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Document: Assignment 2 (Cyclist Dataset)

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Problem

In this section, we will be discussing the 3 problems that are to be solved. Each problem will be solved one completely before going to the next one.

Problem 1

Months in the year that are substantially busier than the rest. Create two plots showing the total cyclist per month for each year. Then draw conclusions from additional plots of the percentage difference for each month obtained by: $\% \text{month diff.} = 100 * (\text{total cyclist in month} - \text{average total cyclist per month}) / \text{average total cyclist per month}$ i.e. calculated per year.

Problem 2

Days in the week that are substantially busier than the rest during any particular quarter of the year. Create eight plots showing the total cyclist per day for the first week in: January, April, July, October, for each year. Then draw conclusions from additional plots of the percentage difference for each day obtained by: $\% \text{day diff.} = 100 * (\text{total cyclist in day} - \text{average total cyclist per day}) / \text{average total cyclist per day}$ i.e. calculated per month.

Problem 3

Time periods during a working day (Mon-Sat) that are substantially busier than the rest of the day. Create twelve plots, each showing the total cyclist per hour for each working day in the first week of April for each year. Draw conclusions from additional plots of the percentage difference for each hour obtained by: $\% \text{hour diff.} = 100 * (\text{total cyclist in hour} - \text{average total cyclist per hour}) / \text{average total cyclist per hour}$ i.e. calculated per week.

Methodology

In this section we will be focusing on the steps required to solving the 3 problems including. These are the main points that we will be focusing on:

- Major Steps needed to be done to get the data.
- Flowcharts(s) indicating how the major steps mentioned about should be performed.

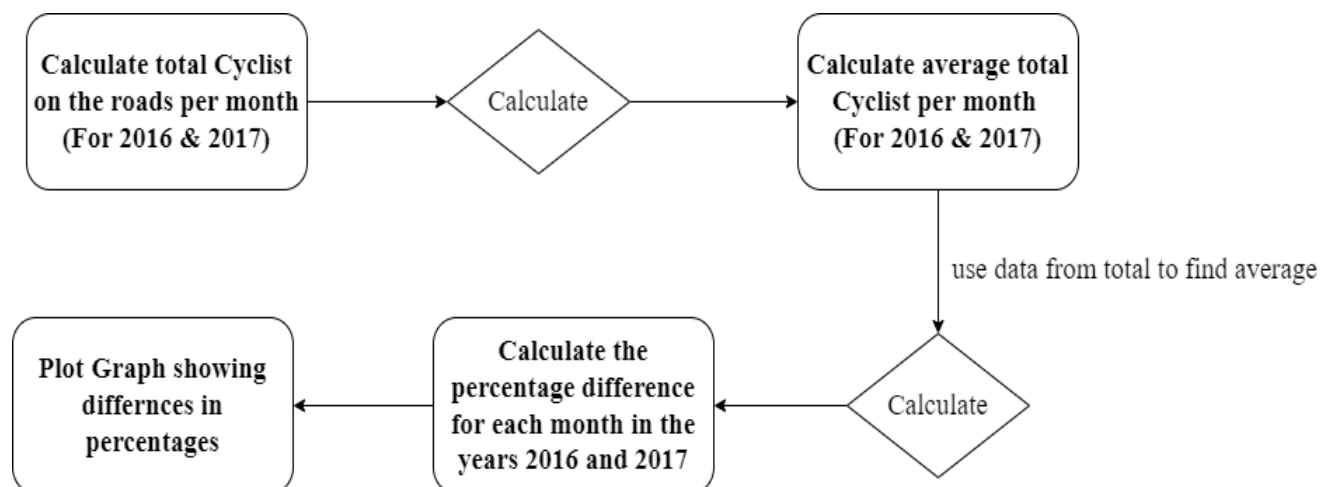
Question 1 (Major Steps)

For the first question we need to outline what it is we are trying to solve. We need to obtain data for all of the cyclist for each year (2016/2017). According to the information given above on the problem, there are specific set of data that we need to figure out:

- The total cyclist on the roads per month in both 2016 and 2017.
- Calculate the average total cyclist per month.
- Find the percentage difference for each month between 2016 and 2017. This is: $(\text{total cyclist per month} - \text{average cyclist per month} / \text{average cyclist per month}) * 100$.
- Plot the difference in percentages per month for the years 2016 and 2017 and compare.

Flowchart

The flowchart below shows the major steps needed to solve the problem.



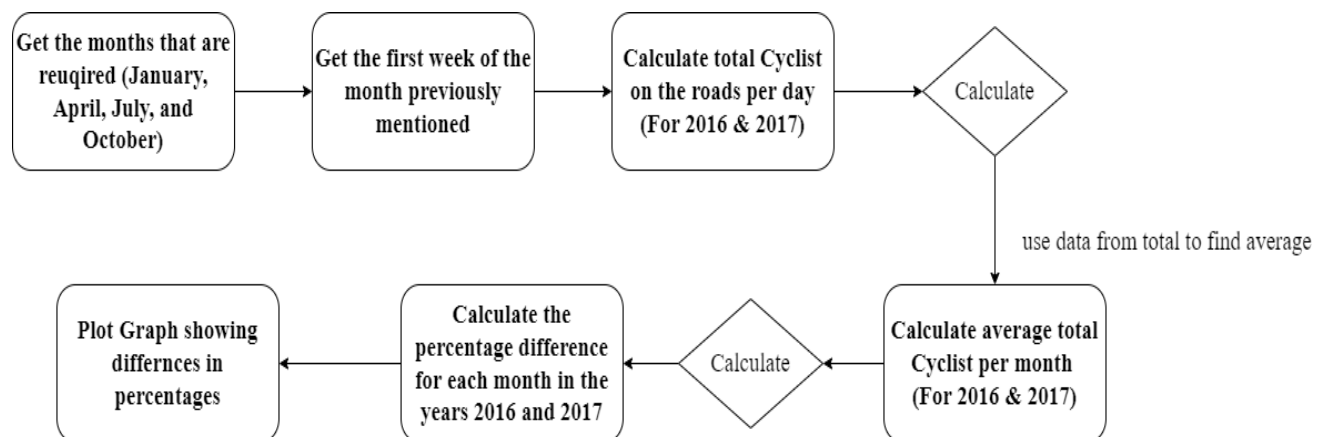
Question 2 (Major Steps)

For question 2 we need to find out specific days in the week that are busier than other days in a year (according to specific months). To do this we need to do the following:

- Select the months (January, April, July, and October for 2016 and 2017)
- The first week in the months ad for the years mentioned above.
- Get the total cyclists per day for each week for the specific month.
- Get the average total of the cyclists listed above.
- Find the percentage difference for each week between 2016 and 2017 for the specific month. This is: $(\text{total cyclist per day} - \text{average cyclist per day} / \text{average cyclist per day}) * 100$.
- Plot the difference in percentages per day of the specific week for the years 2016 and 2017 and compare.

Flowchart

The flowchart below shows the major steps needed to solve the problem.



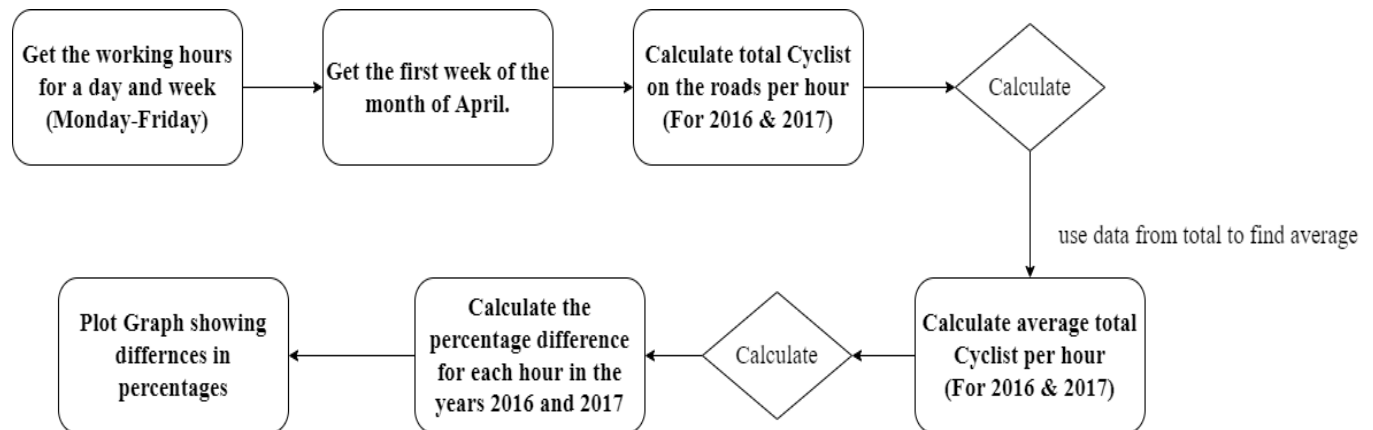
Question 3 (Major Steps)

For question 3 we need to find out the time periods during working days (Monday -Friday) for the month of April (first week) and compare them to see which is busier for 2016 and 2017 by finding the % difference. To do this we need to do the following:

- Get the time period for a working week (Monday-Friday).
- Get the first week of April for both 2016 and 2017.
- Get the total cyclist per working hour.
- Get the average total cyclist per working hour.
- Find the percentage difference for each working hour (first week) between 2016 and 2017 for the specific month. This is: $(\text{total cyclist per hour} - \text{average cyclist per hour} / \text{average cyclist per hour}) * 100$.
- Plot the difference in percentages.

Flowcharts

The flowchart below shows the major steps needed to solve the problem.



Results

Question 1: Months in 2016 & 2017

Below are the graphs showing the cyclist in the months of 2016 and 2017 as well as the percentage difference for each of them.

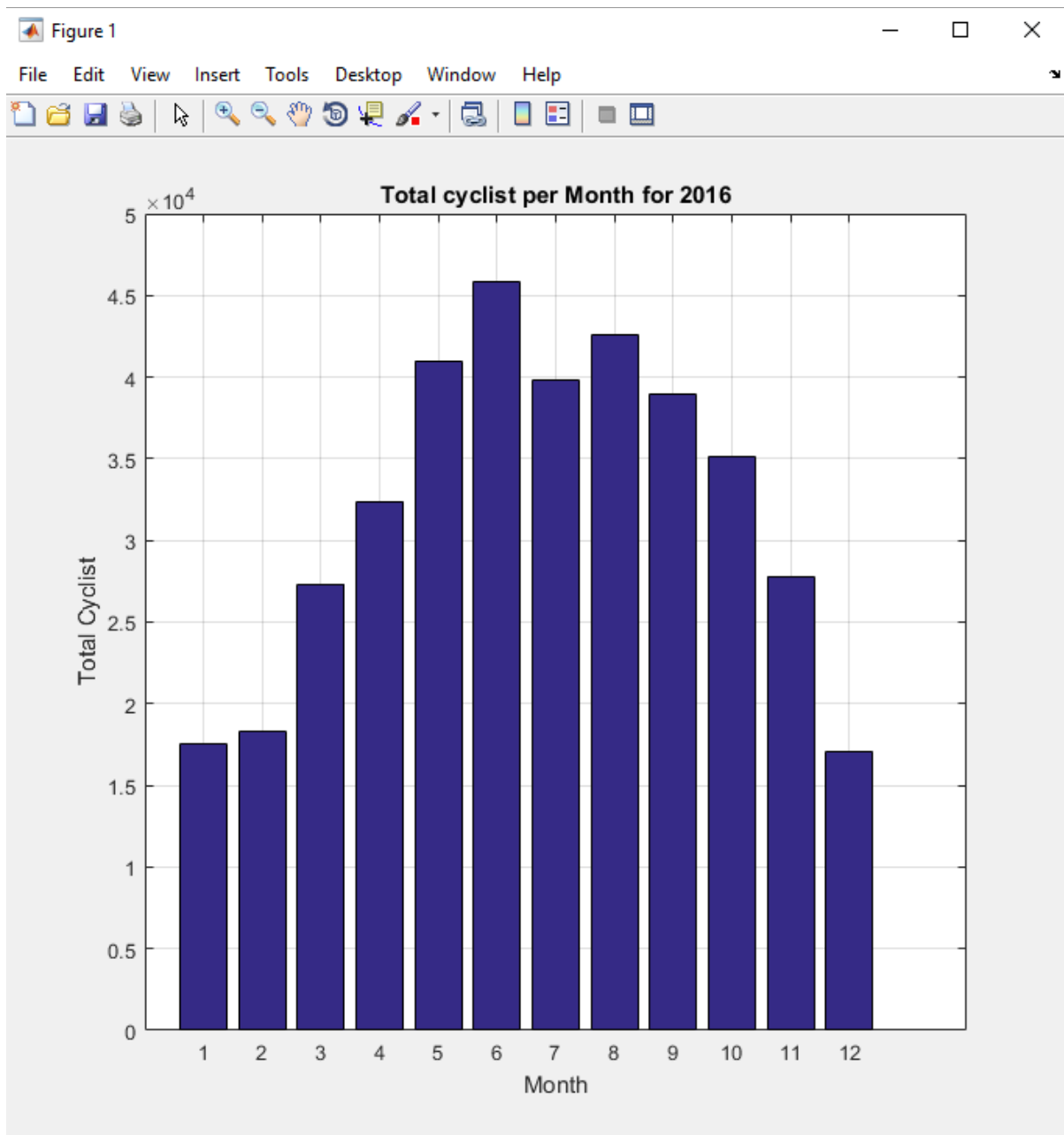


Figure 1 of graph showing cyclists for 2016.

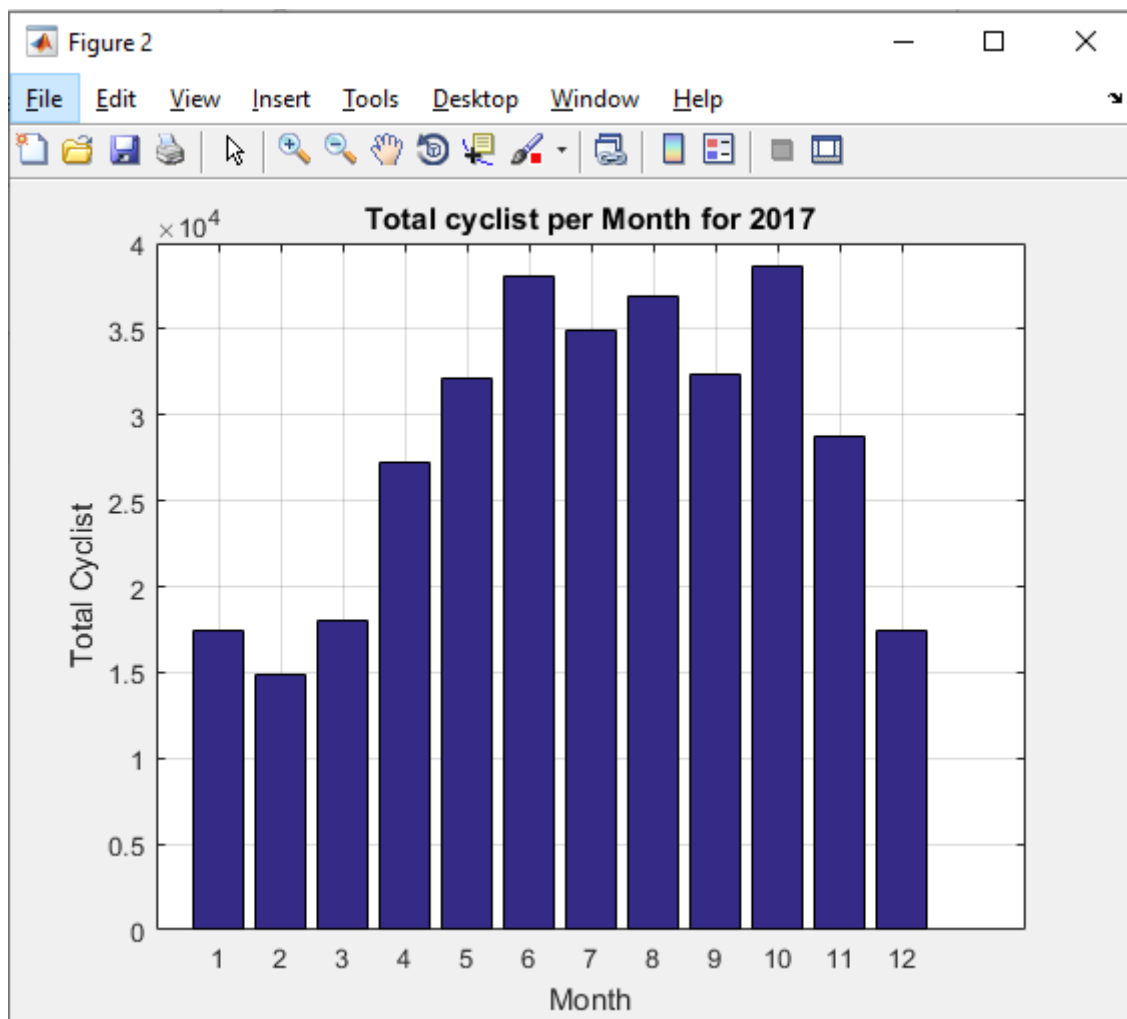


Figure 2 of graph showing cyclists for 2017.

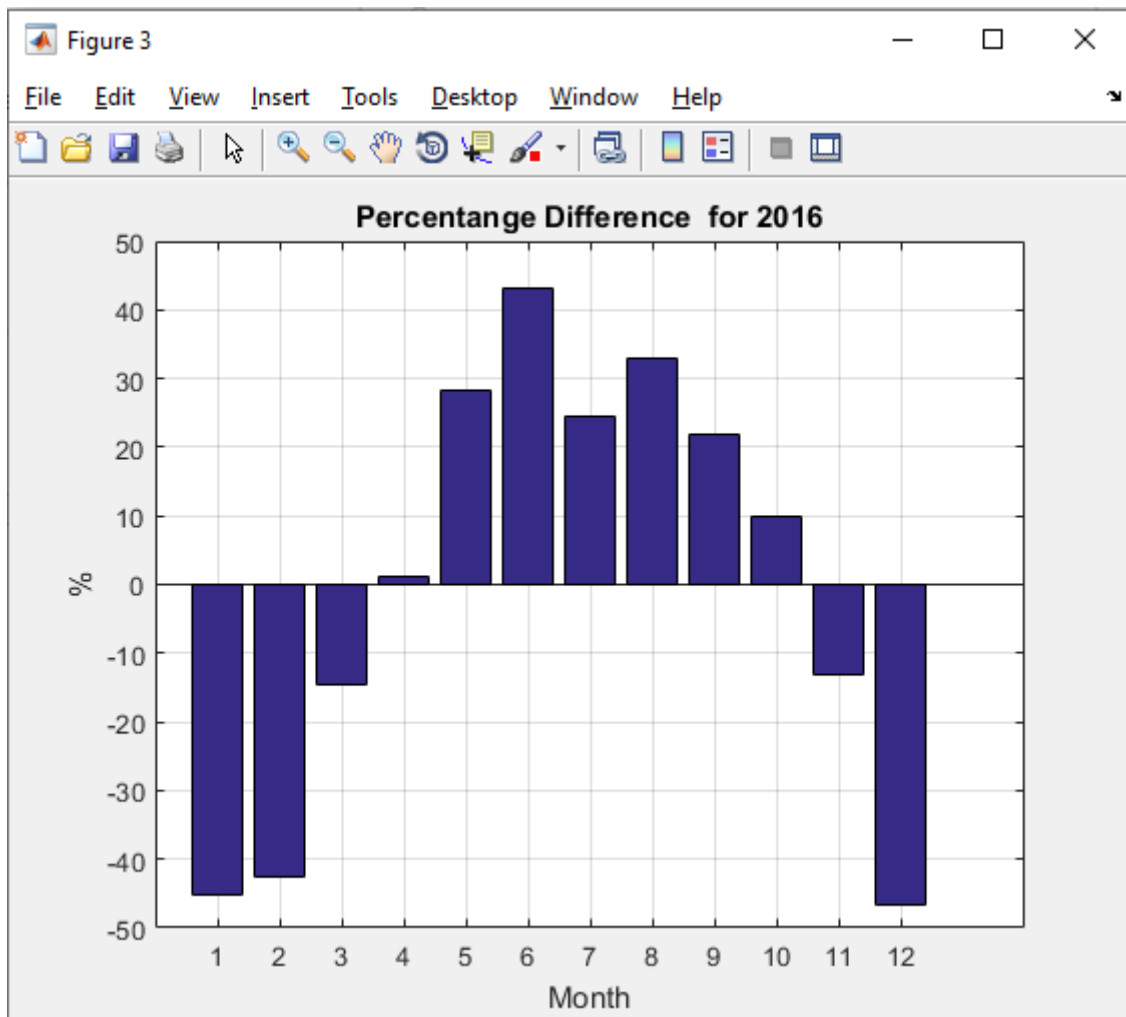


Figure 3 of graph showing the percentage differences for cyclists for 2016.

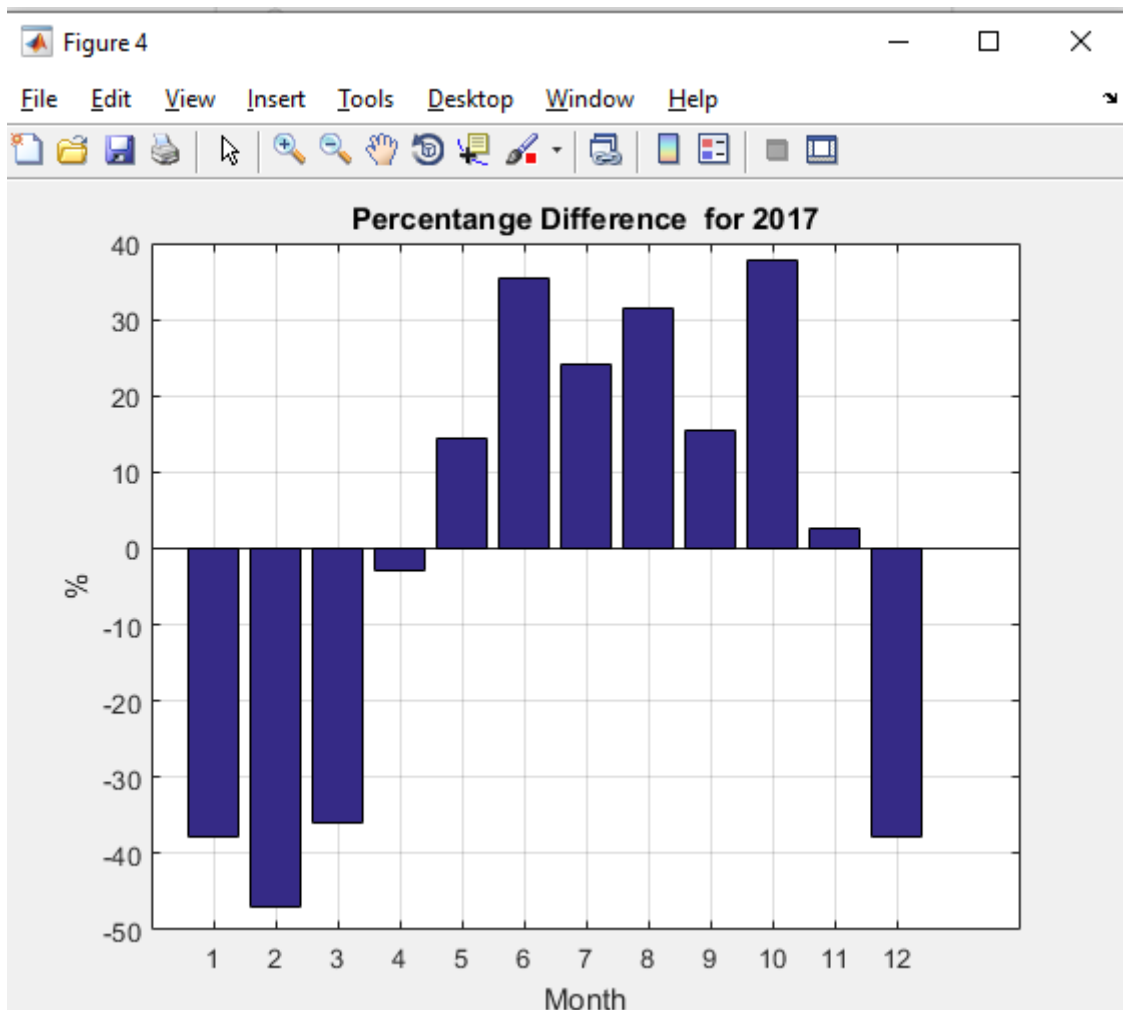


Figure 4 of graph showing the percentage differences for cyclists for 2017.

Comparing % differences for months of 2016 and 2017:

After observing the graphs above one can notice that for 2016, on average the positive percentage months along the x axis is approx. 22.9% while the positive months for 2017 is 24.8%. So 2017 saw an increase in cyclist in those positive percentages. Also those positive months are slightly different in 2016 than in 2017.

For instance, in 2016 the positive months are:

- April to October.

In 2017:

- May to November

So there was a shift in months in which there were more cyclists.

While there are differences, there are similarities. For example there are 7 months in 2016 that the months are positive which is the same for 2017. The same can be said about the negative

months as well. In 2016 the average for the negative months is -32% while in 2017 the percentage is -31.6%. Despite the small increase in percentage, they have some similarities. 2016 and 2017 have the same number of months that generate negative percentages.

Question 2: Specific days in 2016 & 2017

Below are the graphs showing the cyclist in the first week of the months of January, April, July, and October (2016 & 2017) as well as the percentage difference for each of them.

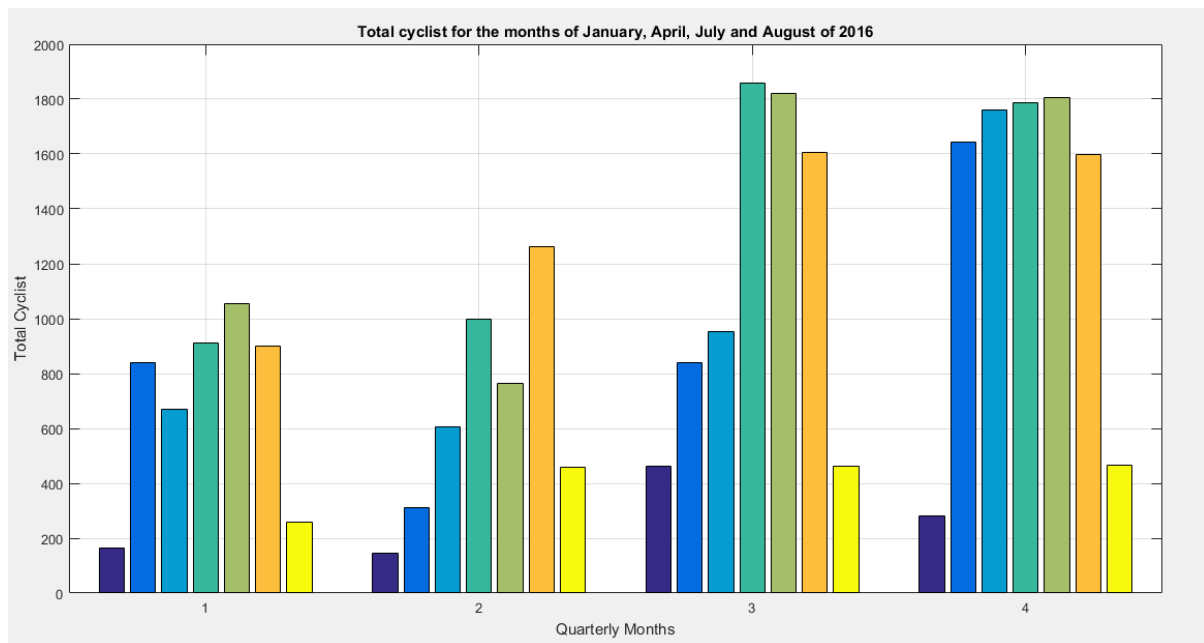


Figure showing the total cyclist for the quarterly month of 2016 (January, April, July, and October)

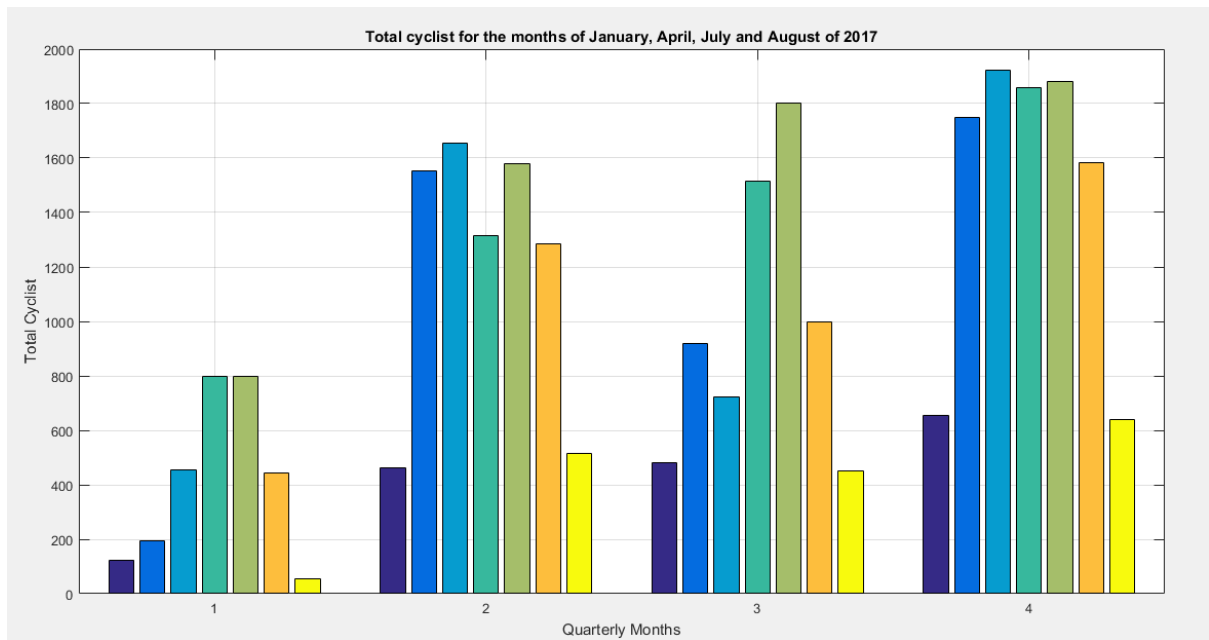
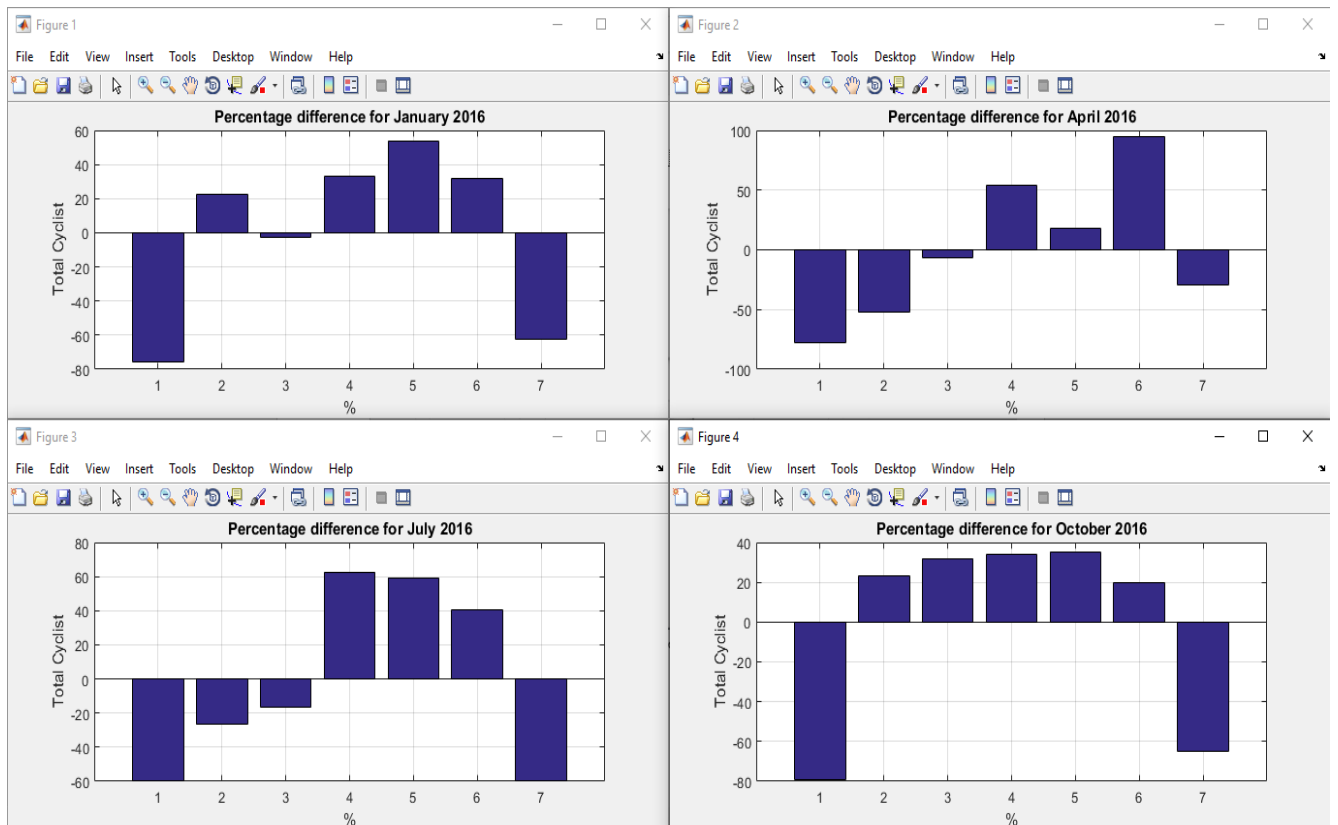
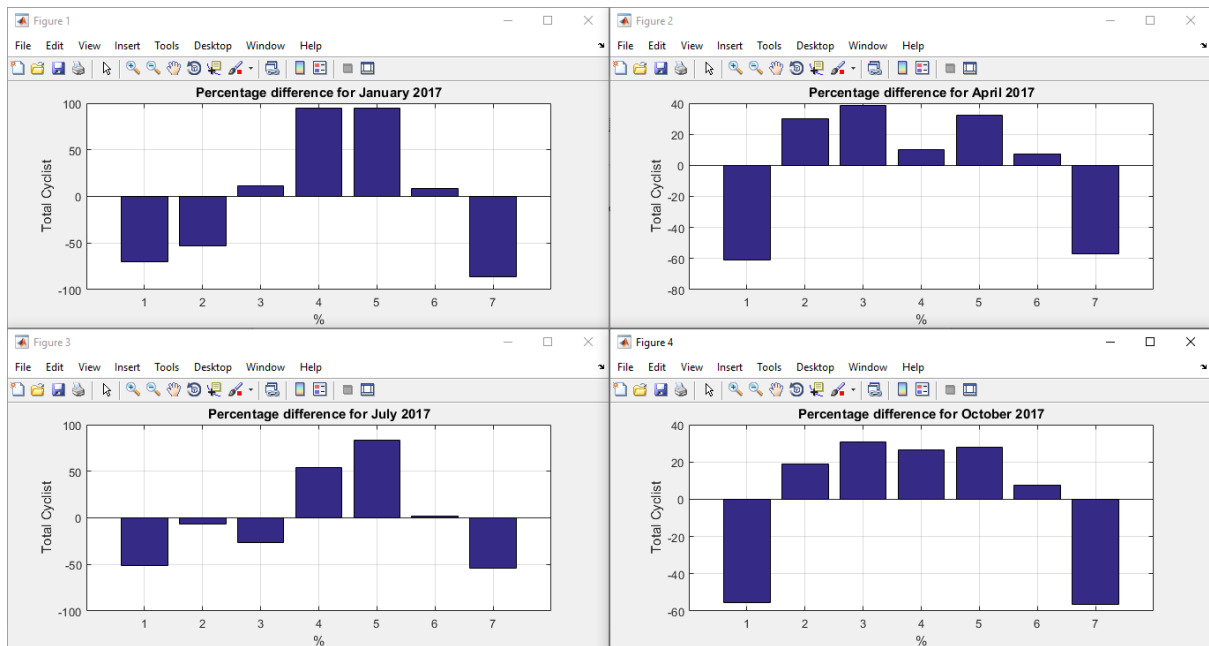


Figure showing the total cyclist for the quarterly month of 2017 (January, April, July, and October)



Percentage difference for the specific months in 2016



Percentage difference for the specific months in 2017

Comparing % differences for months of 2016:

In the 4 month in 2016, these are what were observed.

- In January, there were 4 positive days and 3 negative days. The positive days were during the week while the negative days were mostly during the weekend (except for Tuesday).
- In October, it trends almost similarly like January but the difference is that there were 5 positives instead of 4 for January.
- In April there were 3 positive and 4 negative days. The negative days took place coming to the end of the week with the weekends and a couple days in the week (Monday and Tuesday).
- In July, there were 4 negative differences and 3 positive differences. The negative % were from Sunday to Tuesday and Saturday while the rest were positive.

Comparing % differences for months of 2017:

In the 4 month in 2017, these are what were observed.

- In January there were 4 days which showed positive percentages and 3 days showing negative percentages. The positive days were in the middle of the week while the negatives were at the start and at the end of the week.
- In April, there were 5 positive percentages and 2 negative percentages. Much like January, the positive days were in the middle of the week (Monday – Friday) while the negative days were on the weekends.
- In July, there were, like April, 4 negatives and 3 positives. Percentages.

Question 3: Working days in April of 2016 & 2017

April 2016

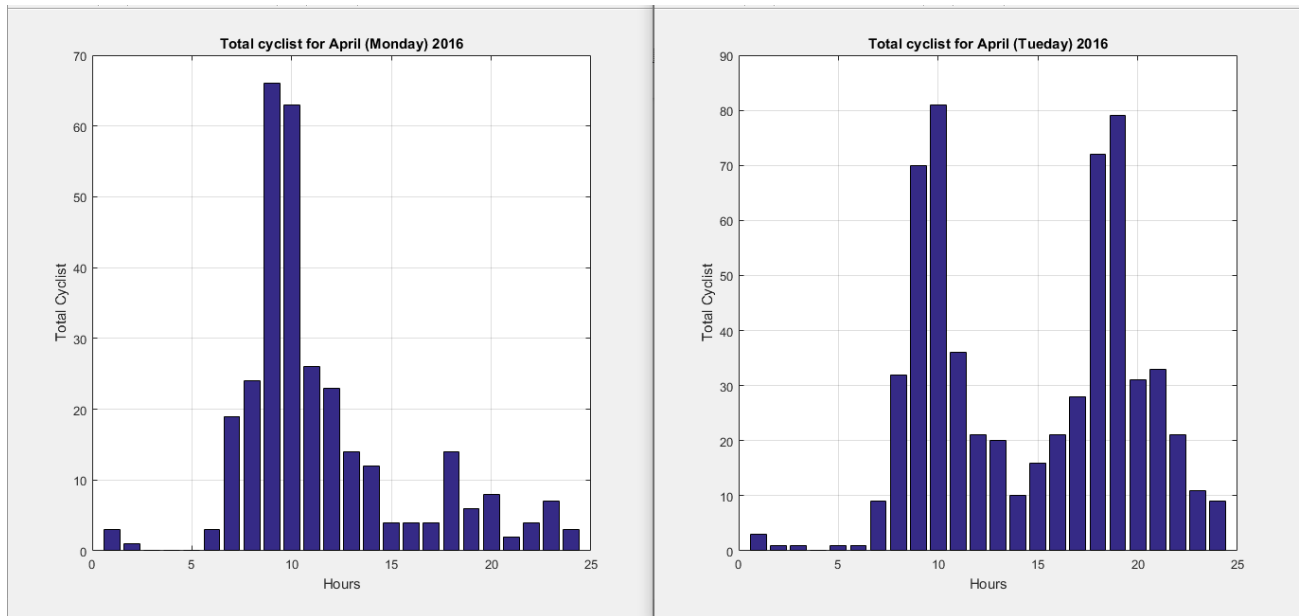


Figure 1 and 2 for days Monday and Tuesday April 2016

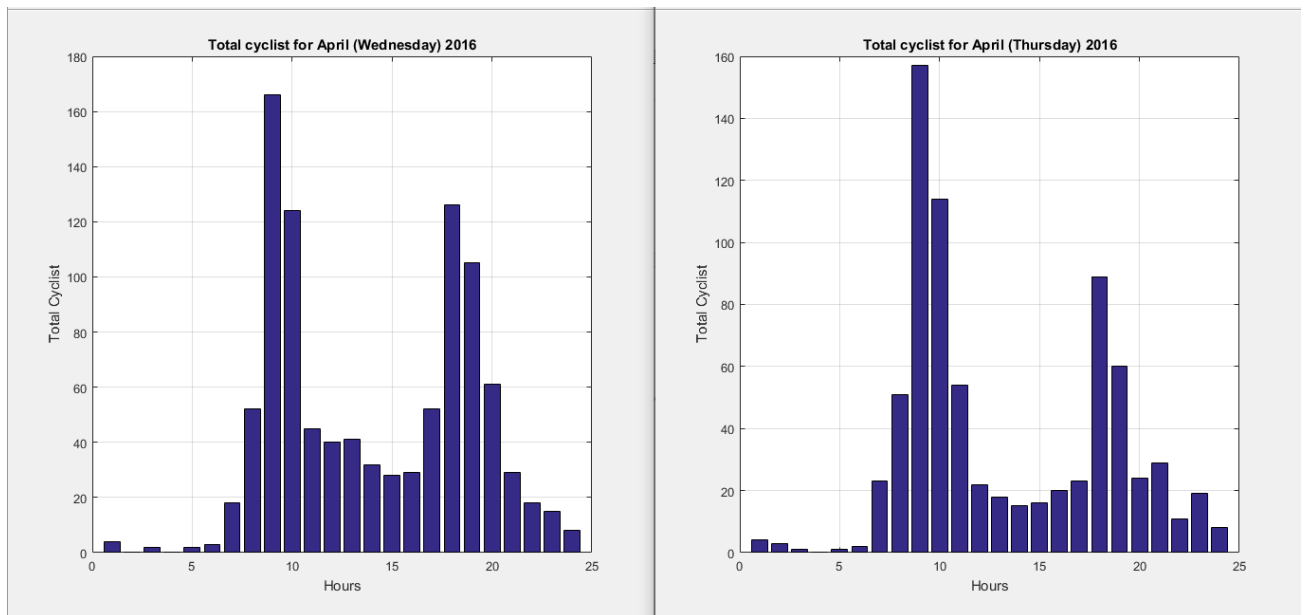


Figure 3 and 4 for days Wednesday and Thursday April 2016

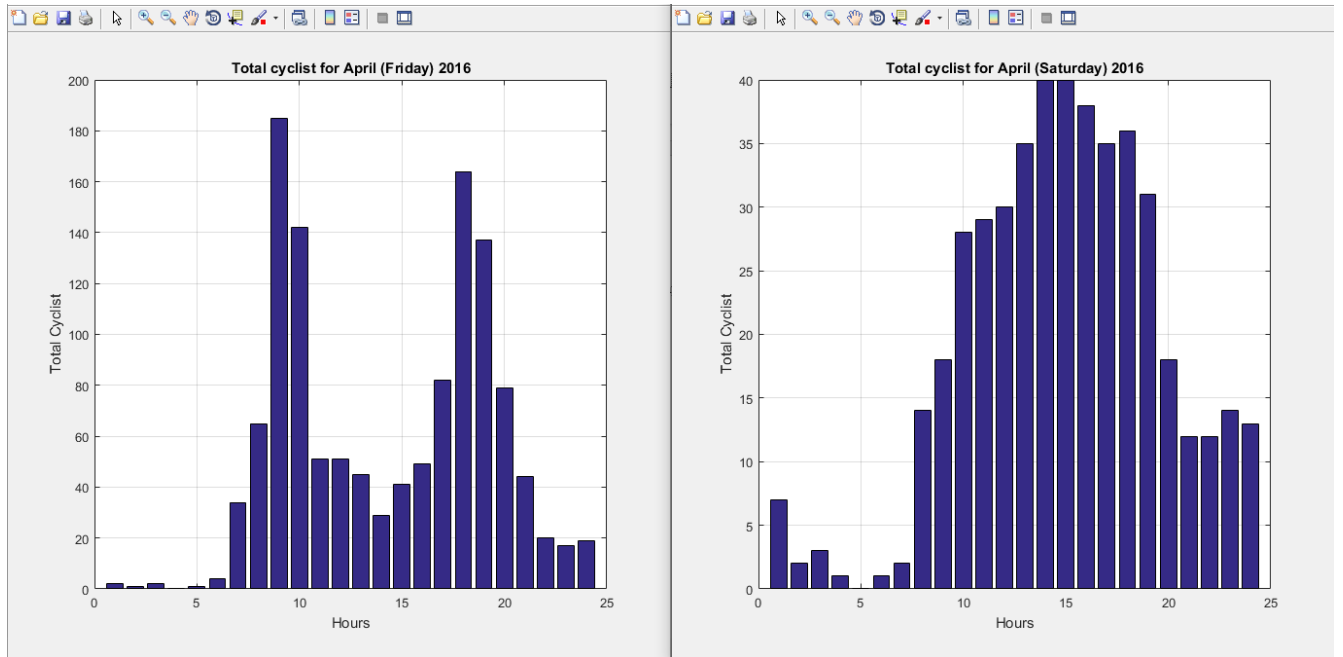


Figure 5 and 6 for days Friday and Saturday April 2016

April 2017

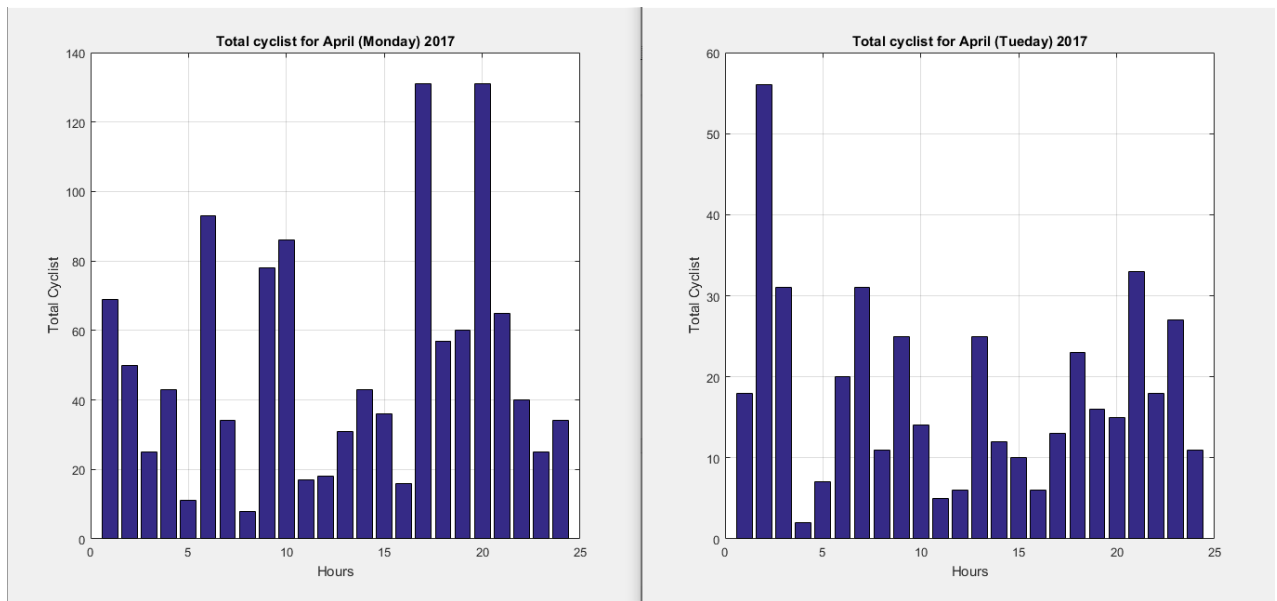


Figure 1 and 2 for days Monday and Tuesday April 2017

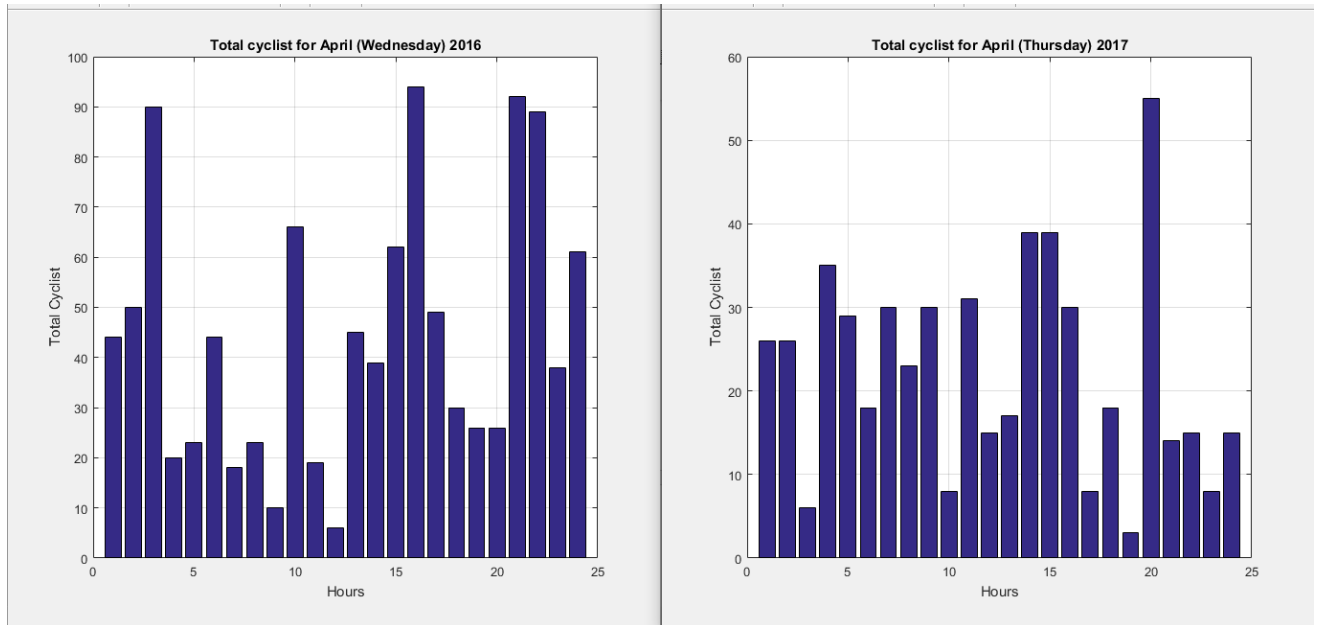


Figure 3 and 4 for days Wednesday and Thursday April 2017

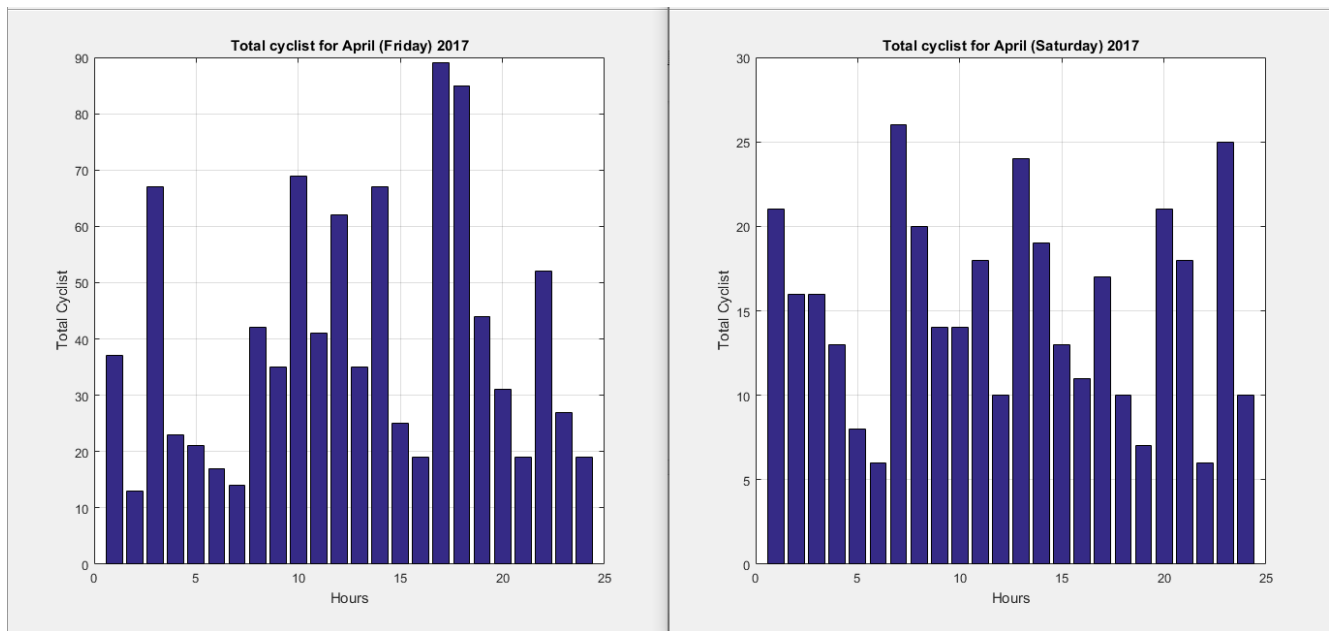
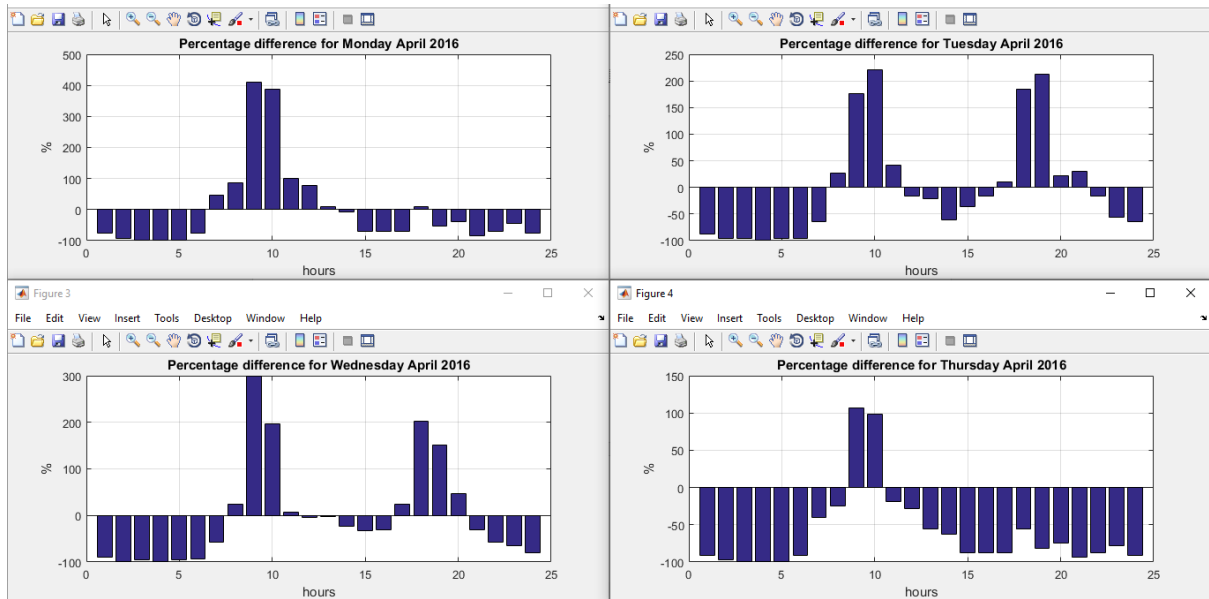
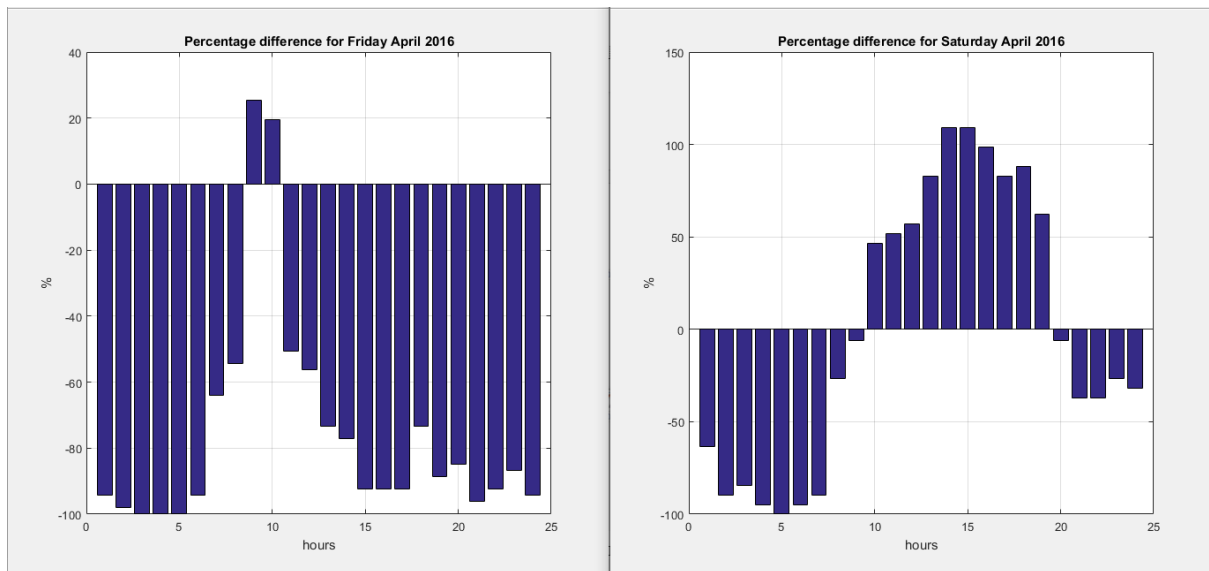


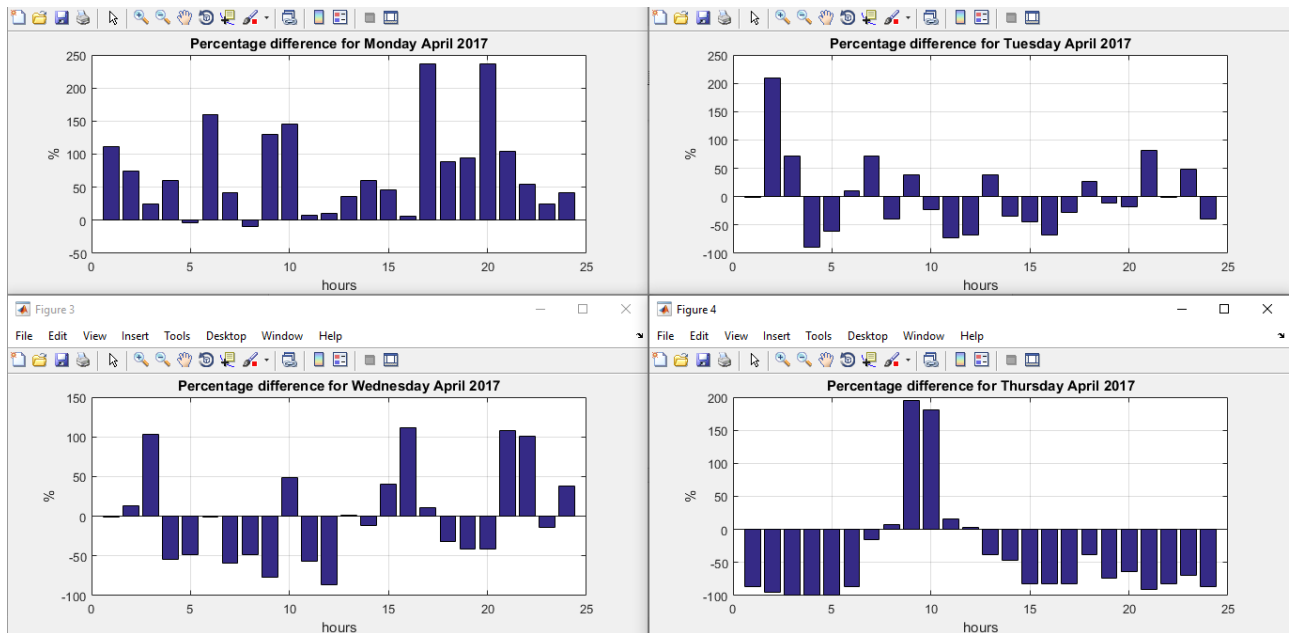
Figure 5 and 6 for days Friday and Saturday April 2017



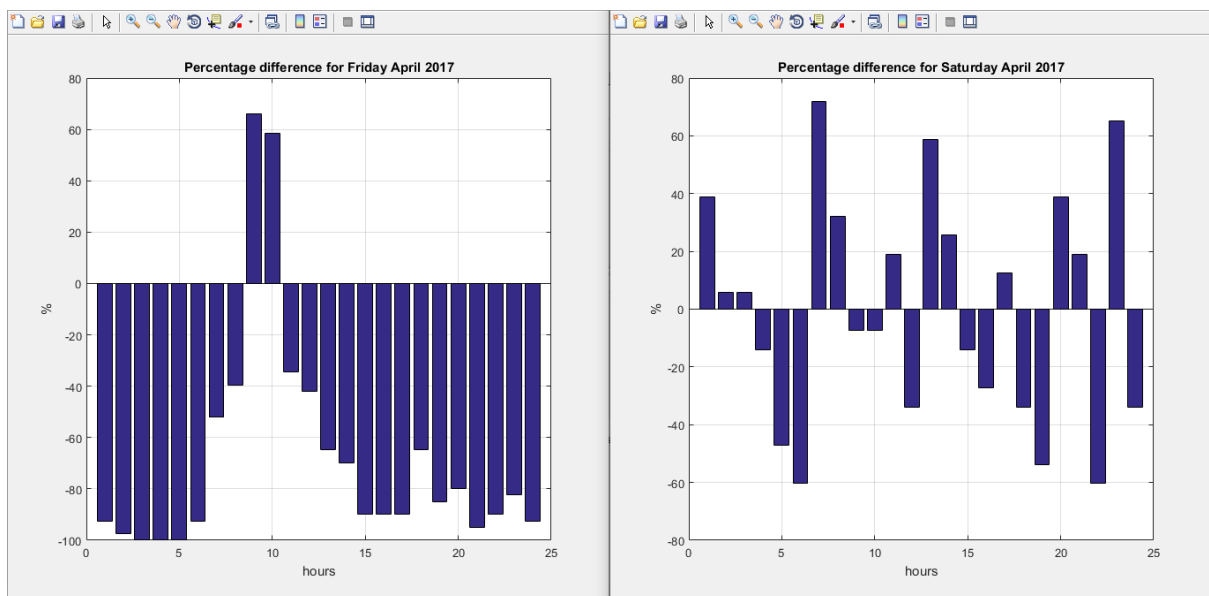
Percentage difference for Days Monday – Thursday for 2016



Percentage difference for days Friday and Saturday 2016



Percentage difference for days Monday to Thursday 2017



Percentage difference for days Friday and Saturday 2017

Comparing % differences for months of 2016:

- Monday, there were 8 positive percentages and 16 negative percentages. The positive percentages were observed during the times between 7am and 2pm.
- Tuesday, there were 9 hours in which there was positive percentages while the other 15 hours were negative.
- Wednesday, like Tuesday, were 9 hours with positive percentages while the other 15 were negative.
- Thursday, there were only two hours that had positive percentages while the remaining 22 were negative. The two hours that were positive were between 9 am and 10 am.
- Friday, like Thursday had 2 hours that were positive while 22 were negative. The positive hours were 9am and 10 am.
- Sunday, there were 10 hours that were positive percentages while 14 were negative. The positive hours were between 10 am and 7pm.

Comparing % differences for months of 2017:

- Monday, there were 22 hours positive percentages and 2 hours in which it was negative. The negative hours were 5am and 7am.
- Tuesday, there were 10 positive percentages while there were 14 negatives.
- Wednesday, there were 11 positive percentages in respect to 13 negative percentages.
- Thursday, there were 5 positive percentages while there were 19 negative percentages. The negative percentages were 1am to 7am, 1pm to 12am.
- Friday, there were only 2 positive percentages with respect to 22 hours negative percentages. The two ours that were positive were 9am and 10 am.
- Saturday, there were 12 hours that were positive percentages with respect to the 12 hours that were negative.

Appendix

Question 1

%%Question 1

%2016

```
date = EcoTotemBroadwayBicycleCount(:,1);
```

```
dateNum = datevec(date);
```

```
date_2016 = (dateNum(:,1)==2016);
```

```
cyclist = EcoTotemBroadwayBicycleCount(:,5);
```

```
total_cyclist = cell2mat(cyclist);
```

%Fill data into empty matrix

%%Get months in the year

```
cyclist_2016 = zeros(12,1);
```

```
for i=1:1:12
```

```
    mon_2016 = dateNum(:,2)==i;
```

```
    month_2016Vec = mon_2016.*date_2016;
```

```
    month_2016_vec = month_2016Vec > 0;
```

```
    cyclist_2016(i,1) = sum(total_cyclist(month_2016_vec));
```

```
end
```

%2017

%Fill data into empty matrix

```
date_2017 = (dateNum(:,1)==2017);
```

```
cyclist_2017 = zeros(12,1);
```

```
for i=1:1:12
```

```
    mon_2017 = dateNum(:,2)==i;
```

```
    month_2017Vec = mon_2017.*date_2017;
```

```
    month_2017_vec = month_2017Vec > 0;
```

```
    cyclist_2017(i,1) = sum(total_cyclist(month_2017_vec));
```

```
end
```

%Plotting total cyclist per month for 2016/2017

```
figure(1); bar(cyclist_2016);title('Total cyclist per Month for 2016');xlabel('Month');ylabel('Total Cyclist'); grid on;
```

```
figure(2); bar(cyclist_2017);title('Total cyclist per Month for 2017');xlabel('Month');ylabel('Total Cyclist'); grid on;
```

%%Percentage difference for 2016

%Get Average First

```
avg_cyclist_2016 = mean(cyclist_2016);
```

```
month_difference_2016 =100*((cyclist_2016 - avg_cyclist_2016) / avg_cyclist_2016);
```

%%Percentage difference for 2017

%Get Average First

```
avg_cyclist_2017 = mean(cyclist_2017);
```

```
month_difference_2017 = 100*((cyclist_2017 - avg_cyclist_2017) / avg_cyclist_2017);
```

%%Plot percentage difference

```
figure(3); bar(month_difference_2016);title('Percentange Difference for 2016');xlabel('Month');ylabel('%'); grid on;
```

```
figure(4); bar(month_difference_2017);title('Percentange Difference for 2017');xlabel('Month');ylabel('%'); grid on;
```

%2016

A decorative horizontal border at the bottom of the page, composed of many small green icons arranged in two rows.

```

%Percentage differences for Jan 2016
janA_cyclist_2016 = mean(Jan_2016);
per_difference_2016 =100*((Jan_2016 - janA_cyclist_2016) /
janA_cyclist_2016);
figure(1);
bar(per_difference_2016);title('Percentage difference for January 2016');
xlabel('%');
ylabel('Total Cyclist');
grid on;

%Percentage differences for Apr 2016
aprA_cyclist_2016 = mean(Apr_2016);
aPer_difference_2016 =100*((Apr_2016 - aprA_cyclist_2016) /
aprA_cyclist_2016);
figure(2);
bar(aPer_difference_2016);title('Percentage difference for April 2016');
xlabel('%');
ylabel('Total Cyclist');
grid on;

%Percentage differences for Jul 2016
jula_cyclist_2016 = mean(Jul_2016);
juPer_difference_2016 =100*((Jul_2016 - jula_cyclist_2016) /
jula_cyclist_2016);
figure(3);
bar(juPer_difference_2016);title('Percentage difference for July 2016');
xlabel('%');
ylabel('Total Cyclist');
grid on;

%Percentage differences for Oct 2016
octA_cyclist_2016 = mean(Oct_2016);
oPer_difference_2016 =100*((Oct_2016 - octA_cyclist_2016) /
octA_cyclist_2016);
figure(4);
bar(oPer_difference_2016);title('Percentage difference for October 2016');
xlabel('%');
ylabel('Total Cyclist');
grid on;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%2017
date_2017 = (dateNum(:,1)==2017);
cyclist_2017 = zeros(4,7);
%Full empty matrix with cyclists
for i=1:1:4
    aP = 1 + (i-1)*3;
    month = (dateNum(:,2)==aP);

    dateWeekVec =(date_2017.*month.*dayMon)>0;
    dateMonVec = dates(dateWeekVec);
    Sunday = dateMonVec(1:96,1);

    startDay(i,1) = Sunday(1,1);
    start_p = startDay(i,1);
    endP = startDay(i,1) + 6;
    m = 1;
    for j=start_p:1:endP
        day = (dateNum(:,3)==j);

```

```

        month_day = date_2017.*month.*day;
        month_day_vec = month_day > 0;
        cyclist_2017(i,k) = sum(total_cyclist(month_day_vec));
        m = m+1;
    end
end

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%%Graph for 4 quarterly months in 2017
figure(1);
bar(cyclist_2017);title('Total cyclist for the 4 quarterly months in 2017');
xlabel('Quarterly months');
ylabel('Total Cyclist');
grid on;

%Rows for cyclist for 2017
Jan_2017 = cyclist_2017(1,:);
Apr_2017 = cyclist_2017(2,:);
Jul_2017 = cyclist_2017(3,:);
Oct_2017 = cyclist_2017(4,:);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%Percentage differences for Jan 2017
janA_cyclist_2017 = mean(Jan_2017);
per_difference_2017 =100*((Jan_2017 - janA_cyclist_2017) /
janA_cyclist_2017);
figure(1);
bar(per_difference_2017);title('Percentage difference for January 2017');
xlabel('%');
ylabel('Total Cyclist');
grid on;

%Percentage differences for Apr 2017
aprA_cyclist_2017 = mean(Apr_2017);
aPer_difference_2017 =100*((Apr_2017 - aprA_cyclist_2017) /
aprA_cyclist_2017);
figure(2);
bar(aPer_difference_2017);title('Percentage difference for April 2017');
xlabel('%');
ylabel('Total Cyclist');
grid on;

%Percentage differences for Jul 2017
jula_cyclist_2017 = mean(Jul_2017);
juPer_difference_2017 =100*((Jul_2017 - jula_cyclist_2017) /
jula_cyclist_2017);
figure(3);
bar(juPer_difference_2017);title('Percentage difference for July 2017');
xlabel('%');
ylabel('Total Cyclist');
grid on;

%Percentage differences for Oct 2017
octA_cyclist_2017 = mean(Oct_2017);
oPer_difference_2017 =100*((Oct_2017 - octA_cyclist_2017) /
octA_cyclist_2017);
figure(4);

```

```
bar(oPer_difference_2017);title('Percentage difference for October 2017');  
xlabel('%');  
ylabel('Total Cyclist');  
grid on;
```

Question 3

`%April 2016`

```
date = EcoTotemBroadwayBicycleCount(:,1);
dateNum = datevec(date);
date_2016 = (dateNum(:,1)==2016);
```

`%extract data from dataset for cyclists`

```
cyclist = EcoTotemBroadwayBicycleCount(:,5);
cyclist_t = cell2mat(cyclist);
```

`%get the month of April`

```
monthApril = (dateNum(:,2)==4);
```

```
dates = dateNum(:,3);
```

```
day = datevec(EcoTotemBroadwayBicycleCount(:,2),'dddd');
```

```
startDay = (day(:,3)==3);
```

```
dateVec2016 = (date_2016.*monthApril.*startDay)>0;
```

```
dateMonVec = dates(dateVec2016);
```

```
Monday = dateMonVec(1:96,1);
```

```
start_P = Monday(1,1);
```

```
end_P = Monday(1,1) + 5;
```

`%shell to store cyclist`

```
cycApril = zeros(96,6);
```

`%shell to store hours`

```
cycHourApril = zeros(24,6);
```

```
k = 0;
```

```
for i=start_P:1:end_P
```

```
    dateVec = (dateNum(:,3)==i);
```

```
    dateVec2016 = (date_2016.*monthApril.*dateVec)>0;
```

```
    k = k + 1;
```

```
    cycApril(:,k) = cyclist_t(dateVec2016);
```

```
    for j=1:1:24
```

```
        start_P = j + (j - 1)*3;
```

```
        end_P = start_P + 3;
```

```
        dayTemp = cycApril(:,k);
```

```
        cycHourApril(j,k) = sum(dayTemp(start_P:end_P,1));
```

```
    end
```

```
end
```

```
day1 = cycHourApril(:,1);
```

```
day2 = cycHourApril(:,2);
```

```
day3 = cycHourApril(:,3);
```

```
day4 = cycHourApril(:,4);
```

```
day5 = cycHourApril(:,5);
```

```
day6 = cycHourApril(:,6);
```

`%%Graph for April 2016`

`%Monday`

```
figure(1);
```

```
bar(day1);title('Total cyclist for April (Monday) 2016');
```

```
xlabel('Hours');
```

```

ylabel('Total Cyclist');
grid on;

%Tuesday
figure(2);
bar(day2);title('Total cyclist for April (Tuesday) 2016');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Wednesday
figure(3);
bar(day3);title('Total cyclist for April (Wednesday) 2016');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Thursday
figure(4);
bar(day4);title('Total cyclist for April (Thursday) 2016');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Friday
figure(5);
bar(day5);title('Total cyclist for April (Friday) 2016');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Saturday
figure(6);
bar(day6);title('Total cyclist for April (Saturday) 2016');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Percentage differences for Monday April 2016
%Monday
mon_cyclist_2016 = mean(day1);
per_difference1 =100*((day1 - mon_cyclist_2016) / mon_cyclist_2016);
figure(1);
bar(per_difference1);title('Percentage difference for Monday April 2016');
xlabel('hours');
ylabel('%');
grid on;

%Tuesday
tue_cyclist_2016 = mean(day2);
per_difference2 =100*((day2 - tue_cyclist_2016) / tue_cyclist_2016);
figure(2);
bar(per_difference2);title('Percentage difference for Tuesday April 2016');
xlabel('hours');
ylabel('%');
grid on;

%Wednesday
wed_cyclist_2016 = mean(day3);
per_difference3 =100*((day3 - wed_cyclist_2016) / wed_cyclist_2016);

```



```

figure(3);
bar(per_difference3);title('Percentage difference for Wednesday April
2016');
xlabel('hours');
ylabel('%');
grid on;

%Thursday
thu_cyclist_2016 = mean(day4);
per_difference4 =100*((day1 - thu_cyclist_2016) / thu_cyclist_2016);
figure(4);
bar(per_difference4);title('Percentage difference for Thursday April
2016');
xlabel('hours');
ylabel('%');
grid on;

%Friday
fri_cyclist_2016 = mean(day5);
per_difference5 =100*((day1 - fri_cyclist_2016) / fri_cyclist_2016);
figure(5);
bar(per_difference5);title('Percentage difference for Friday April 2016');
xlabel('hours');
ylabel('%');
grid on;

%Saturday
sat_cyclist_2016 = mean(day6);
per_difference6 =100*((day6 - sat_cyclist_2016) / sat_cyclist_2016);
figure(6);
bar(per_difference6);title('Percentage difference for Saturday April
2016');
xlabel('hours');
ylabel('%');
grid on;

%April 2017
date_2017 = (dateNum(:,1)==2017);

%empty shell for cyclists
cycApril2017 = zeros(96,6);

%empty shell for hours
cycHourApril2017 = zeros(24,6);

dateVec2017 = (date_2017.*monthApril.*startDay)>0;
dateMonVec = dates(dateVec2017);
Monday = dateMonVec(1:96,1);

start_17 = Monday(1,1);
end_17 = Monday(1,1) + 5;
p = 0;
for i=start_17:1:end_17
    dateVec = (dateNum(:,3)==i);
    dateVec2017 = (date_2017.*monthApril.*dateVec)>0;
    p = p + 1;
    cycApril2017(:,p) = cyclist_t(dateVec2017);
    for j=1:1:24

```

```

        aP_start = j + (j - 1)*3;
        aP_end = aP_start + 3;
        dayTemp = cycApril2017(:,p);
        cycHourApril2017(j,p) = sum(dayTemp(aP_start:aP_end,1));
    end
end

day171 = cycHourApril2017(:,1);
day172 = cycHourApril2017(:,2);
day173 = cycHourApril2017(:,3);
day174 = cycHourApril2017(:,4);
day175 = cycHourApril2017(:,5);
day176 = cycHourApril2017(:,6);

%%Graph for April 2017
%Monday
figure(1);
bar(day171);title('Total cyclist for April (Monday) 2017');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Tuesday
figure(2);
bar(day172);title('Total cyclist for April (Tuesday) 2017');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Wednesday
figure(3);
bar(day173);title('Total cyclist for April (Wednesday) 2016');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Thursday
figure(4);
bar(day174);title('Total cyclist for April (Thursday) 2017');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Friday
figure(5);
bar(day175);title('Total cyclist for April (Friday) 2017');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Saturday
figure(6);
bar(day176);title('Total cyclist for April (Saturday) 2017');
xlabel('Hours');
ylabel('Total Cyclist');
grid on;

%Percentage differences for Monday April 2017
%Monday
mon_cyclist_2017 = mean(day171);

```

```

per_difference171 = 100 * ((day171 - mon_cyclist_2016) / mon_cyclist_2017);
figure(1);
bar(per_difference171); title('Percentage difference for Monday April
2017');
xlabel('hours');
ylabel('%');
grid on;

%Tuesday
tue_cyclist_2017 = mean(day172);
per_difference172 = 100 * ((day172 - tue_cyclist_2017) / tue_cyclist_2017);
figure(2);
bar(per_difference172); title('Percentage difference for Tuesday April
2017');
xlabel('hours');
ylabel('%');
grid on;

%Wednesday
wed_cyclist_2017 = mean(day173);
per_difference173 = 100 * ((day173 - wed_cyclist_2017) / wed_cyclist_2017);
figure(3);
bar(per_difference173); title('Percentage difference for Wednesday April
2017');
xlabel('hours');
ylabel('%');
grid on;

%Thursday
thu_cyclist_2017 = mean(day174);
per_difference174 = 100 * ((day174 - thu_cyclist_2017) / thu_cyclist_2017);
figure(4);
bar(per_difference174); title('Percentage difference for Thursday April
2017');
xlabel('hours');
ylabel('%');
grid on;

%Friday
fri_cyclist_2017 = mean(day175);
per_difference175 = 100 * ((day175 - fri_cyclist_2017) / fri_cyclist_2017);
figure(5);
bar(per_difference175); title('Percentage difference for Friday April
2017');
xlabel('hours');
ylabel('%');
grid on;

%Saturday
sat_cyclist_2017 = mean(day176);
per_difference176 = 100 * ((day176 - sat_cyclist_2017) / sat_cyclist_2017);
figure(6);
bar(per_difference176); title('Percentage difference for Saturday April
2017');
xlabel('hours');
ylabel('%');
grid on;

```