1.

(b)

b =

0.0029 0.0087 0.0087 0.0029

a =

1.0000 -2.3741 1.9294 -0.5321

(c)

b =

1.0e-04 \*

0.0123 0.0861 0.2582 0.4304 0.4304 0.2582 0.0861 0.0123

a =

1.0000 -5.5890 13.5047 -18.2709 14.9365 -7.3738 2.0344 -0.2419

(d)

b =

0.1667 0.5000 0.5000 0.1667

a =

1.0000 -0.0000 0.3333 -0.0000

(e)

Increasing L, which is the order of the Butterworth filter, will result in a narrower transition band near its cutoff frequency. We get a sharper transition band similar to what an ideal lowpass filter has. By comparing (b) and (c), we can see that (c) with the higher order does a better job at preserving desired frequencies and attenuating undesired frequencies. Nevertheless, the price to pay is getting a more complicated transfer function, which might cause issues in filter stability. What’s more, the phase shift response of a Butterworth filter is also reduced by increasing its order.

Increasing , which is the cutoff frequency of the filter, will result in a larger passband for the lowpass Butterworth filter. By comparing (a) and (c), we can see that in (b), most of the signal is attenuated as its main frequency (0.2) is larger than 0.1. On the other hand, most of the signal is preserved as its main frequency (0.2) is smaller than 0.5.

2.

(b)

b =

1.0e-09 \*

Columns 1 through 11

0.0000 0.0005 0.0038 0.0175 0.0570 0.1367 0.2507 0.3581 0.4029 0.3581 0.2507

Columns 12 through 17

0.1367 0.0570 0.0175 0.0038 0.0005 0.0000

a =

1.0e+03 \*

Columns 1 through 11

0.0010 -0.0128 0.0770 -0.2894 0.7596 -1.4772 2.2009 -2.5625 2.3560 -1.7161 0.9869

Columns 12 through 17

-0.4434 0.1525 -0.0388 0.0069 -0.0008 0.0000

(c)

b =

1.0e-05 \*

Columns 1 through 11

0.0001 0 -0.0009 0 0.0070 0 -0.0326 0 0.1060 0 -0.2544

Columns 12 through 22

0 0.4664 0 -0.6663 0 0.7496 0 -0.6663 0 0.4664 0

Columns 23 through 33

-0.2544 0 0.1060 0 -0.0326 0 0.0070 0 -0.0009 0 0.0001

a =

1.0e+04 \*

Columns 1 through 11

0.0001 -0.0008 0.0042 -0.0155 0.0456 -0.1126 0.2407 -0.4530 0.7622 -1.1576 1.5992

Columns 12 through 22

-2.0211 2.3471 -2.5125 2.4853 -2.2750 1.9291 -1.5155 1.1028 -0.7424 0.4617 -0.2645

Columns 23 through 33

0.1392 -0.0669 0.0293 -0.0115 0.0041 -0.0013 0.0003 -0.0001 0.0000 -0.0000 0.0000

The above are the coefficients for the following equation,

Figure for mybutter1.m:

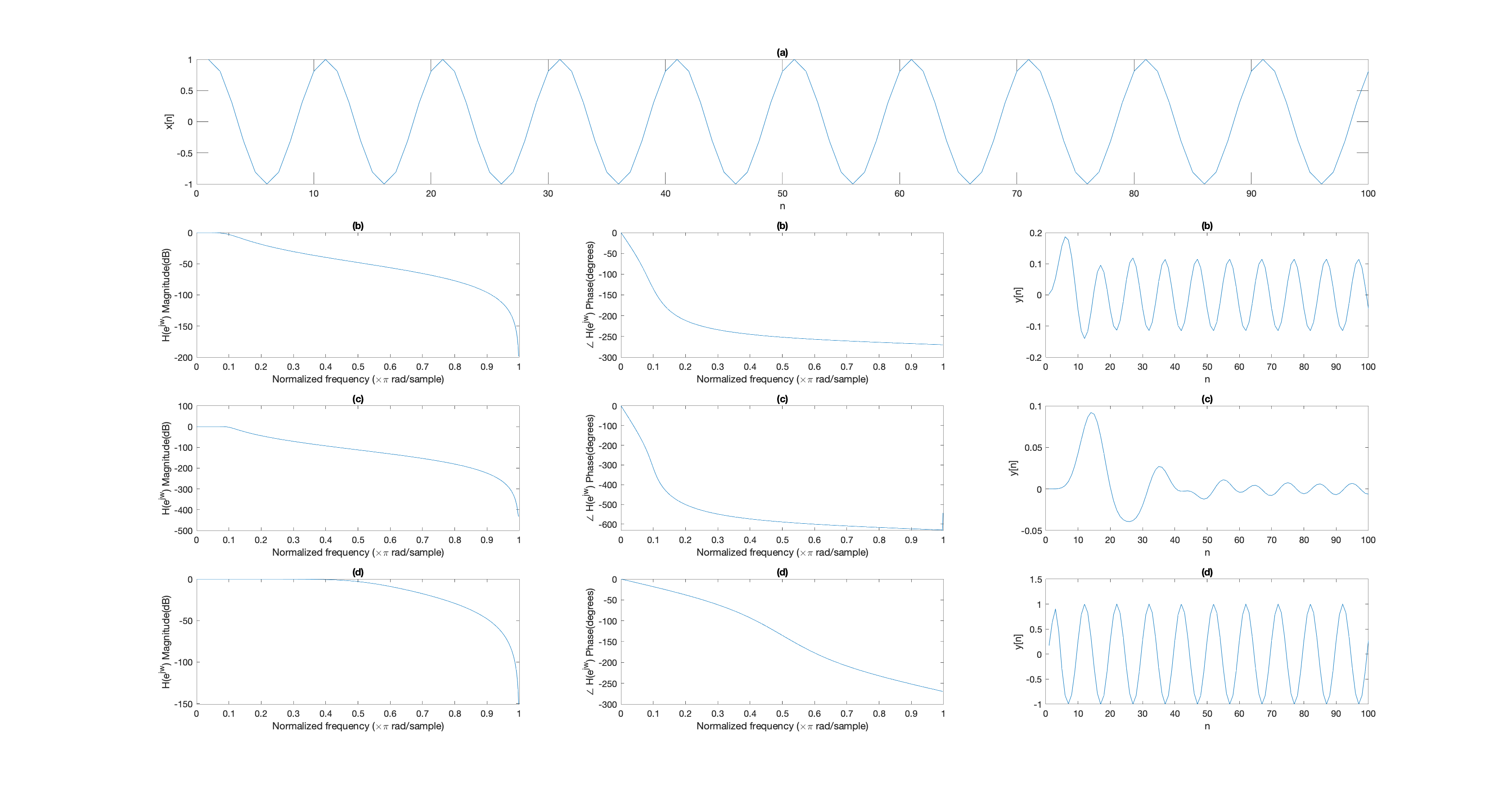
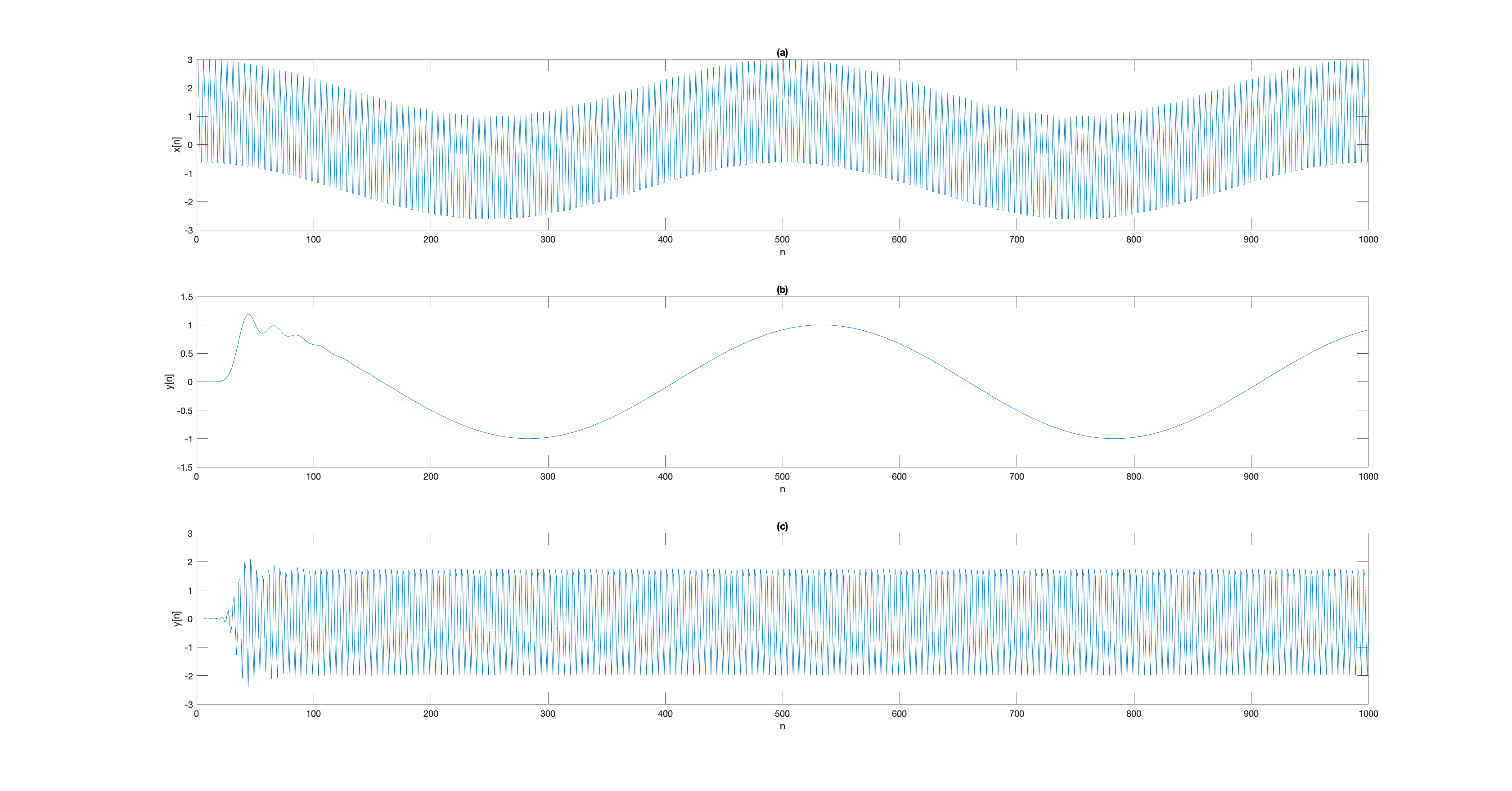


Figure for mybutter2.m:



-B08902073資工一 陳宇浩