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% Author(s): Andrew Patella
% Assignment title: 2012 Coding challenge 1
% Purpose: Analyze data from Sanitas hike
% Creation date: 9/25/2023
% Revisions: N/A

clear;
clc;
close all;

%Read in the data, storing it in a matrix titled 'time'
time = readmatrix('sanitas_times');

%Empty any NaN from the data
time(isnan(time)) = [];
```

Calculate Mean and Standard Deviation using a for loop

```
%Creating a variable that is the length of time for the summation for loop
N=length(time);

%Setting the initial value of the sum to zero for the for loop
sum1 = 0;

tic %starting timing

%For loop to sum all values of time
for i = 1: N
    sum1 = time(i) + sum1;
end

%Calculating the mean from the sum value and N
xbar_1 = sum1/N;


sigma_sum=0; %setting the initial value of the sum

%calculating the sum part of the sigma calculation
```

```
for i = 1:N
    sigma_sum=(time(i)-xbar_1).^2+sigma_sum;
end

%Calculating sigma
sigma_1 = sqrt((1/(N-1))*sigma_sum);

code_run_time_1 = toc; %ending timing
```

Calculate using Sum() function

```
tic

%calculating the mean
xbar_2 = sum(time)/N;

%calculating the sum part of the sigma
sigma_sum_2 = sum((time-xbar_2).^2);

%calculating sigma
sigma_2 = sqrt((1/(N-1))*sigma_sum_2);

code_run_time_2 = toc;
```

Calculating using mean() and std()

```
tic

%Using mean function to find the mean
xbar_3 = mean(time);

%using the mean functoin to calculate sigma
sigma_3 = std(time);

code_run_time_3 = toc;
```

Standard Error of the Mean, PDF

```
SEM = sigma_1/sqrt(N);

%x is the range of x values of times, from xmin to xmax. This is a linearly
%spaced array of values to plug into pdf formula
x_min = min(time);
x_max = max(time);
x_pdf= linspace(x_min,x_max,10000);

%calculating pdf value at each value of x
f  = 100/(sigma_1 * sqrt(2*pi)) * exp(-1/2 * ((x_pdf-xbar_1)/sigma_1).^2);
```

Plotting the results

```
figure(1);
```

```
hold on; %making sure all lines show up on the same figure
histogram(time,100); %Plotting the histogram with 100 bins

line([xbar_1, xbar_1],[0,max(ylim)],'color','k','linewidth',1.5);  %Plotting a
 vertical line at x_bar
line([xbar_1+sigma_1, xbar_1+sigma_1],
[0,max(ylim)],'Color','k','LineStyle','--'); %plotting the x_bar pm sigma as
 vertial lines
line([xbar_1-sigma_1, xbar_1-sigma_2],
[0,max(ylim)],'Color','k','LineStyle','--');

ylabel('Number of occurances');  %labels for the axes
xlabel('Time (m)');

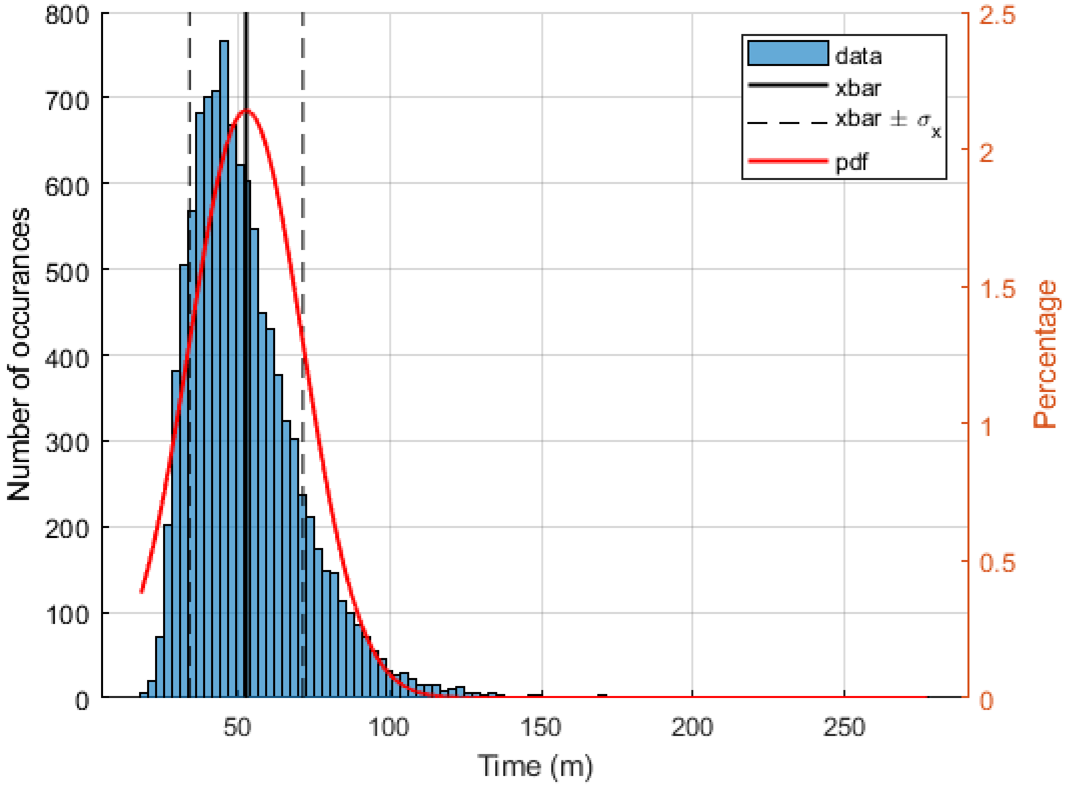
yyaxis right; %Setting up a second y axis so the pdf graphs visibly
plot (x_pdf,f,'color', 'red','linewidth',1.5); %plotting the pdf against the
 time x_pdf
ylabel('Percentage'); %label for the axis

grid on; %turning on the grid
legend('data','xbar','xbar \pm \sigma_x','','pdf') %creating a legend

hold off;

fprintf('SEM = %f, Time 1: %f, Time 2: %f, Time 3: %f
 \n',SEM,code_run_time_1,code_run_time_2,code_run_time_3);
fprintf('Mean: %3.2f, Standard Deviation: %f \n',xbar_1,sigma_1);
```

```
SEM = 0.181436, Time 1: 0.001087, Time 2: 0.000439, Time 3: 0.000327
Mean: 52.81, Standard Deviation: 18.637664
```



Questions

```
%The times do seem to be normally distributed. They loosely follow the
%shape of the normal curve. I believe that the data is slightly skewed
%since the only people who really use Strava are more avid trail users, so
% the fast time the data represents may not actually represent the true data
% of climb times. There are come gaps between the curve and the histogram,
% but it matches the data pretty well. I believe that with more data from
% more people, the data would begin to look a lot more like the curve.
```

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