American International University- Bangladesh

COE 3103: DATA COMMUNICATION

Final Lab Report 05
Spring 2021-2022

Section: I
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Submitted by, Group 03

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Tasks

Performance Task:

Assume your ID is **AB-CDEFG-H**, and then convert 'E', 'F' and 'G' to 8 bit ASCII characters and together you have a bit stream of 24 bits. Convert this bit stream to analog signal using the following:

1. 8-ASK, different amplitudes in the modulated signal can be 1:0.5:4.5 for 000 to 111 in that order.

2. 8-FSK, different frequencies in the modulated signal can be 1:0.5:4.5 for 000 to 111 in that order.

3. 8-PSK, different phases in the modulated signal can be 0°:45°:315° for 000 to 111 in that order.

Keep in mind the width of any pulse or portion of analog signal representing group of 3 bits should be 2 second.

Solution of Performance Task (1)

```
%ID: 19-41468-3
%E = 4 = (ASCII) 52 = (BIN) 00110100
%F = 6 = (ASCII) 54 = (BIN) 00110110
%G = 8 = (ASCII) 56 = (BIN) 00111000

x = [0 0 1 1 0 1 0 0 0 0 1 1 0 1 1 0 0 0 1 1 1 0 0 0]; %input signal
am = 1:0.5:4.5; %amplitudes
nx = size(x,2); %number of bits in input signal

i=1; %first index of every three bits
j=0; %time index of a signal element

while i<nx-1 %until first index of last three bits
    t = j:0.001:j+2; %time of a signal element in duration of 2 seconds
    if x(i)==0 && x(i+1)==0 && x(i+2)==0 %when three bits are 000
        ask = as(1)*sin(2*pi*t); %changes the amplitudes, phase 0, frequency 1
    elseif x(i)==0 && x(i+1)==0 && x(i+2)==1 %when three bits are 001
        ask = as(2)*sin(2*pi*t);
    elseif x(i)==0 && x(i+1)==1 && x(i+2)==0 %when three bits are 010
        ask = as(3)*sin(2*pi*t);
```

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```matlab
    elseif x(i)==0 && x(i+1)==1 && x(i+2)==1 %when three bits are 011
        ask = as(4)*sin(2*pi*t);
    elseif x(i)==1 && x(i+1)==0 && x(i+2)==0 %when three bits are 100
        ask = as(5)*sin(2*pi*t);
    elseif x(i)==1 && x(i+1)==0 && x(i+2)==1 %when three bits are 101
        ask = as(6)*sin(2*pi*t);
    elseif x(i)==1 && x(i+1)==1 && x(i+2)==0 %when three bits are 110
        ask = as(7)*sin(2*pi*t);
    else %when three bits are 111
        ask = as(8)*sin(2*pi*t);
    end

    i=i+3; %index of next three bits
    j=j+2; %time index of next signal element

    plot(t,ask);
    hold on;
    grid on;
    axis([0 16 -4.5 4.5]);
    title('Amplitude Shift Key');
    xlabel('Time (s)');
    ylabel('Amplitude');
end
```
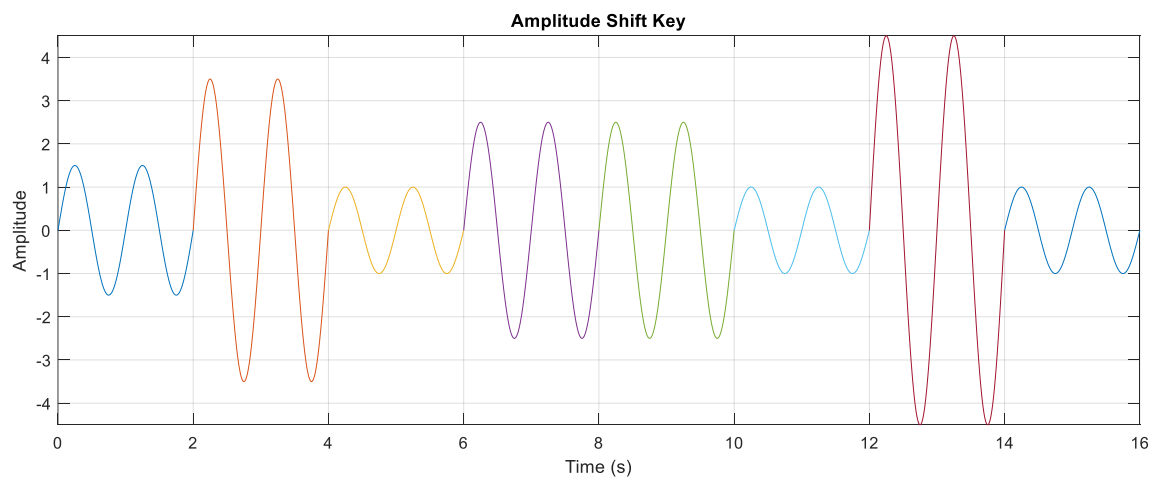

Solution of Performance Task (2)

```matlab
%ID: 19-41468-3
%E = 4 = (ASCII) 52 = (BIN) 00110100
%F = 6 = (ASCII) 54 = (BIN) 00110110
%G = 8 = (ASCII) 56 = (BIN) 00111000

x = [0 0 1 1 0 1 0 0 0 0 1 1 0 1 1 0 0 0 1 1 1 0 0 0]; %input signal
fs = 1:0.5:4.5; %frequensies
nx = size(x,2); %number of bits in input signal

i=1; %first index of every three bits
j=0; %time index of a signal element
```
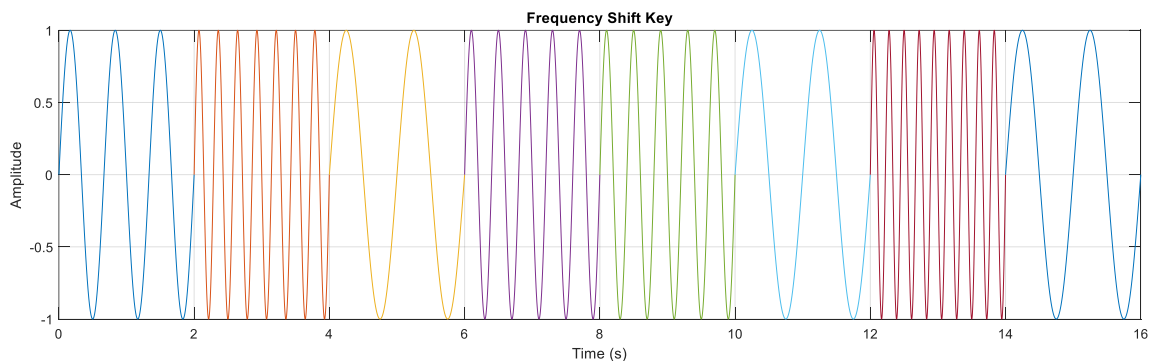
```matlab
while i<nx-1 %until first index of last three bits
    t = j:0.001:j+2; %time of a signal element in duration of 2 seconds
    if x(i)==0 && x(i+1)==0 && x(i+2)==0 %when three bits are 000
        fsk = sin(2*pi*fs(1)*t); %changes the frequescies, amplitued 1, phase 0
    elseif x(i)==0 && x(i+1)==0 && x(i+2)==1 %when three bits are 001
        fsk = sin(2*pi*fs(2)*t);
    elseif x(i)==0 && x(i+1)==1 && x(i+2)==0 %when three bits are 010
        fsk = sin(2*pi*fs(3)*t);
    elseif x(i)==0 && x(i+1)==1 && x(i+2)==1 %when three bits are 011
        fsk = sin(2*pi*fs(4)*t);
    elseif x(i)==1 && x(i+1)==0 && x(i+2)==0 %when three bits are 100
        fsk = sin(2*pi*fs(5)*t);
    elseif x(i)==1 && x(i+1)==0 && x(i+2)==1 %when three bits are 101
        fsk = sin(2*pi*fs(6)*t);
    elseif x(i)==1 && x(i+1)==1 && x(i+2)==0 %when three bits are 110
        fsk = sin(2*pi*fs(7)*t);
    else %when three bits are 111
        fsk = sin(2*pi*fs(8)*t);
    end

    i=i+3; %index of next three bits
    j=j+2; %time index of next signal element

    plot(t,fsk);
    hold on;
    grid on;
    axis([0 16 -1 1]);
    title('Frequency Shift Key');
    xlabel('Time (s)');
    ylabel('Amplitude');
end
```


Solution of Performance Task (3)

```matlab
%ID: 19-41468-3
%E = 4 = (ASCII) 52 = (BIN) 00110100
%F = 6 = (ASCII) 54 = (BIN) 00110110
%G = 8 = (ASCII) 56 = (BIN) 00111000

x = [0 0 1 1 0 1 0 0 0 0 1 1 0 1 1 0 0 0 1 1 1 0 0 0]; %input signal
```

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```matlab
ps = 0:pi/4:7*(pi/4); %phases
nx = size(x,2); %number of bits in input signal

i=1; %first index of every three bits
j=0; %time index of a signal element

while i<nx-1 %until first index of last three bits
    t = j:0.001:j+2; %time of a signal element in duration of 2 seconds
    if x(i)==0 && x(i+1)==0 && x(i+2)==0 %when three bits are 000
        psk = sin(2*pi*t+ps(1)); %changes the phases, amplitued 1, frequency 1
    elseif x(i)==0 && x(i+1)==0 && x(i+2)==1 %when three bits are 001
        psk = sin(2*pi*t+ps(2));
    elseif x(i)==0 && x(i+1)==1 && x(i+2)==0 %when three bits are 010
        psk = sin(2*pi*t+ps(3));
    elseif x(i)==0 && x(i+1)==1 && x(i+2)==1 %when three bits are 011
        psk = sin(2*pi*t+ps(4));
    elseif x(i)==1 && x(i+1)==0 && x(i+2)==0 %when three bits are 100
        psk = sin(2*pi*t+ps(5));
    elseif x(i)==1 && x(i+1)==0 && x(i+2)==1 %when three bits are 101
        psk = sin(2*pi*t+ps(6));
    elseif x(i)==1 && x(i+1)==1 && x(i+2)==0 %when three bits are 110
        psk = sin(2*pi*t+ps(7));
    else %when three bits are 111
        psk = sin(2*pi*t+ps(8));
    end

    i=i+3; %index of next three bits
    j=j+2; %time index of next signal element

    plot(t,psk);
    hold on;
    grid on;
    axis([0 16 -1 1]);
    title('Phase Shift Key');
    xlabel('Time (s)');
    ylabel('Amplitude');
end
```