

Script of the main program:

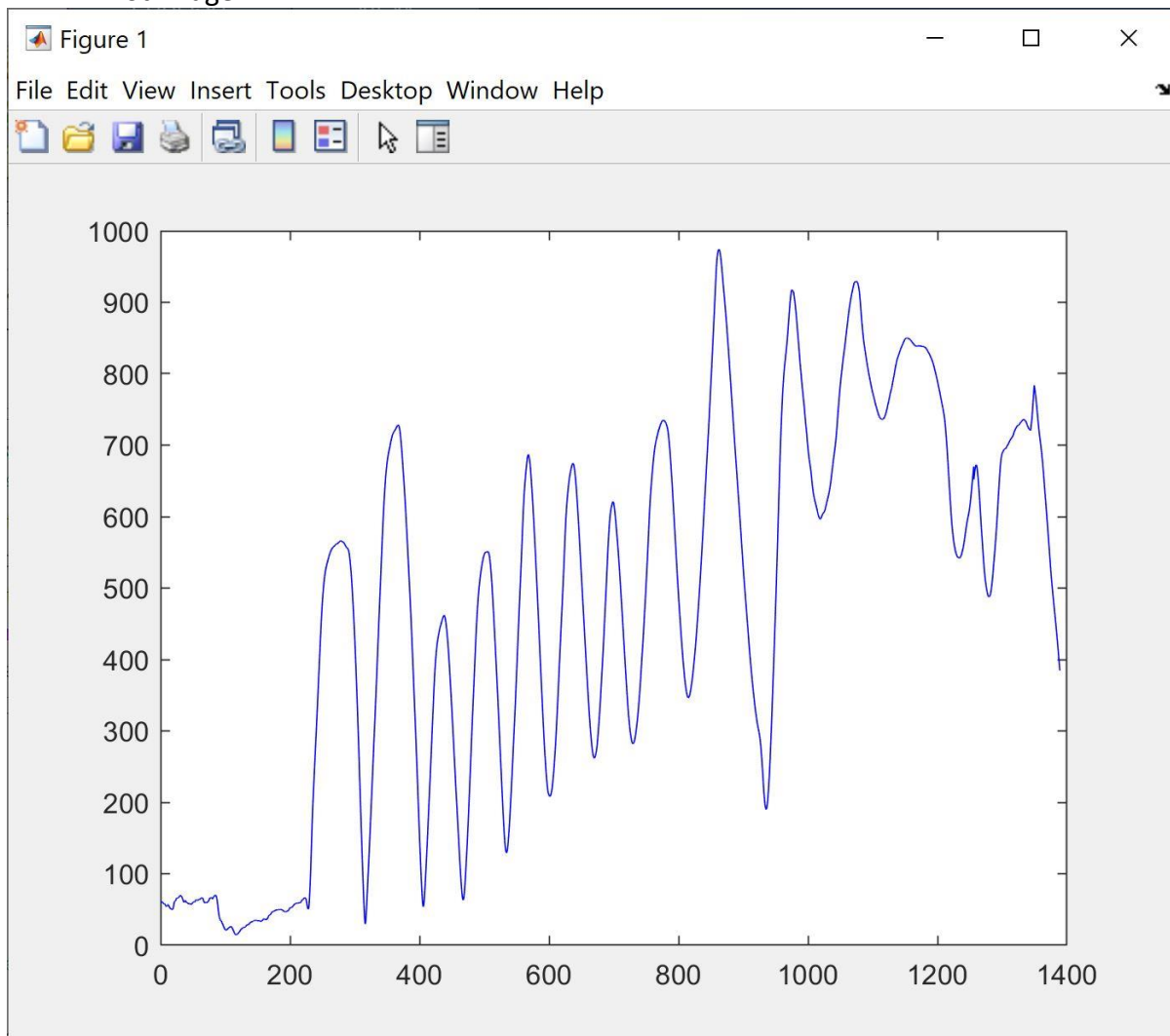
```

%9:30TR                                10/1/2019                                samkramer6
%This code will calculate the amount of times that two boats get within 2
%boat lengths of eachother
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%begin script
clear;clc;format compact;
%this loads the actual .csv file
a = input('Input the file name: ', 's');
data = load(a);
%this sets all the columns of the .csv file to be equal to a matrix that is
%used in the user defined function to calculate the distance
time = data(:,1);%time
lat1 = data(:,2);%latitude of boat one
lon1 = data(:,3);%longitude of boat one
lat2 = data(:,4);%latitude of boat two
lon2 = data(:,5);%longitude of boat two
k = 1; %these are used in the ticker variable
d = 0; %this variable is the amount of tiems that the boats come within 54 m
of eachother
while k < numel(time)%This is the while loop that will calculate how many
times that the boats come within 2 boat lengths of eachother
    [mApart] = distance(lat1, lat2, lon1, lon2);%Calling on the user defined
function
    q = k-1; %this is necessary because we need to do the last value in the
matrix to see if it was greater than 54
    if q~=0 %q must equal an integer because there is no zeroth entry of the
vector mApart
        if mApart(q) > 54.00 && mApart(k) <= 54.00 %this calculates if it is
actually changing from being outside of 54 meters to within
            d = d+1;
        end
    end
    k = k + 1; %adds one to the ticker
end
%This displays the amount of times and then also makes a new .txt document
%that displays the amount of times that they come close together
clc;%clears the command window just to clean things up.
fprintf('The amount of times that the boats came within 54 meters of
eachother was %4.2f times. \n', d)
fid = fopen('boatsclose2.txt', 'w');
fprintf(fid, 'The amount of times that the boats came within 54 meters of
eachother was %4.2f times.', d);
fclose(fid);
%This is the part that will now plot the time vs. distance graph
title('Plot of Race Boat Seperation as a Function of Time');%Labels the x,y,
and title of the plot
xlabel('Time(s)');
ylabel('Boat seperation distance(m)');
plot(time, mApart, '-b'); %this plots the graph

```

Script of the Function:

```
%This is the function that will compute the
function[mApart] = distance(lat1, lat2, lon1, lon2)
    lat1R = (lat1.*pi)/180;%This converts the readings into radians
    lat2R = (lat2.*pi)/180;
    lon1R = (lon1.*pi)/180;
    lon2R = (lon2.*pi)/180;
    Dlat = lat2R - lat1R;
    Dlon = lon2R - lon1R;
    Rearth = 6371000; %must be in meters to compute the distance between
the boats in meters
    c = (sin(Dlat/2)).^2 + cos(lat1R).*cos(lat2R).*(sin(Dlon/2)).^2;
    g = 2*atan2(sqrt(c),sqrt(1-c));
    mApart = Rearth*g;
end
```

Screenshots:**Plot image:**

Boatstoclose2 file screenshot:



What does the plot tell you about when the boats were within 54 meters of each other?

The plot tells me that when the boats were within 54 meters of each other it was at the very beginning of the race. Where the second boat quickly caught up to the first boat and then the distance started to heavily increase. I also know that they never passed each other because there is no point where the distance is zero.