## ภาคผนวกโปรแกรม MATLAB ที่ใช้ในการคำนวณ

```
Function v=test28 %Sum 1-4
[y,FS,NBITS]=wavread('c:\my documents\thesis\sound\s9');
disp('sampling rate and bit')
disp([FS,NBITS])

figure(1);
Ny=length(y);
T=1/FS   %sampling period
t=0:1:(Ny-1);
t=t*T;
plot(t,y);
xlabel('Sec.'),ylabel('Amplitude')
title('Origin Signal')

[xin,yin]=ginput(2);
n1=fix(xin(1)/T)+1;
n2=fix(xin(2)/T)+1;
y=y(n1:n2);
disp('Selected Number')
Ny=length(y)
t=((0:1:(Ny-1))*T)+((n1-1)*T);

pause
figure(2);
plot(t,y), xlabel('Second'),ylabel('Amplitude')
title('Selected Signal')
```

```
Fc=882/(FS/2);
pause
figure(3);
disp('Filter Coefficient')
[b,a]=butter(5,Fc);
[H,w]=freqz(b,a,1024);
plot(w*FS/(2*pi),abs(H));
xlabel('Frequency'),ylabel('Magnitude')
title('Lowpass Filter Frequency response')

pause
figure(4);
sf=filter(b,a,y);
plot(t,sf);
xlabel('Sec.'),ylabel('Amplitude')
title('Filtered Signal')

pause
figure(5);
sf=fliplr(sf');
sf=sf';
Ny=length(sf);
t=((0:1:(Ny-1))*T);
plot(t,sf)
xlabel('Sec.'),ylabel('Amplitude')
title('Time-inverse Filtered Signal')
```

```
pause
figure(6);
sf=filter(b,a,sf);
plot(t,sf);
xlabel('Sec.'),ylabel('Amplitude')
title('Filtered Time-inverse Filtered Signal')

pause
figure(7);
sf=sf/(max((abs(sf))));
plot(t,sf);
xlabel('Sec.'),ylabel('Amplitude')
title('Normalize')

pause
figure(8);
co1=-(sf.^2).*log10(sf.^2);
Ny=length(co1);
t=((0:1:(Ny-1))*T);
plot(t,abs(co1)),
xlabel('Sec.')
title('Shannon Energy')

pause
figure(9);
co2=sf.^2;
Ny=length(co2);
t=((0:1:(Ny-1))*T);
plot(t,abs(co2)),
```

```
xlabel('Sec.')
title('Energy Square')

pause
figure(10);
co3=-(abs(sf)).*log10(abs(sf));
Ny=length(co3);
t=((0:1:(Ny-1))*T);
plot(t,abs(co3)),
xlabel('Sec.')
title('Shannon Entropy')

pause
figure(11);
%co(1:3)=0;
co4=(abs(sf));
Ny=length(co4);
t=((0:1:(Ny-1))*T);
plot(t,abs(co4)),
xlabel('Sec.')
title('Absolute Value')
%co2=co2>15;

pause
figure(12);
subplot(411);
co1=-(sf.^2).*log10(sf.^2);
Ny=length(co1);
t=((0:1:(Ny-1))*T);
```

```
plot(t,abs(co1))
title('Shannon Energy')

subplot(412);
co2=sf.^2;
Ny=length(co2);
t=((0:1:(Ny-1))*T);
plot(t,abs(co2)),
title('Energy Square')

subplot(413);
co3=-(abs(sf)).*log10(abs(sf));
Ny=length(co3);
t=((0:1:(Ny-1))*T);
plot(t,abs(co3))
title('Shannon Entropy')

subplot(414);
%co(1:3)=0;
co4=(abs(sf));
Ny=length(co4);
t=((0:1:(Ny-1))*T);
plot(t,abs(co4))
title('Absolute Value')
%co2=co2>15;
```

```
pause
figure(13)
N=fix(0.02/T);%number of sampling in one window,the window is 0.02 second
Nsf=length(sf);%total sample of the selected signal
Nw=fix(Nsf/N)%number of consecutive window, no overlapping
Es1=[];
nt1=[];
for I=1:2*Nw,
  sfs=(sf(fix((((I-1)*N)+1)-(((I-1)*(N+1))/2)):fix(((I*N)-((I-1)*(N+1))/2)))).^2;
  sfs=sfs.*(log10(sfs));
  sfss=(-1/N)*sum(sfs);
  Es1=[Es1,sfss];
  t1=((((((I-1)*N)+1)-(((I-1)*(N+1))/2))+(((I*N)-((I-1)*(N+1))/2)))/2)*T;
  nt1=[nt1,t1];
end
plot(nt1,Es1);
xlabel('Es(Sec.)')
title('Average Shanon Energy')

pause
figure(14)
N=fix(0.02/T);%number of sampling in one window,the window is 0.02 second
Nsf=length(sf);%total sample of the selected signal
Nw=fix(Nsf/N);%number of consecutive window, no overlapping
Es2=[];
nt2=[];
for I=1:2*Nw,
  sfs=(sf(fix((((I-1)*N)+1)-(((I-1)*(N+1))/2)):fix(((I*N)-((I-1)*(N+1))/2)))).^2;
  %sfs=sfs.*(log10(sfs));
```

```
  sfss=(1/N)*sum(sfs);
  Es2=[Es2,sfss];
  t2=((((((I-1)*N)+1)-(((I-1)*(N+1))/2))+(((I*N)-((I-1)*(N+1))/2)))/2)*T;
  nt2=[nt2,t2];
end
plot(nt2,Es2);
xlabel('Es(Sec.)')
title('Average Energy Square ')

pause
figure(15)
N=fix(0.02/T);%number of sampling in one window,the window is 0.02 second
Nsf=length(sf);%total sample of the selected signal
Nw=fix(Nsf/N);%number of consecutive window, no overlapping
Es3=[];
nt3=[];
for I=1:2*Nw,
  sfs=abs(sf(fix((((I-1)*N)+1)-(((I-1)*(N+1))/2)):fix(((I*N)-((I-1)*(N+1))/2))));
  sfs=abs(sfs).*(log10(abs(sfs)));
  sfss=(-1/N)*sum(sfs);
  Es3=[Es3,sfss];
  t3=((((((I-1)*N)+1)-(((I-1)*(N+1))/2))+(((I*N)-((I-1)*(N+1))/2)))/2)*T;
  nt3=[nt3,t3];
end
plot(nt3,Es3);
xlabel('Es(Sec.)')
title('Average Shannon Entropy ')
```

```
pause
figure(16)
N=fix(0.02/T);%number of sampling in one window,the window is 0.02 second
Nsf=length(sf);%total sample of the selected signal
Nw=fix(Nsf/N);%number of consecutive window, no overlapping
Es4=[];
nt4=[];
for I=1:2*Nw,
  sfs=abs(sf(fix((((I-1)*N)+1)-(((I-1)*(N+1))/2)):fix(((I*N)-((I-1)*(N+1))/2))));
  %sfs=abs(sfs).*(log10(abs(sfs)));
  sfss=(1/N)*sum(sfs);
  Es4=[Es4,sfss];

  t4=((((((I-1)*N)+1)-(((I-1)*(N+1))/2))+(((I*N)-((I-1)*(N+1))/2)))/2)*T;
  nt4=[nt4,t4];
end
plot(nt4,Es4);
xlabel('Es(Sec.)')
title('Average Absolute Value')

pause
figure(17);
subplot(411);
plot(nt1,Es1);
title('Average Shanon Energy')

pause
subplot(412);
plot(nt2,Es2);
```

```
title('Average Energy Square ')

pause
subplot(413);
plot(nt3,Es3);
title('Average Shannon Entropy')
pause
subplot(414);
plot(nt4,Es4);
xlabel('Es(Sec.)')
title('Average Absolute Value')

disp('Mean and Standard Deviation')
MEs1=mean(Es1);
SEs1=std(Es1);Ts=N*T/2;%divided by 2,because of overlappling
pause
figure(18)
Pa1=Es1>(MEs1+SEs1);%average Shannon energy that is larger than mean + standard deviation
plot(nt1,Pa1);
xlabel('Sec.')
title('Therhold of Average Shanon Energy')

Ts=N*T/2;%divided by 2,because of overlappling
t=Ny/FS
Nn=Ny/(N)
FSn=Nn/t
FSo=2*FSn
N21=FSo*0.25
ZeroRange =2*N21
```

```
PP1=[];
ZeroCount=0;
for  n=1:Ny
  if Pa1(n)==1
    if ZeroCount >= ZeroRange
      ZeroCount = 0;
      PP1=[PP1,(n-1)*Ts];
    end;% if ZeroCount
  else
    ZeroCount = ZeroCount + 1;
  end;%if Pa

end;%for n
Peak1=PP1
Period1=[(PP1(3)-PP1(2))+(PP1(2)-PP1(1))]/2
Heartbeat1=60/Period1

disp('Mean and Standard Deviation')
MEs2=mean(Es2);
SEs2=std(Es2);
pause
figure(19)
Pa2=Es2>(MEs2+SEs2);%average Shannon energy that is larger than mean + standard deviation
plot(nt2,Pa2);
xlabel('Sec.')
title('Therhold of Average Energy Square')
Ts=N*T/2;%divided by 2,because of overlappling
t=Ny/FS
Nn=Ny/(N)
```

```
FSn=Nn/t
FSo=2*FSn
N21=FSo*0.25
ZeroRange =2*N21
PP2=[];
ZeroCount=0;
for  n=1:Ny
   if Pa2(n)==1
      if ZeroCount >= ZeroRange
         ZeroCount = 0;
         PP2=[PP2,(n-1)*Ts];
      end;% if ZeroCount
   else
      ZeroCount = ZeroCount + 1;
   end;%if Pa

end;%for n

Peak2=PP2
Period2=[(PP2(3)-PP2(2))+(PP2(2)-PP2(1))]/2
Heartbeat2=60/Period2

disp('Mean and Standard Deviation')
MEs3=mean(Es3);
SEs3=std(Es3);
pause
figure(20)
Pa3=Es3>(MEs3+SEs3);%average Shannon energy that is larger than mean + standard deviation
plot(nt3,Pa3);
```

```
xlabel('Sec.')
title('Therhold of Average Shannon Entropy')

Ts=N*T/2;%divided by 2,because of overlappling
t=Ny/FS
Nn=Ny/(N)
FSn=Nn/t
FSo=2*FSn
N21=FSo*0.25
ZeroRange =2*N21
PP3=[];
ZeroCount=0;
for  n=1:Ny
  if Pa3(n)==1
    if ZeroCount >= ZeroRange
      ZeroCount = 0;
      PP3=[PP3,(n-1)*Ts];
    end;% if ZeroCount
  else
    ZeroCount = ZeroCount + 1;
  end;%if Pa

end;%for n

Peak3=PP3
Period3=[(PP3(3)-PP3(2))+(PP3(2)-PP3(1))]/2
Heartbeat3=60/Period3
```

```
disp('Mean and Standard Deviation')
MEs4=mean(Es4);
SEs4=std(Es4);
pause
figure(21)
Pa4=Es4>(MEs4+SEs4);%average Shannon energy that is larger than mean + standard deviation
plot(nt4,Pa4);
xlabel('Sec.')
title('Therhold of Average Absolute Value')
Ts=N*T/2;%divided by 2,because of overlappling
t=Ny/FS
Nn=Ny/(N)
FSn=Nn/t
FSo=2*FSn
N21=FSo*0.25
ZeroRange =2*N21
PP4=[];
ZeroCount=0;
for  n=1:Ny
  if Pa4(n)==1
    if ZeroCount >= ZeroRange
      ZeroCount = 0;
      PP4=[PP4,(n-1)*Ts];
    end;% if ZeroCount
  else
    ZeroCount = ZeroCount + 1;
  end;%if Pa

end;%for n
```

```
Peak4=PP4
Period4=[(PP4(3)-PP4(2))+(PP4(2)-PP4(1))]/2
Heartbeat4=60/Period4

pause
figure(22);
subplot(411);
plot(nt1,Pa1)
title('Therhold of Average Shanon Energy')
subplot(412);
plot(nt2,Pa2)
title('Therhold of Average Energy Square')
subplot(413);
plot(nt3,Pa3)
title('Therhold of Average Shannon Entropy')
subplot(414);
plot(nt4,Pa4)
title('Therhold of Average Absolute Value')

Peak1
Peak2
Peak3
Peak4

Heartbeat1
Heartbeat2
Heartbeat3
Heartbeat4
```