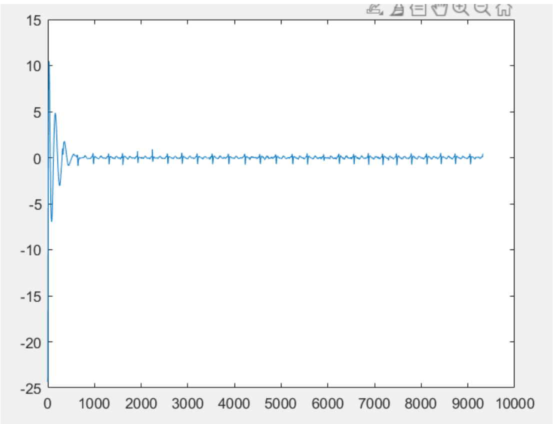
Part10

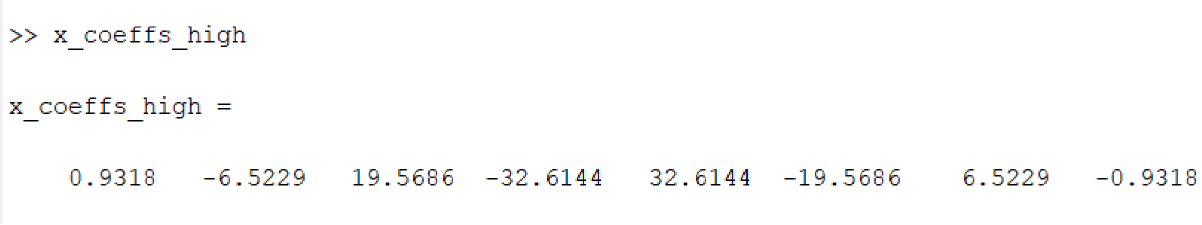


Part11

After filtering, the PSD graph looks considerably smoother than before. The noises have been removed and the needed information has been left and clearer to see. Therefore, this filtering did a really great job on data processing.

Part12

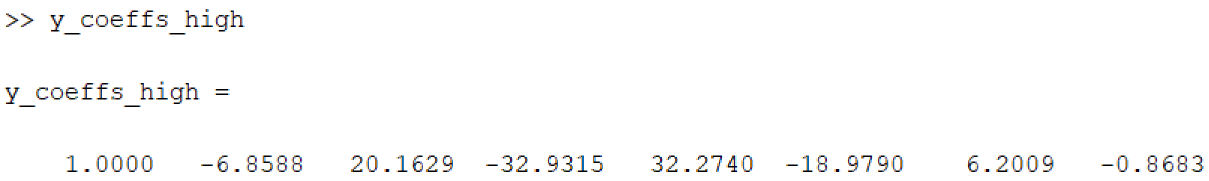




```
>> x_coeffs_high

x_coeffs_high =

    0.9318   -6.5229   19.5686  -32.6144   32.6144  -19.5686    6.5229   -0.9318
```



```
>> y_coeffs_high

y_coeffs_high =

    1.0000   -6.8588   20.1629  -32.9315   32.2740  -18.9790    6.2009   -0.8683
```