

Scilab Manual for
Audio and Speech Processing Part 1
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Experiment: 1

Basic Operations on Signals

Scilab code Solution 1.1 Generating a sin wave

```
1 //Generating a sine wave
2 //
3 //OS: windows 7
4 //Scilab: 5.5.2
5 //
6 clc;
7 close;
8 clear;
9 f=100;
10 Fs=44000; //sampling frequency
11 t=0:1/Fs:.02; // 2 cycles only
12 y=sin(2*%pi*f*t);
13 plot(y);
14 title('Sine wave')
15 xlabel('sample number');
16 ylabel('amplitude');
```

Scilab code Solution 1.2 Program to compare two sine waves with different frequencies

```

1 //Program to compare two sine waves with different
  frequencies.
2 //
3 //OS: windows 7
4 //Scilab: 5.5.2
5 //
6
7 clc;
8 close;
9 clear;
10 f1=100;
11 F=4400; //sampling frequency
12 t=0:1/F:.02;
13 y=sin(2*%pi*f1*t);
14
15 f2=200;
16 z=2*sin(2*%pi*f2*t);
17
18
19 subplot(211)
20 plot(y);
21 xlabel('sample number');
22 ylabel('amplitude');
23
24 subplot(212)
25 plot(z)
26 xlabel('sample number');
27 ylabel('amplitude');

```

Scilab code Solution 1.3 Program to generate squarewave

```

1 //Program to generate squarewave
2 //
3 //OS: windows 7
4 //Scilab: 5.5.2

```

```

5 //
6 f=100;
7 Fs=44000; //sampling frequency
8 t=0:1/Fs:.02; // 2 cycles only
9 y=squarewave(2*%pi*f*t);
10 plot(y);
11 xlabel('sample number');
12 ylabel('amplitude');

```

Scilab code Solution 1.4 Program to add sin and squarewave

```

1 //Program to add sin and squarewave
2 //
3 //OS: windows 7
4 //Scilab: 5.5.2
5 //
6 clc;
7 close;
8 clear;
9 f=100;
10 Fs=44000; //sampling frequency
11 t=0:1/Fs:.02; // 2 cycles only
12 y=squarewave(2*%pi*f*t);
13 z=sin(2*%pi*f*t);
14 subplot(311)
15 plot(y)
16 title('Suqre wave')
17 subplot(312)
18 plot(z)
19 title('Sine wave')
20 zz=y+z; // Adding two signals
21 subplot(313)
22 plot(zz);
23 title('Result of adding sin and square wave')

```

Experiment: 2

Concatenation of Speech Signals

Scilab code Solution 2.1 Program to concatenate speech signals

```
1 //This code Reads 2 audio files and concatenates
  them.
2 //
3 //OS: windows 7
4 //Scilab: 5.5.2
5 //
6 clc;
7 close;
8 clear;
9 [y,Fs] = wavread('C:\Users\ACER\Desktop\Number_1.wav
  '); // reading the audiofile 1
10 [x,Fs]= wavread('C:\Users\ACER\Desktop\Number_2.wav'
  );// reading the audiofile 2
11 z=[y,x];
12 sound(z,Fs)// playing concatenated file.
13 t=(0:length(z)-1)*1/Fs;
14 plot(t,z)
15 title('Concatenated Speech signal waveform')
16 xlabel('Time in seconds')
```

```
17 ylabel('Amplitude')
```

Scilab code Solution 2.2 Concatenating into Stereo file

```
1 //This Program Reads 2 audio files and coccatenates
  them into a stereo file.
2 //
3 //OS: windows 7
4 //Scilab: 5.5.2
5 //
6 clc;
7 close;
8 clear;
9 [y,Fs] = wavread('C:\Users\ACER\Desktop\Number_1.wav
  '); // reading the audiofile 1
10 [x,Fs]= wavread('C:\Users\ACER\Desktop\Number_2.wav'
  );// reading the audiofile 2
11 z=[x;y]; // Concatenating. //Two files must be of
  same length
12 sound(z,Fs)// playing concatenated file. // Observe
  two seperate signals played together.
```

Scilab code Solution 2.3 Stereo to Mono conversion

```
1 //This Program Reads a stereo file and converts it
  in to individual files.
2 //
3 //OS: windows 7
4 //Scilab: 5.5.2
5 //
6 clc;
7 close;
8 clear;
```

```

9 [y,Fs] = wavread('C:\Users\ACER\Desktop\stereo.wav')
    ; // Reading a stereo file
10 //sound(y,Fs); // Uncomment to play stereo file
11 left=y(1,:); //Extracts the first row
12 sound(left,Fs); //Uncomment to get left side
    component
13 t=(0:length(left)-1)*1/Fs;
14 subplot(211)
15 plot(t,left)
16 title('Left side audio component')
17 xlabel('Time in seconds')
18 ylabel('Amplitude')
19
20 right=y(2,:);
21 sound(right,Fs); // Uncomment to get right side
    componet.
22 subplot(212)
23 plot(t,left)
24 title('Right side audio component')
25 xlabel('Time in seconds')
26 ylabel('Amplitude')

```

Experiment: 3

Finding the Resonating Frequency of a Tuning Fork

Scilab code Solution 3.1 Resonating Freq using spectrum

```
1 // Program to find the Resonating frequency of a
  Tuning fork
2 // using spectrum of the signal
3 //
4 //OS: windows 7
5 //Scilab: 5.5.2
6 //
7 clc;
8 close;
9 clear;
10 [y,Fs] = wavread('C:\Users\ACER\Desktop\Freq512Hz.
  wav');
11 y=y(200:1900); // considering only a segment to
  reduce the amount of computation
12 t=(0:length(y)-1)/Fs;
13 subplot(211)
14 plot(t,y)
15 xlabel('Time in seconds')
16 title('Original signal')
```

```

17 Y=abs(fft(y)); //find the fourier transform
18
19 l = length(Y)/2;
20 f = (0:(l-1))*Fs/(2*l); //modify the x axis to
    represent frequency instead of samples
21
22 abs_fft = abs(Y(1:l));
23 subplot(212)
24 plot(f,abs_fft); //plot magnitude of fourier
    transform
25 title('Fourier Transform of signal')
26 xlabel('Frequency')
27 ylabel('Amplitude')
28
29 peak = max(abs_fft); //find the first maxima of the
    spectrum
30 peakfreq = [f(abs_fft == peak)]
31 disp('Resonating frequency of given tuning fork (in
    Hz): ');
32 disp(peakfreq); //display the contained frequencies

```

Scilab code Solution 3.2 Resonating Freq in mixed frequency signal

```

1 // This program finds the frequency components in a
    given mixed frequency signal
2 // Mixed frequency signal was recorded by playing 2
    Tunng forks simultaneously
3 //
4 //OS: windows 7
5 //Scilab: 5.5.2
6 //
7 clc;
8 close;
9 clear;
10

```

```

11 [y,Fs] = wavread('C:\Users\ACER\Desktop\
    Mixed512and384.wav'); //read the audio file
12
13 Y=abs(fft(y)); //find the fourier transform
14
15 l = length(Y)/2;
16 f = (0:(l-1))*Fs/(2*l); //modify the x axis to
    represent frequency instead of samples
17
18 abs_fft = abs(Y(1:l));
19 plot(f,abs_fft); //plot magnitude of fourier
    transform
20 title('Fourier Transform of signal')
21 xlabel('Frequency')
22 ylabel('Amplitude')
23
24 peak = max(abs_fft); //find the first maxima of the
    spectrum
25 secpeak = max(abs_fft(abs_fft<max(abs_fft))); //
    find the second maxima of the spectrum
26 peakfreq = [f(abs_fft == peak), f(abs_fft == secpeak
    )]; //find the frequency corresponding to the
    peaks
27 peakfreq = gsort(peakfreq); //sort the detected
    frequencies
28 peakfreq(abs(max(peakfreq) - max(peakfreq(peakfreq<
    max(peakfreq)))) < 10) = []; //remove frequencies
    that are very close to one another
29
30 disp('Given signal has following frequencies (in Hz)
    : ');
31 disp(peakfreq); //display the contained frequencies

```

Scilab code Solution 3.3 Resonating Freq using Autocorrelation

```

1 // Finding the Resonating frequency of a Tuning fork
  using
2 // Autocorrelation method.
3
4 //
5 //OS: windows 7
6 //Scilab: 5.5.2
7 //
8 clc;
9 close;
10 clear;
11 [y,Fs] = wavread('C:\Users\ACER\Desktop\Freq512Hz.
    wav');
12 y=y(200:1900); // considering only a segment to
    reduce the amount of computation
13 t=(0:length(y)-1)/Fs;
14 subplot(211)
15 plot(t,y)
16 xlabel('Time in seconds')
17 title('Original signal');
18 c1=xcorr(y);
19 subplot(212)
20 lag=(1:length(c1))-ceil(length(c1)/2);
21 plot(lag,c1)
22 title('Autocorrelation if the given segment')
23
24 c1 = -c1; //flip the ACF to get two maxima peaks
25
26 [a,b] = max(c1); //find the first maxima
27 [c,d] = max(c1(b+1:$)); //find the second maxima
28
29 numsamples = d+1; //get the number of samples
    between the peaks
30
31 frequency = Fs/numsamples; //calculate the frequency
    of the signal
32
33 disp('Resonating frequency in Hz: ');

```

```
34 disp(freqncy); //display the frequency
```
