Zach Rump

Programming Assignment 3

Ece1000 spring14

1)

a)

function [ wd\_wave ] = wedgewave( numberofFreq )

% Creates a data set consisting of <numberofFreq> different waves

%at a random frequency between 200hz and 6000hz

time = 0:.001:.149; %150 points

amplitude = 1;

wd\_wave = zeros(1, 150); %initialize output variable

for i = 1:numberofFreq %loop n times

freq = randi([200, 6000]); %random frequency between 200hz and 6000hz

tmp\_wave = amplitude\*square(2\*pi\*freq\*time);

wd\_wave = (wd\_wave + tmp\_wave);

end

end

b)

function [ lpf\_out ] = lpf(lpf\_in, cutoffFreq\_hz, sampleRate)

%lpf - takes a waveform and applies a 2nd order lowpass filter

%w/ the specified cutoff freq and sample rate

norm\_sampleRate = (cutoffFreq\_hz\*2/sampleRate); %normalized sample rate for use w/ butter

[b, a] = butter(2, norm\_sampleRate, 'low'); %returns filter coefficients for a 2nd order hpf, w/ specified cutoff frequency

lpf\_out = filter(b, a, lpf\_in); %creates data set lpf\_out w/ filter created by butter using lpf\_in

end

c)

function [ hpf\_out ] = hpf(hpf\_in, cutoffFreq\_hz, sampleRate )

%hpf - takes a waveform and applies a 2nd order lowpass filter w/ the

%specified sample rate and cutoff freq

norm\_sampleRate = (cutoffFreq\_hz\*2/sampleRate); %normalized sample rate for use w/ butter

[b, a] = butter(2, norm\_sampleRate, 'high'); %returns filter coefficients for a 2nd order hpf, w/ specified cutoff freq

hpf\_out = filter(b, a, hpf\_in); %creates data set lpf\_out w/ filter created by butter using lpf\_in

end

d)

function plotwaves(orig\_wave, lpf\_wave, hpf\_wave)

%Plot the original wedge wave and the two filtered waves on the same graph

% Detailed explanation goes here

time = 0:(1/20000):.00745; %150 points at 20000hz sample rate

plot(time, orig\_wave, 'r', time, lpf\_wave, 'g', time, hpf\_wave, 'b');

end



2)

%The sound recorded using the theremin kit contains many different frequencies.

%Use the filters that you designed to filter out frequencies above 200 Hz and below 200 Hz.

%Plot the first 150 points of the original wave and the filtered waves on the same graph.

load data1;

theremin\_dat = data1; %load theremin data from data1 file

theremin\_lpf = lpf(theremin\_dat, 200, 1000); %store low-pass filtered theremin data

theremin\_hpf = hpf(theremin\_dat, 200, 1000); %store high-pass filtered theremin data

time = 0:.001:.149; %150 points

plot(time, theremin\_dat(1:150), 'r', time, theremin\_lpf(1:150), 'g', time, theremin\_hpf(1:150), 'b');



3)

**%chapter 5 #1**

%original code multiplies every element by 2

mat = mat\*2;

**%ch5 #2**

%original code takes the sum of all elements in the vector

result = sum(vec);

**%ch5 #3**

%original code

newv = zeros(size(vec));

myprod = 1;

for i = 1:length(vec)

myprod = myprod\*vec(i);

newv(i)=myprod;

end

newv %disp value

%vectorized code

newv = cumprod(vec); %cumulative product

**%chapter 5 #4**

%create 1x6 vector of random ints

randvec = randi(20, 1, 6); %randi(IMAX,M,N) MxN matrix w/ random numbers between 1-IMAX

%find min value using builtin functions

minval = min(randvec);

%find max value in vector using builtin functions

maxval = max(randvec);

%create vector of cumulative sums using cumsum

csum = cumsum(randvec);

**%chapter 5 num 5**

%write a relational expression for a vector variable that will verify that

%the last value in a vector created by cumsum is the same as the result

%returned by sum

randvec = randi(10, 1, 5);

x=cumsum(randvec);

x(length(randvec)) == sum(randvec); %return 1 if true 0 if false

**%chapter 5 number 6**

%create vector of 5 random ints from -10 to 10

randvec = randi([-10 10], 1, 5); %uniform distribution on the set -10:10, 1x5 matrix

%perform the following using only vectorized code

%subtract 3 from each element

randvec = randvec - 3;

%count how many elements are positive

%assuming 0 is a positive number

sum(vec>=0); or sum(vec>0);

%get absolute value of each element

absval\_randvec = abs(randvec);

%find the maximum

maxval = max(randvec);

I did this assignment on my own so I am going to give myself 100% contribution for the assignment.

That being said, I used the book, stackexchange, google, mathworks website, and the TA for help.