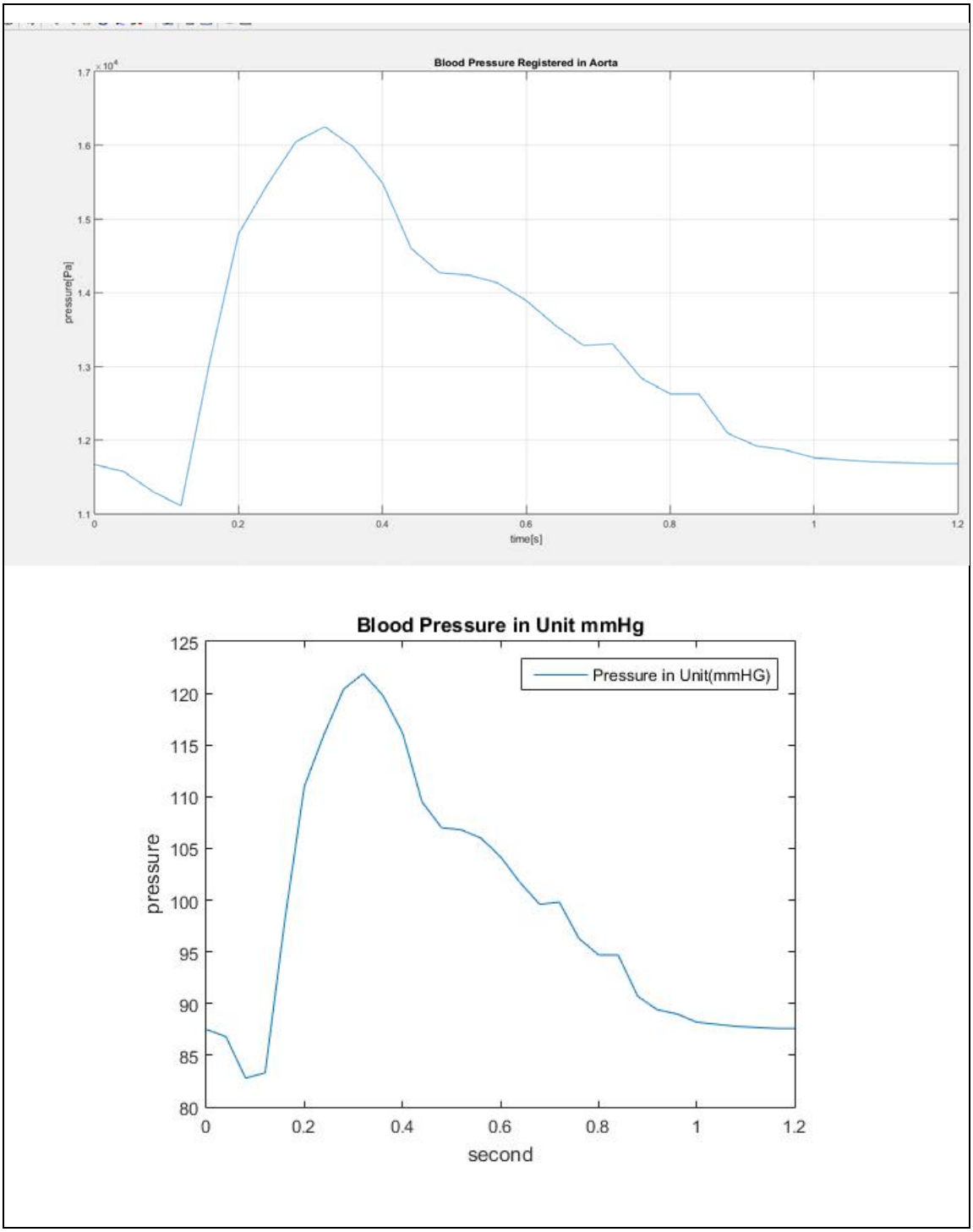
MATLAB, Lab 9 – Individual work

The table below presents the blood pressure registered in aorta during single heartbeat cycle.

time [s]	pressure [mmHg]
0	87.5
0.04	86.8
0.08	84.8
0.12	83.3
0.16	98.0
0.20	111.0
0.24	116.0
0.28	120.4
0.32	121.9
0.36	119.8
0.40	116.2
0.44	109.5
0.48	107.0
0.52	106.8
0.56	106.0
0.60	104.2
0.64	101.7
0.68	99.6
0.72	99.8
0.76	96.3
0.80	94.7
0.84	94.7
0.88	90.7
0.92	89.4
0.96	89.0
1.00	88.2
1.04	88.0
1.08	87.8
1.12	87.7
1.16	87.6
1.20	87.6

1. Recalculate the pressure into Pascals. Plot the graph showing this dependency

Screenshot:



2. How many complex Fourier coefficients will be obtained after applying `fft` function to the data presented above? Are all of them necessary to obtain the complete set of Fourier coefficients a_n b_n?

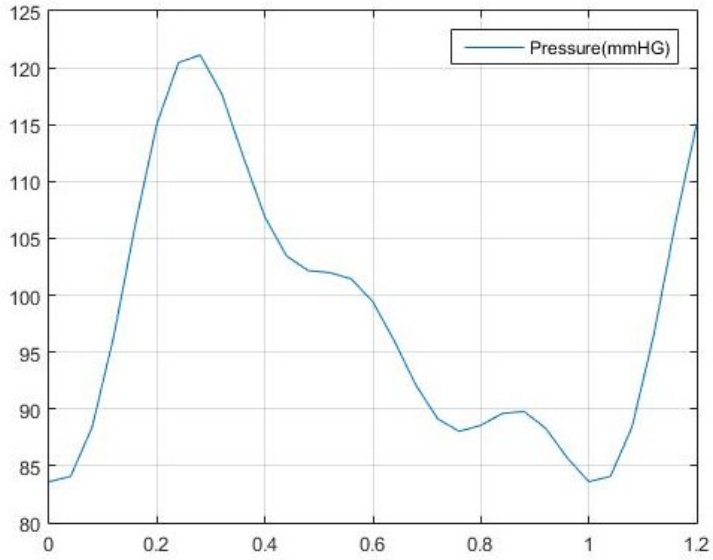
Answer:
We will obtain 31 complex Fourier coefficients but we need only initial value/C(0) = a0 and the coefficients between 1 and 15.Because they are complex conjugate.

3. Use `fft` function to obtain the full set of a_n and b_n coefficients. Add as many rows as necessary. Hint: it is not necessary to rewrite the values of coefficients manually, you may view any Matlab variable in a spreedsheat, copy and paste.

a1	11.8975	b1	-8.0151
a2	-1.1318	b2	-5.7993
a3	-4.5085	b3	-1.0345
a4	-1.8142	b4	1.7990
a5	0.1816	b5	1.0595
a6	-0.1289	b6	0.9846
a7	0.7872	b7	0.8257
a8	0.7742	b8	-0.3614
a9	0.5391	b9	-0.1794
a10	-0.1202	b10	-0.4219
a11	-0.1430	b11	-0.6692
a12	-0.2989	b12	0.2292
a13	-0.2666	b13	0.0795
a14	-0.0280	b14	0.0320
a15	-0.1105	b15	0.1973

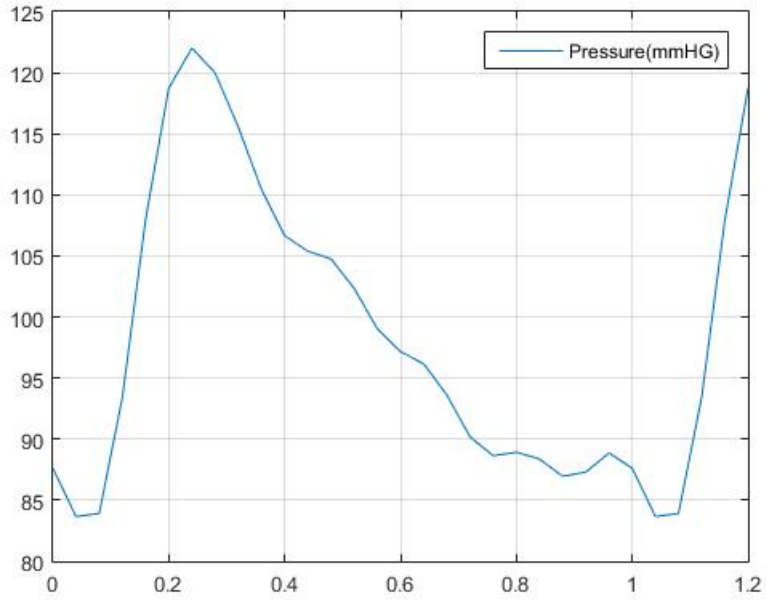
4. Create plot of the Fourier series containing first n elements a_n and b_n. Add data points from the first table and print the plot
   a. n=3

Screenshot:



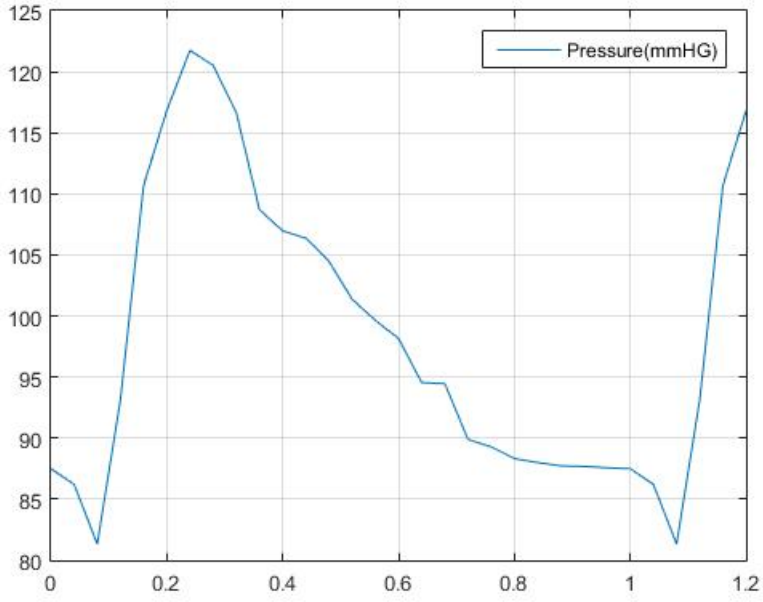
   b. n=6

Screenshot:



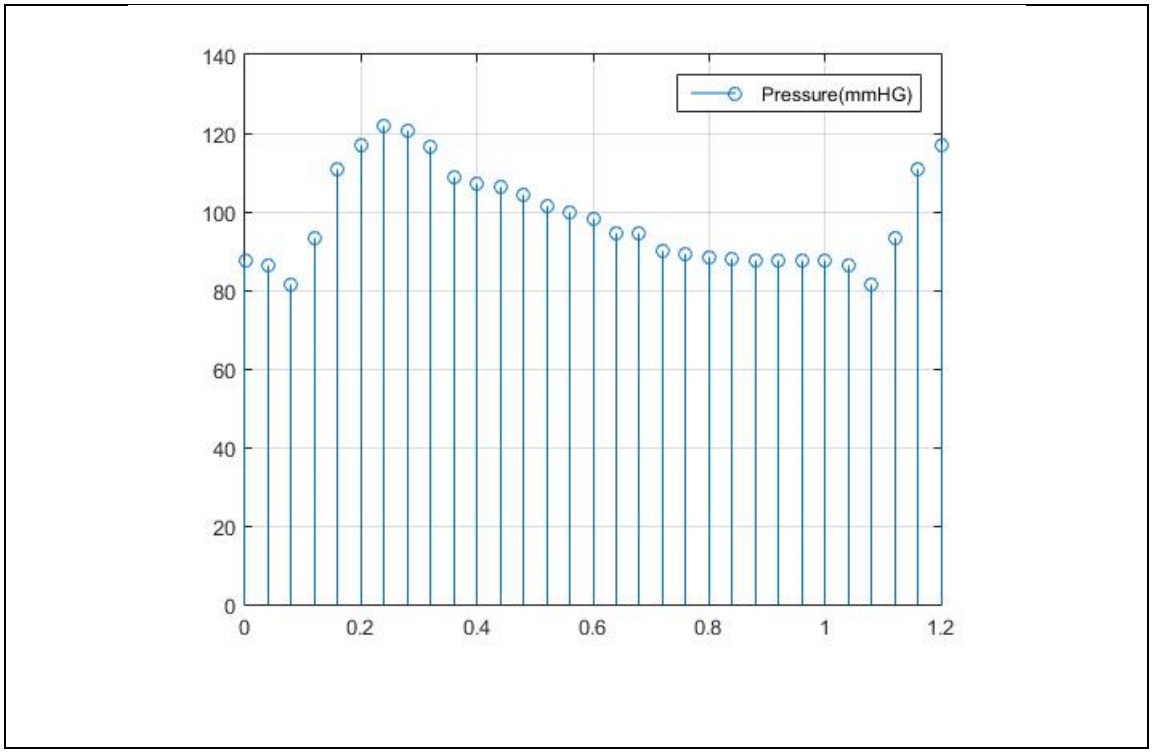
c. all Fourier coefficients obtained in `fft`

Screenshot:



d. with the use of function `stem`, create plots presenting the amplitudes a_n and b_n. Give some comments on number of amplitudes necessary to reconstruct the signal with reasonable accuracy.

Screenshots:


Pressure(mmHG)
140
120
100
80
60
40
20
0
0
0.2
0.4
0.6
0.8
1
1.2