STK 353

Practical 2: Scripts

Name: SJP Eloff

Student number: 10237161

Submission: 30 July 2018, 17:30

Answer Sheet

1

a) There are 10,200 flights that had an arrival delay of two or more hours, as seen from the following (partial) output:

```
# A tibble: 10,200 x 19
    year month   day dep_time sched_dep_time dep_delay arr_time
   <int> <int> <int>    <int>          <int>     <dbl>    <int>
 1  2013     1     1      811            630       101     1047
 2  2013     1     1      848           1835       853     1001
…
```

b) 9,313 Flights had Houston (IAH or HOU) as their destination:

```
# A tibble: 9,313 x 19
    year month   day dep_time sched_dep_time dep_delay arr_time
   <int> <int> <int>    <int>          <int>     <dbl>    <int>
 1  2013     1     1      517            515         2      830
 2  2013     1     1      533            529         4      850
…
```

c) 139,504 Flights were under control of United, American and Delta airlines:

```
# A tibble: 139,504 x 19
    year month   day dep_time sched_dep_time dep_delay arr_time
   <int> <int> <int>    <int>          <int>     <dbl>    <int>
 1  2013     1     1      517            515         2      830
 2  2013     1     1      533            529         4      850
…
```

d) 86,326 Flights departed during summer:

```
# A tibble: 86,326 x 19
    year month   day dep_time sched_dep_time dep_delay arr_time
   <int> <int> <int>    <int>          <int>     <dbl>    <int>
 1  2013     7     1        1           2029       212      236
 2  2013     7     1        2           2359         3      344
…
```

e) 34,583 Flights departed on time (or early) and still arrived more than 2 hours late:

```
# A tibble: 34,583 x 19
    year month   day dep_time sched_dep_time dep_delay arr_time
   <int> <int> <int>    <int>          <int>     <dbl>    <int>
```

```
 1  2013     1     1      554            558        -4      740
 2  2013     1     1      555            600        -5      913
…
```

f) 83,728 Flights departed at least 1 hour late, but made up for at least 30 minutes lost time in flight:

```
# A tibble: 83,728 x 19
    year month   day dep_time sched_dep_time dep_delay arr_time
   <int> <int> <int>    <int>          <int>     <dbl>    <int>
 1  2013     1     1      601            600         1      844
 2  2013     1     1      623            610        13      920
…
```

g) 9,344 Flights departed between 00:00 and 06:00 (inclusively):

```
# A tibble: 9,344 x 19
    year month   day dep_time sched_dep_time dep_delay arr_time
   <int> <int> <int>    <int>          <int>     <dbl>    <int>
 1  2013     1     1      517            515         2      830
 2  2013     1     1      533            529         4      850
…
```

NOTE to g): It seems that flights that departed exactly at 24:00 should be included by nature of the question, however, this does not correspond to question 2's answers so I assume the lecturer does not want me to include those flights – I therefore only coded for the filter `filter(dep_time <= 600)` in stead of `filter(dep_time <= 600|dep_time == 2400)` which delivers the result of 9,373 flights.

2

a) The `between()` function analyses whether the values of a numerical input vector falls in a specific range.

b) Using `between()` in question 1g) delivers the same result:

```
# A tibble: 9,344 x 19
    year month   day dep_time sched_dep_time dep_delay arr_time
   <int> <int> <int>    <int>          <int>     <dbl>    <int>
 1  2013     1     1      517            515         2      830
 2  2013     1     1      533            529         4      850
…
```

3

a) 8255 Flights' departure times are missing:

```
[1] 8255
```

b) The output below shows the columns that contain (at least one) missing value(s):

```
[1] "dep_time"  "dep_delay" "arr_time"  "arr_delay" "tailnum"
[6] "air_time"
```

c) There are many possible causes to consider, e.g. (1) flights that might have been cancelled (for whatever reason, be it not having enough passengers, systems failure of the aircraft, pilot not showing up, etc.), (2) failure to capture the data (be it faulty technology or human error), or (3) flights might have been diverted and never reached their final destination. Note these are only some of the possible causes of the missing data.

4

a) `NA ^ 0` is equal to 1 and not to NA as I expected, since NA is treated as a placeholder for *some possible number*, and from the laws of mathematics, (any possible number)^0 = 1. Thus `NA ^ 0` is not missing.

b) `NA | TRUE` is not missing since, again, NA is simply a placeholder. In this case, as a logical boolean object, i.e. it can only be either TRUE or FALSE. Therefore, `NA | TRUE` will always produce the output `TRUE`.

c) `FALSE & NA` Is not missing for the same reason as in b) and will always produce the output `FALSE`.

5

The following code produces the desired result:

```
flights %>% arrange(desc(is.na(dep_time)), desc(is.na(dep_delay)),
                    desc(is.na(arr_time)), desc(is.na(arr_delay)),
                    desc(is.na(tailnum)),desc(is.na(air_time)))
```

6

The code below first sorts flights according to their real departure time in descending order from the most delayed flight to the flight that left earliest, and then in ascending order from the flight that left earliest to the flight that was most delayed:

```
arrange(flights, desc(dep_delay))
arrange(flights, dep_delay)
```

7

The code below sorts flights in ascending order according to their flight duration:

```
arrange(flights, air_time)
```

8

The code below first sorts flights according to their distance travelled in descending order and thereafter in ascending order:

```
arrange(flights, desc(distance))
arrange(flights, distance)
```

9

The code below converts `dep_time` and `sched_dep_time` to number of minutes since midnight:

```
flights %>% mutate(dep_time = (dep_time %/% 100) * 60 +
                              (dep_time %% 100),
                   sched_dep_time = (sched_dep_time %/% 100) * 60 +
                                    (sched_dep_time %% 100))
```

10

I would expect to find that the average value of `(arr_time - dep_time) - air_time` is close to zero.

Firstly, `arr_time` needs to be mutated to the minutes since midnight format as done with `dep_time` and `sched_dep_time` in question 9.

Furthermore, notice that `arr_time - dep_time` sometimes result in large negative numbers; this occurs when a flight departs before midnight and arrives after it. We can, however, just manipulate the variables algebraically once again to solve this problem.

11 I would expect that `(dep_time – sched_dep_time)- dep_delay` averages close to zero.

12 If there were ties, I might consider (depending on domain knowledge) to use `row_number()` to deal with them.

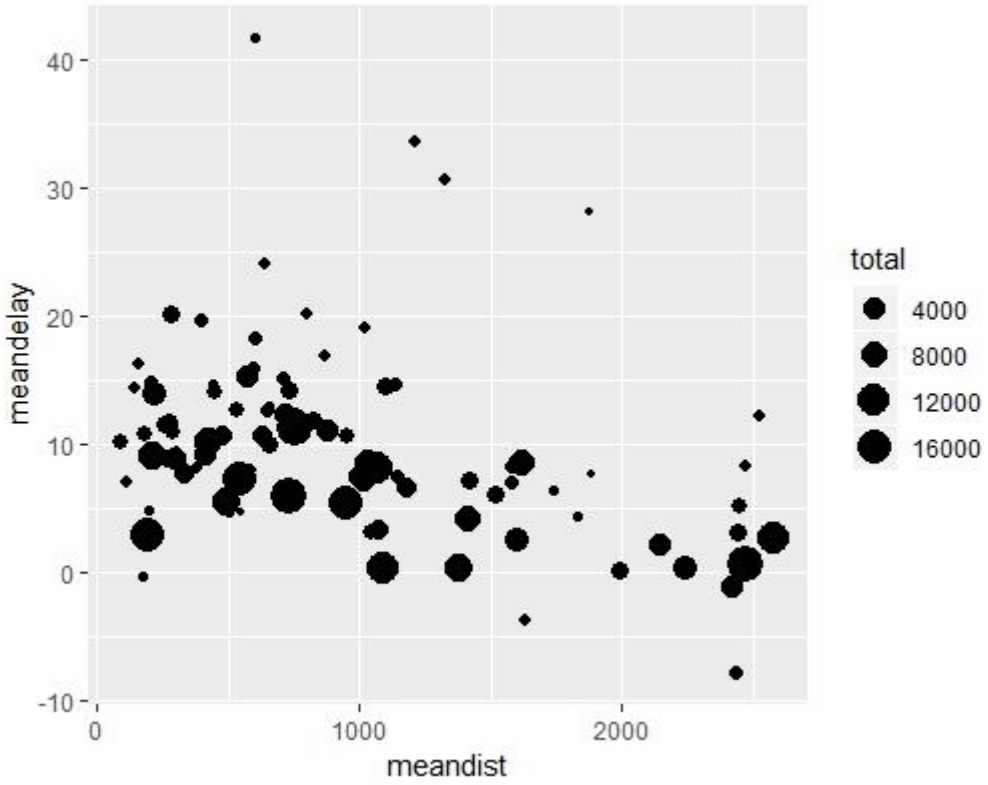
13 `1:3 + 1:10` outputs the following:

```
[1]  2  4  6  5  7  9  8 10 12 11
Warning message:
In 1:3 + 1:10 :
  longer object length is not a multiple of shorter object length
```

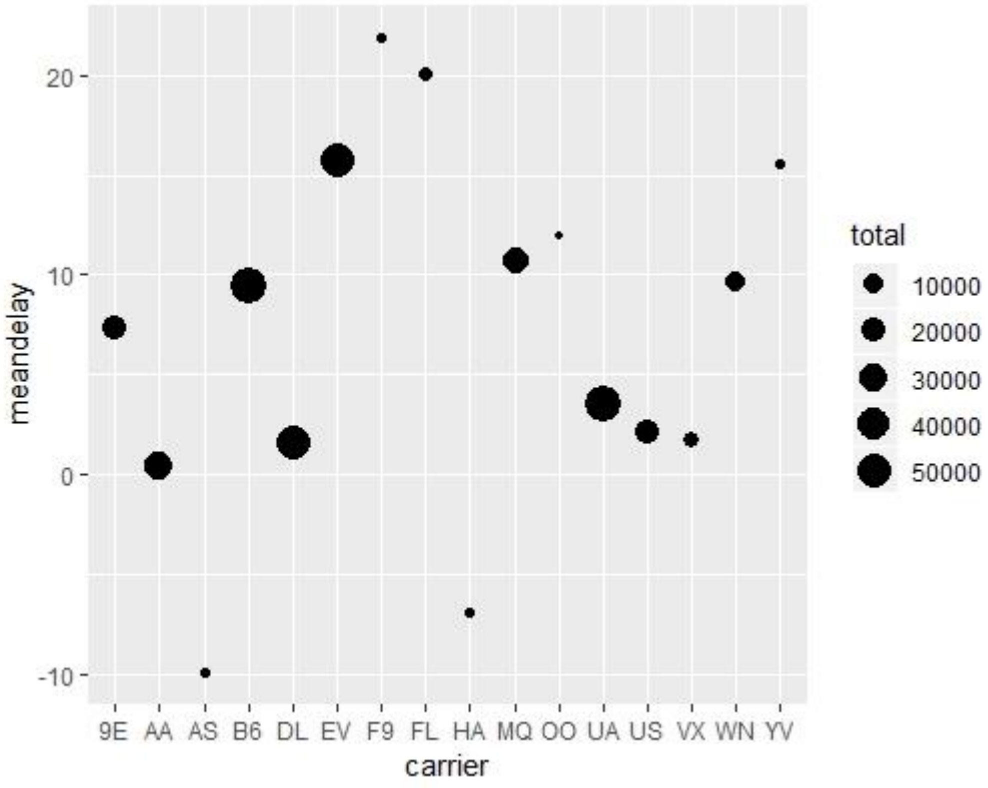
i.e. the problem is that we cannot repeat a vector of size 3 to size 10 since 10 is not a multiple of 3.

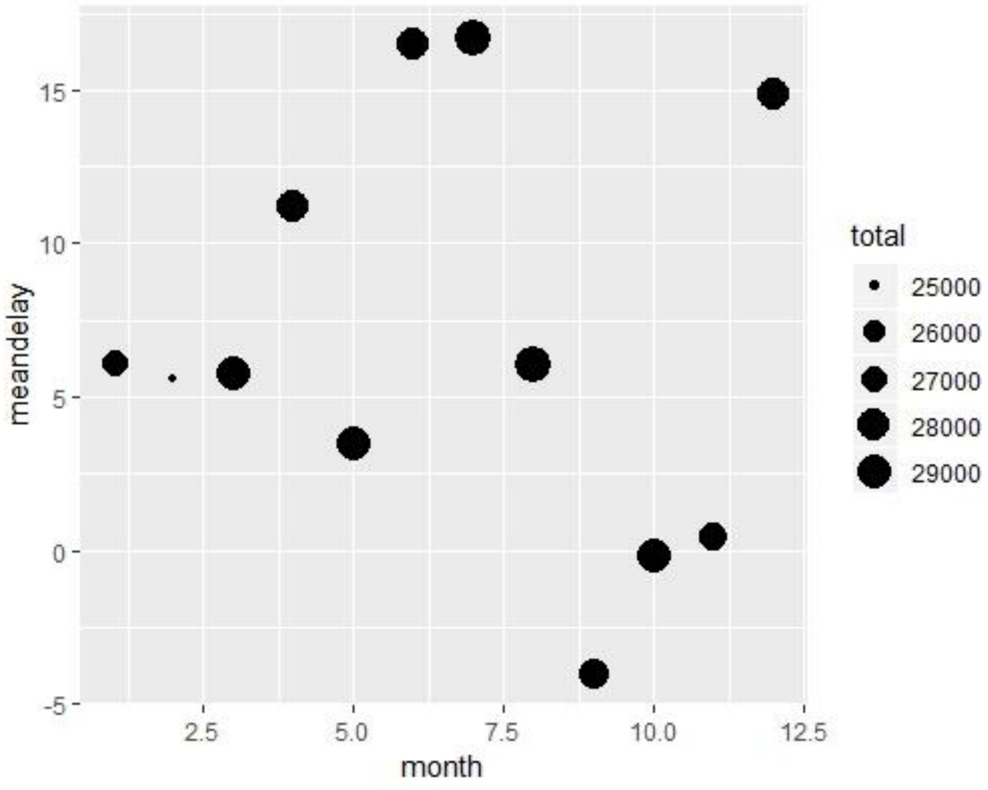
14 From the `?Trig` function, R can compute the cosine, sine, tangent, arc-cosine, arc-sine, arc-tangent, and the two-argument arc-tangent.

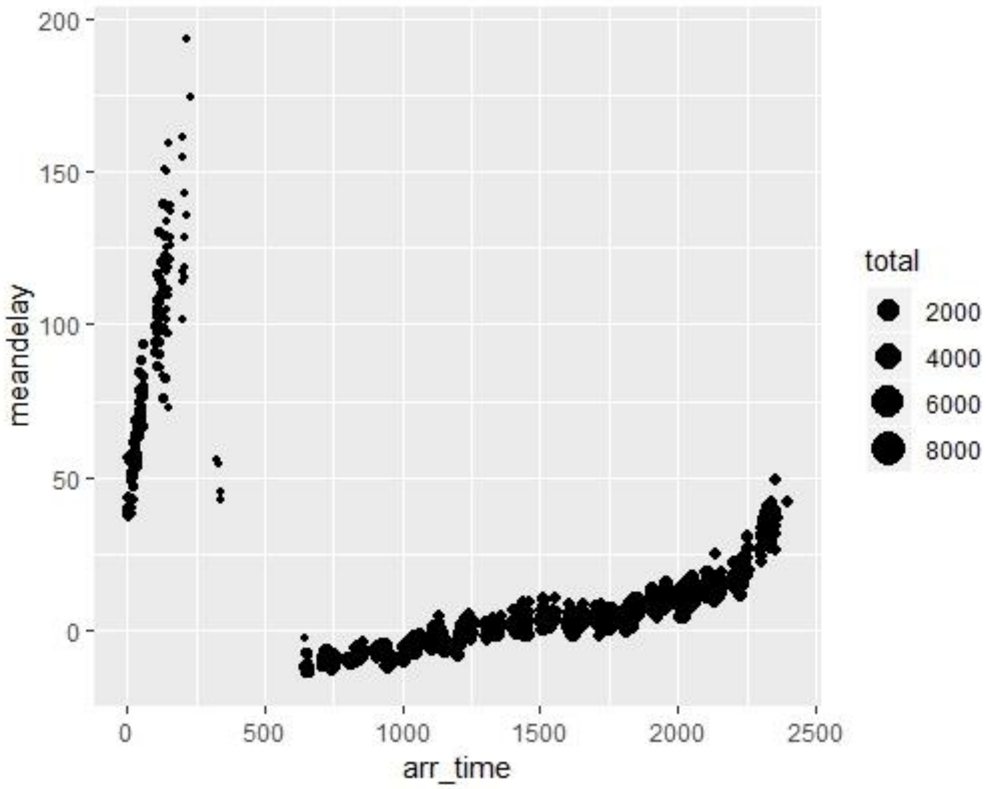
15 Below is a graph depicting the relationship between distance and average arrival delay for each of the locations:

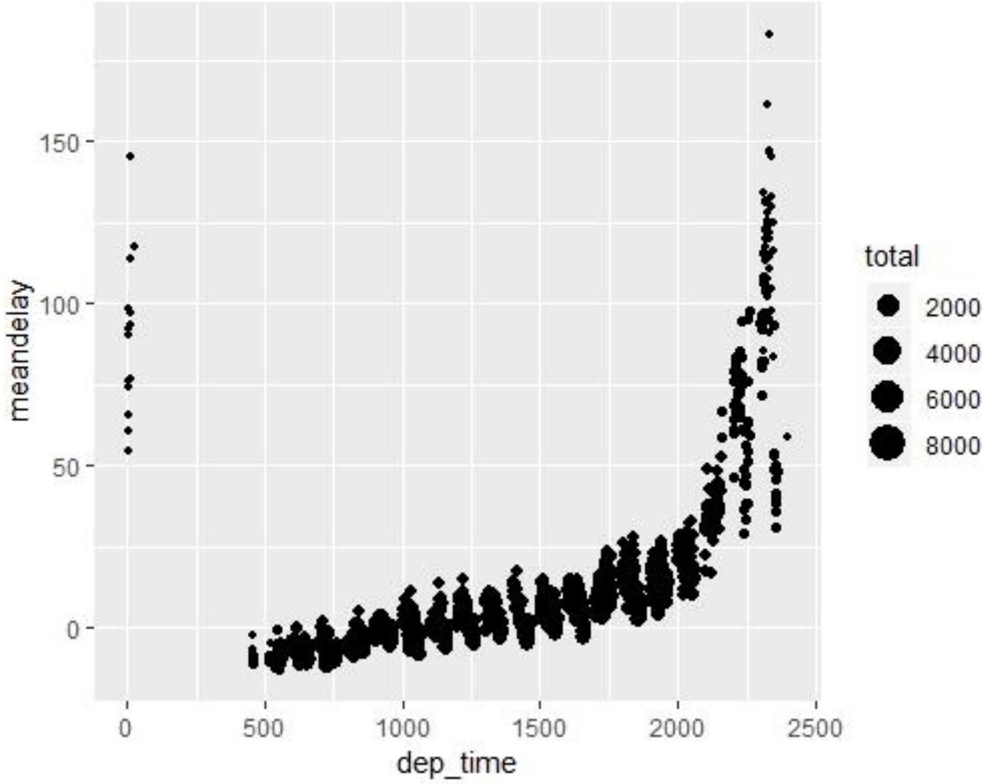


16 Below follows the depicted relationships of `carrier vs. mean delay`, `month vs. mean delay`, `arr_time vs. mean delay` and `dep_time vs. mean delay` respectively:

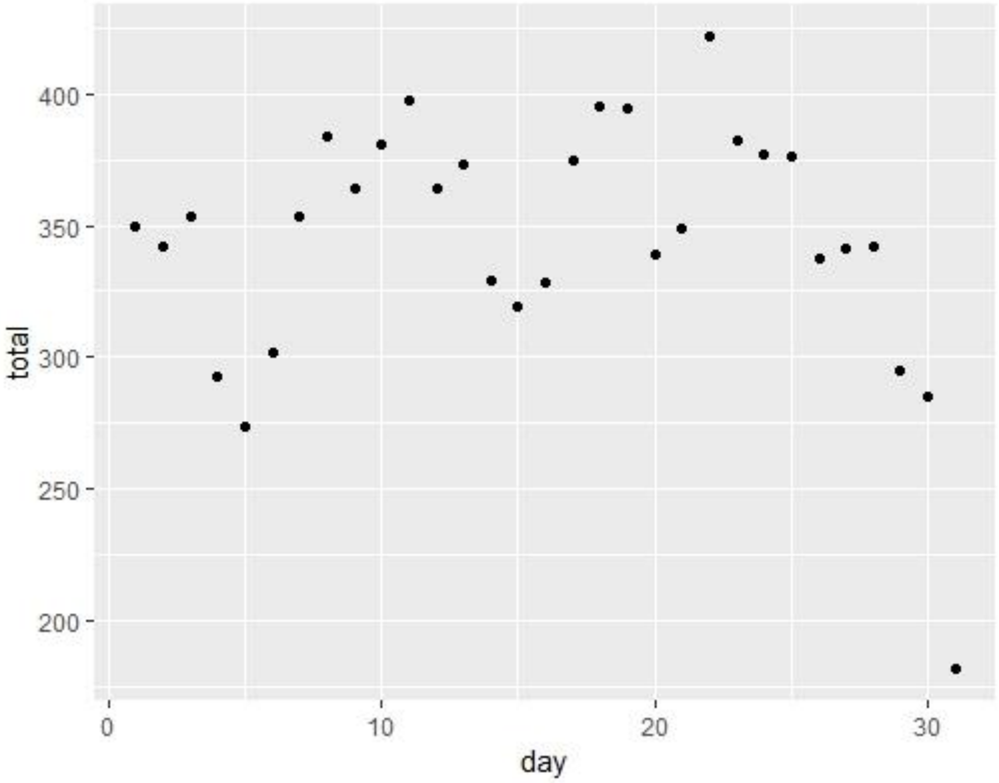




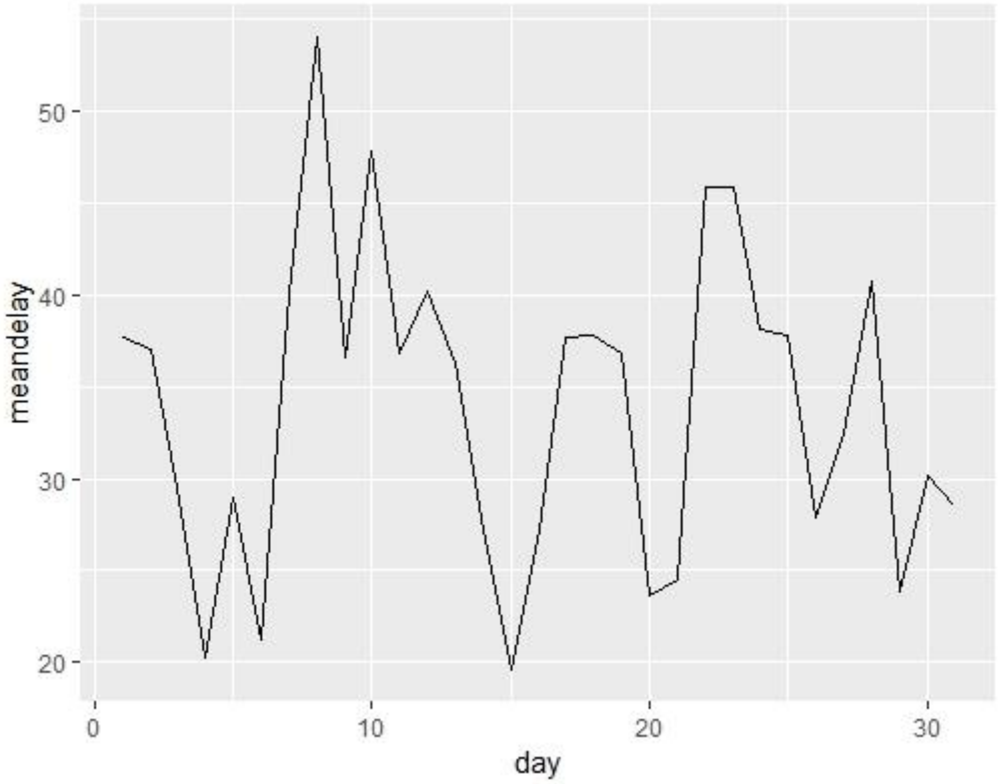

meandelay
200
150
100
50
0
0
500
1000
1500
2000
2500
arr_time
total
2000
4000
6000
8000

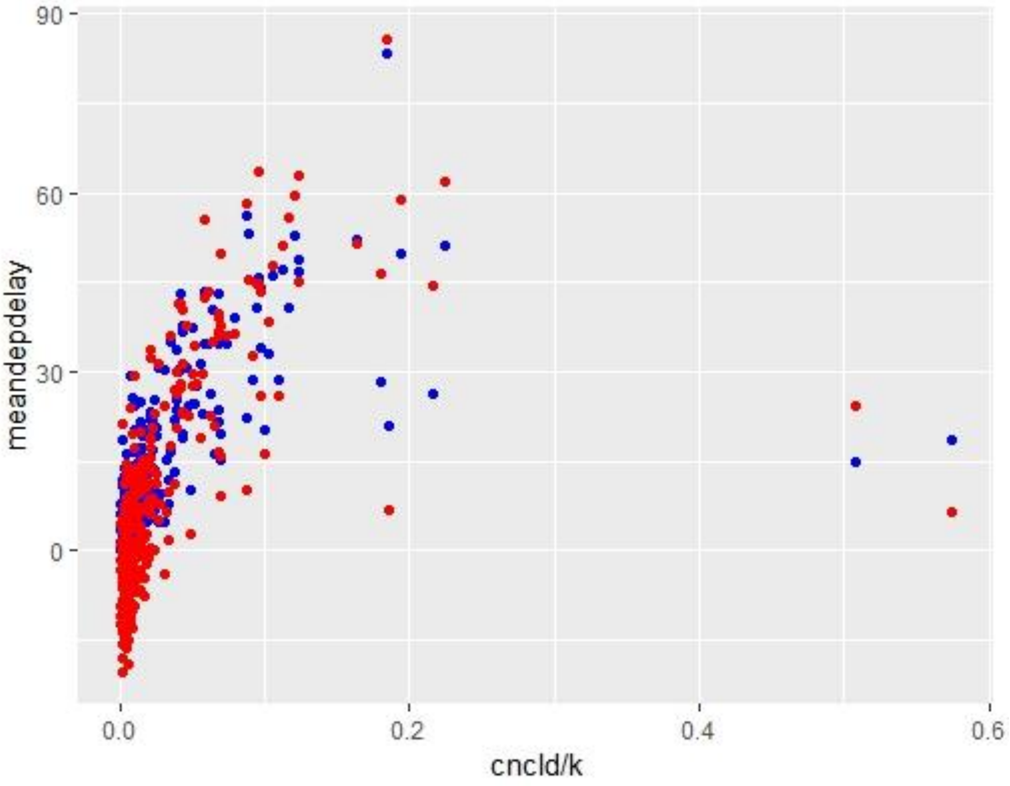

meandelay
150
100
50
0
0
500
1000
1500
2000
2500
dep_time
total
2000
4000
6000
8000

From the four graphs above, it looks to be the case that `dep_time` might be the best predictor for delay time. Furthermore, comparing (firstly) the total number of delayed flights on different days of the month also does not seem very useful and (secondly) neither does the comparison between average delay time and day of the month



:



17	The average delay indeed seems highly related to the number of cancelled flights per day (cncld/k), as depicted below: 

Total Marks (out of 10):