ELEC3810 Homework 4
Name: Young, James Yang (20740589)

Question 1: If the moving direction of the subject is 90°, calculate the simulated spike rate for each of the 4 neurons.

Editor - \\vdifs\myhome\jyyoungaa\Downloads\Homework 4\q1.m

q1.m | q2.m | q3a.m | q3b.m

```
movingDirection = 90;
preferredDirection = [30, 120, 210, 300];
numNeurons = length(preferredDirection);
k = 3;
spikedData = zeros(numNeurons, length(movingDirection));

for i=1:numNeurons
    spikedData(i,:)=exp(k*cosd(movingDirection-preferredDirection(i)));
    fprintf("Neuron %g with preferred direction %g deg has simulated spike rate = %g \n",i,preferredDirection(i), spikedData(i,:));
end
```

Command Window

```
>> q1
Neuron 1 with preferred direction 30 deg has simulated spike rate = 4.48169
Neuron 2 with preferred direction 120 deg has simulated spike rate = 13.4379
Neuron 3 with preferred direction 210 deg has simulated spike rate = 0.22313
Neuron 4 with preferred direction 300 deg has simulated spike rate = 0.0744166
>>
```

Question 2: If the neural firings of the 4 neurons are (5,0,12,18), calculate the decoded moving direction using the population vector method

Editor - \\vdifs\myhome\jyyoungaa\Downloads\Homework 4\q2.m

q1.m | q2.m | q3a.m | q3b.m

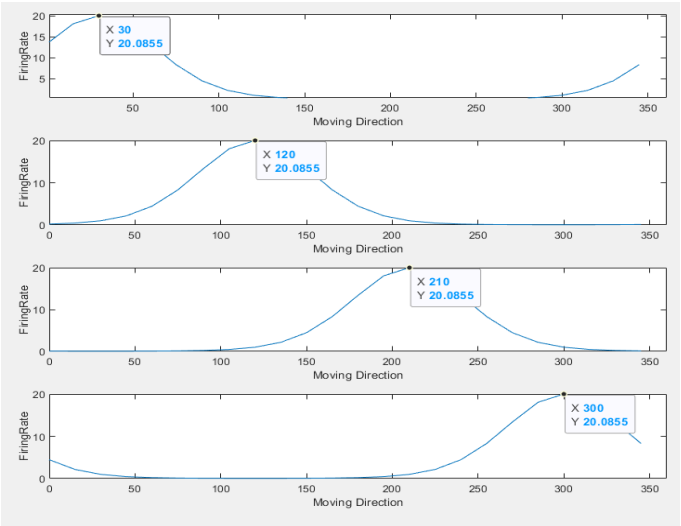
```
preferredDirection = [30 120 210 300];
spikedData = [5 0 12 18];
k=3;


L = length(spikedData);
decodeDirections = zeros(1,2);

for i=1:L
    decodeDirections(1,1) = decodeDirections(1,1) + cosd(preferredDirection(i))*spikedData(i)/sum(spikedData);
    decodeDirections(1,2) = decodeDirections(1,2) + sind(preferredDirection(i))*spikedData(i)/sum(spikedData);
end

disp('Moving Direction Vector:');
disp(decodeDirections);

```

Command Window

```
>> q2
Moving Direction Vector:
    0.0839   -0.5454
```

Movement direction vector = [0.0839 -0.5454]

Question 3a: Generate the simulated spikes for all the moving directions for all the 4 neurons and plot the spike rate in terms of the moving direction

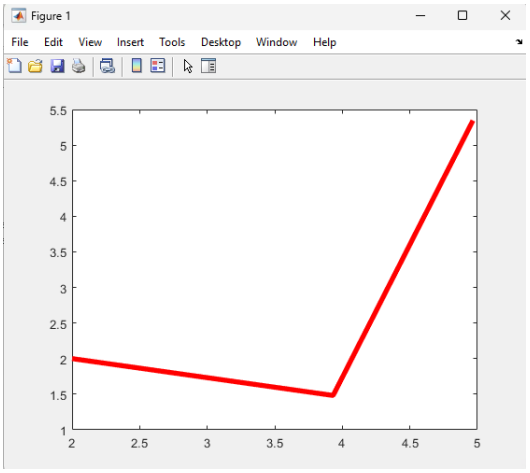


Editor - \\vdifs\myhome\jyyoungaa\Downloads\Homework 4\q3a.m

q1.m | q2.m | q3a.m | q3b.m

```
load("ELEC4830_BIEN4310_homework4.mat");
preferredDirection = [30 120 210 300];
numNeurons = length(preferredDirection);
spikedData = zeros(numNeurons, length(movingDirection));
k=3;
for i=1:numNeurons
    spikedData(i,:)=exp(k*cosd(movingDirection-preferredDirection(i)));
end
figure;
for i=1:numNeurons
    subplot(4,1,i)
    plot(movingDirection,spikedData(i,:));
    xlabel('Moving Direction');
    ylabel('FiringRate');
    xlim([0 360]);
end
```

Question 3b: Decode the movement direction (vector) for each trial and Input this matrix into plotTrajectory(decodedDirection)



Editor - \\VDIFS\MYHOME\jyyoungaa\Downloads\Homework 4\q3b.m

q1.m | q2.m | q3a.m | q3b.m

```
% load data
load("ELEC4830_BIEN4310_homework4.mat");
[trials,numNeurons ]= size(neuralFiring);
decodeDirections = zeros(trials,2);
preferredDirection = [30 120 210 300];
for i=1:trials
    decodeDirections(i,1) =  cosd(preferredDirection)*neuralFiring(i,:).
    decodeDirections(i, 2) = sind(preferredDirection)*neuralFiring(i,:).
end
plotTrajectory(decodeDirections);
disp('Decoded Moving Direction Vector:');
disp(decodeDirections);
```