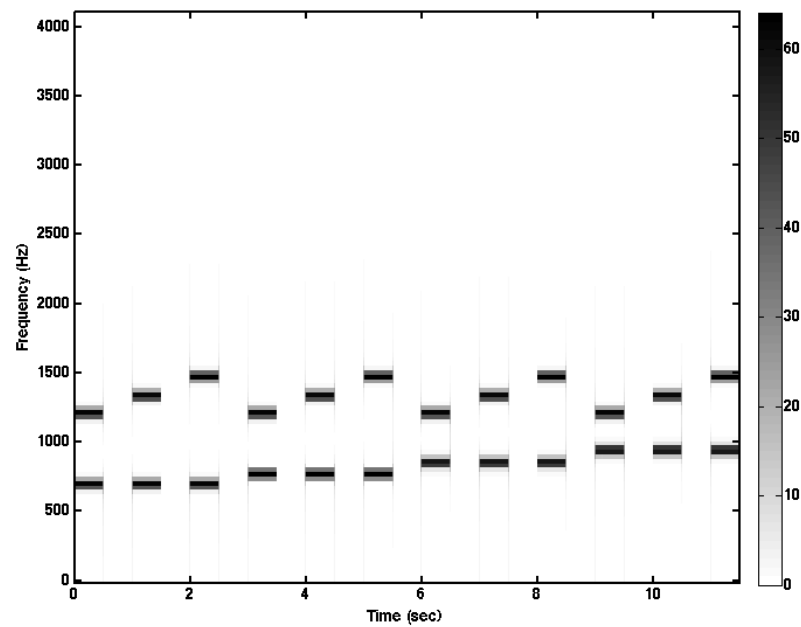


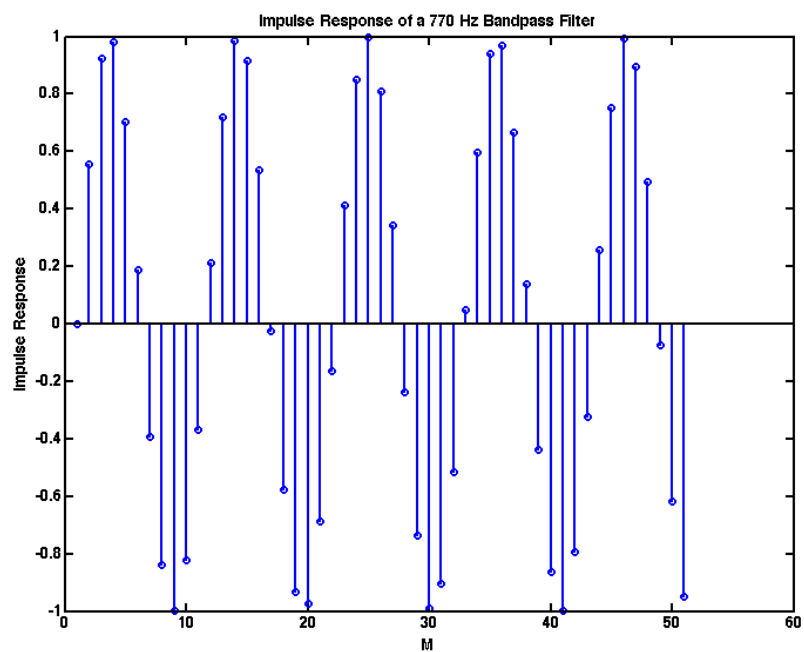
Yu-Hao Kong
LAB 7
7131384364

Question 1



Phone number that was dialed in figure 7.1: 7 6 3 6 *(10) 5 2

Question 2a



b.

printed is the result from the .m file

% Frequency Response!

H =

Columns 1 through 4

17.3672-2.6330i 0.8215-25.2314i -15.9743+0.2714i 0.5059-1.3934i

Columns 5 through 7 !

-1.7254+1.7812i -2.3965-0.1170i -1.4689-0.9898i

% Gain at each frequency!

gain =

17.5657 25.2448 15.9766 1.4824 2.4799 2.3994 1.7712

% Gain Ratio at each frequency

R= 1.4372

c.

printed is the result from the .m file

%Verified Gain Ratio

verified_gain =

17.5657

25.2448

15.9766

1.4824

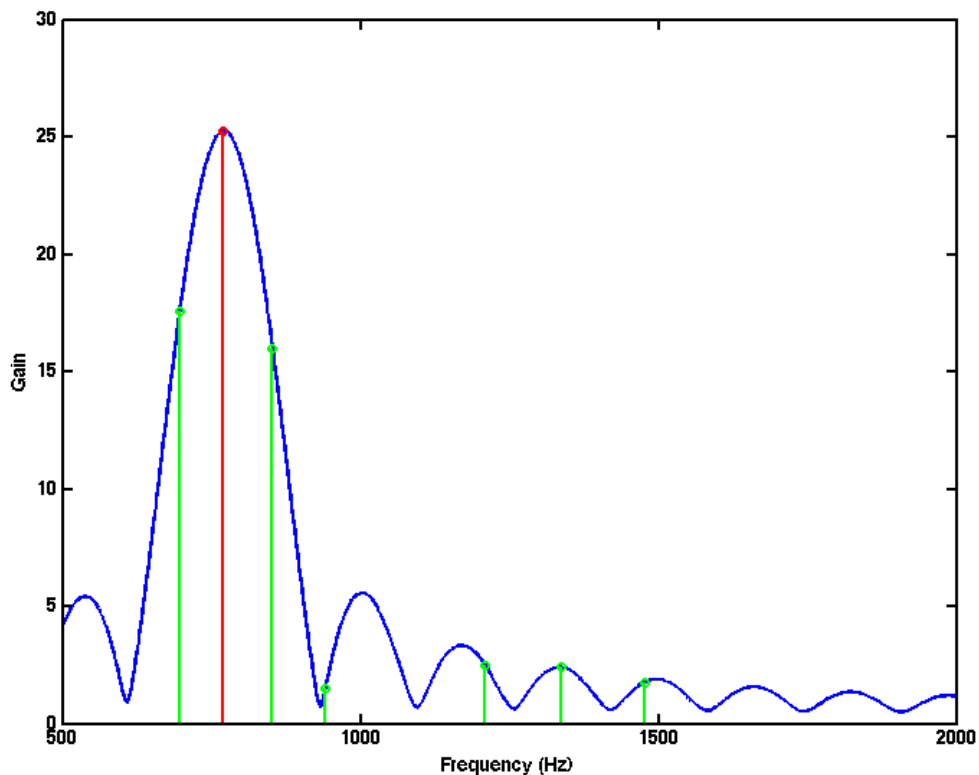
2.4799

2.3994

1.7712

the graph is by comparing the gain generated by dtmf_filt_cahar.m, it shows that the gain in 2b is correct

plot by dtmf_filt_char.m:



- The frequency response is characterized by several lobes and the frequency corresponding to the largest response that will lie in the highest lobe
 - When M Increased M, the more frequency response of the correct frequency can be distinguished from one another. the magnitude is much higher than other frequency responses
 - When M increased, the heights of adjacent lobes (despite the one which includes the correct frequency) become smaller, and it will be more similar
 - The filters frequency has the following features that contribute to the gain ratio: the order of the filter (M), and the central frequency
- **When M is bigger or equal to 103, the gain can be greater than 10 at the center frequency

```
[response, ratio]=dtmf_filt_char(103, 770,1)
```

```
response =
```

```
4.5057
```

```
51.6359
```

```
1.8568
```

```
3.6844
```

```
3.0311
```

```
1.1614
```

```
0.7280
```

ratio =
11.4602

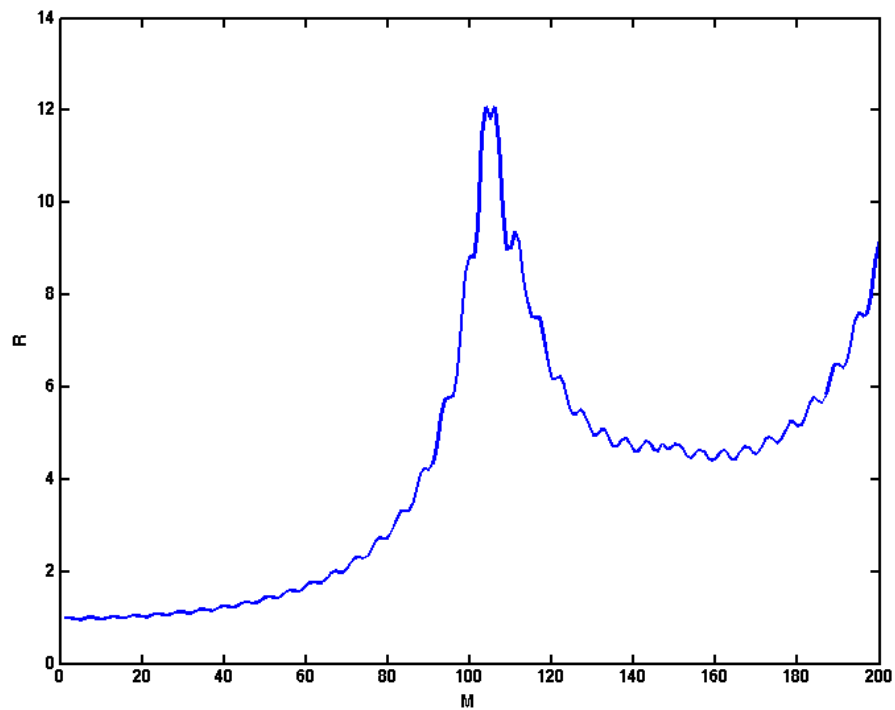
d.

```
[H,w] = freqz(h,1,fs/2);  
gain = abs(H(frqs+1));  
index = find(frqs == frq);  
gain_ratio = abs(H(frqs(index)+1))/max(gain(gain~=abs(H(frqs(index)+1))));
```

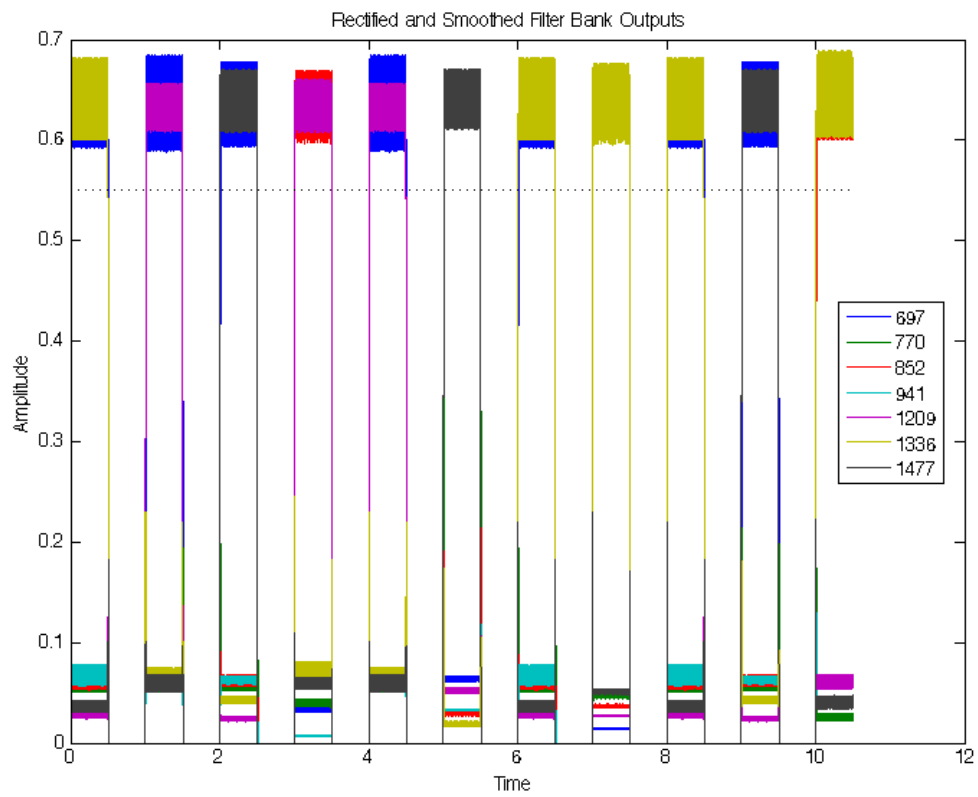
e.

this is the statistics of each bandpass filter:

	697 Hz	770 Hz	852 Hz	941 Hz	1209 Hz	1336 Hz	1477 Hz
Optimal M	102	103	97	90	62	59	56
Gain	51.08	51.64	48.35	45.62	31.15	29.59	28.05
R	10.16	11.46	10.74	10.13	11.02	11.14	11.59



Question 3



4)

