Multivariate Statistical Methods - Lab 1

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Assignment 1

a)

Mean value, standard deviation, variance, min value, max value and median for the seven variables are displayed in the tables below.

```
Mean
```

```
##        100        200        400        800       1500       3000
##  11.357778  23.118519  51.989074   2.022407   4.189444   9.080741
##   Marathon
## 153.619259
```

```
Standard_deviation
```

```
##         100         200         400         800        1500        3000
##  0.39410116  0.92902547  2.59720188  0.08687304  0.27236502  0.81532689
##    Marathon
## 16.43989508
```

```
Variance
```

```
##          100          200          400          800         1500
## 1.553157e-01 8.630883e-01 6.745458e+00 7.546925e-03 7.418270e-02
##         3000     Marathon
## 6.647579e-01 2.702702e+02
```

```
Max
```

```
##      100      200      400      800     1500     3000 Marathon
##    12.52    25.91    61.65     2.29     5.42    13.12   221.14
```

```
Min
```

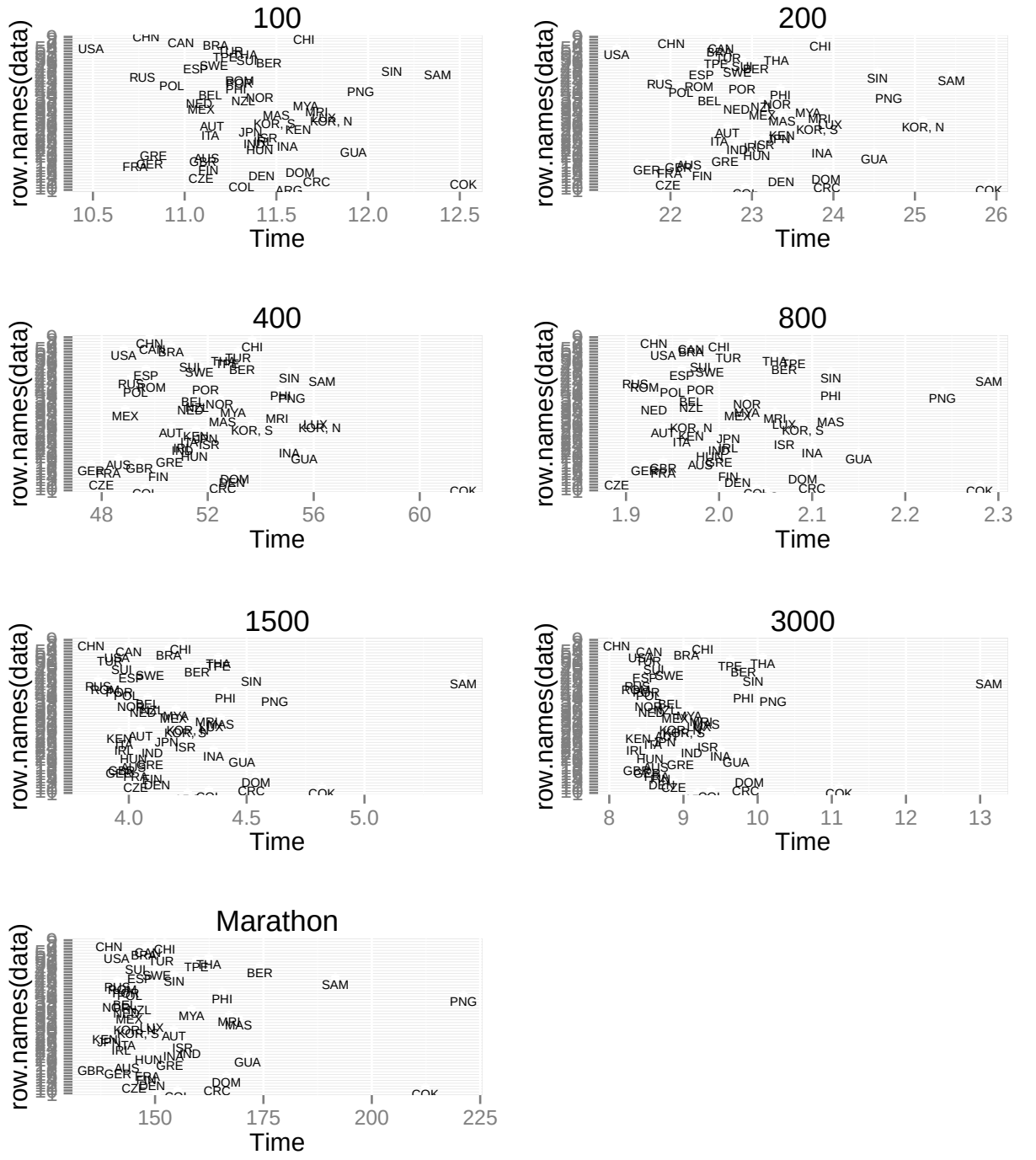
```
##      100      200      400      800     1500     3000 Marathon
##    10.49    21.34    47.60     1.89     3.84     8.10   135.25
```

```
Median
```

```
##      100      200      400      800     1500     3000 Marathon
##   11.325   22.980   51.645    2.005    4.100    8.845  148.430
```

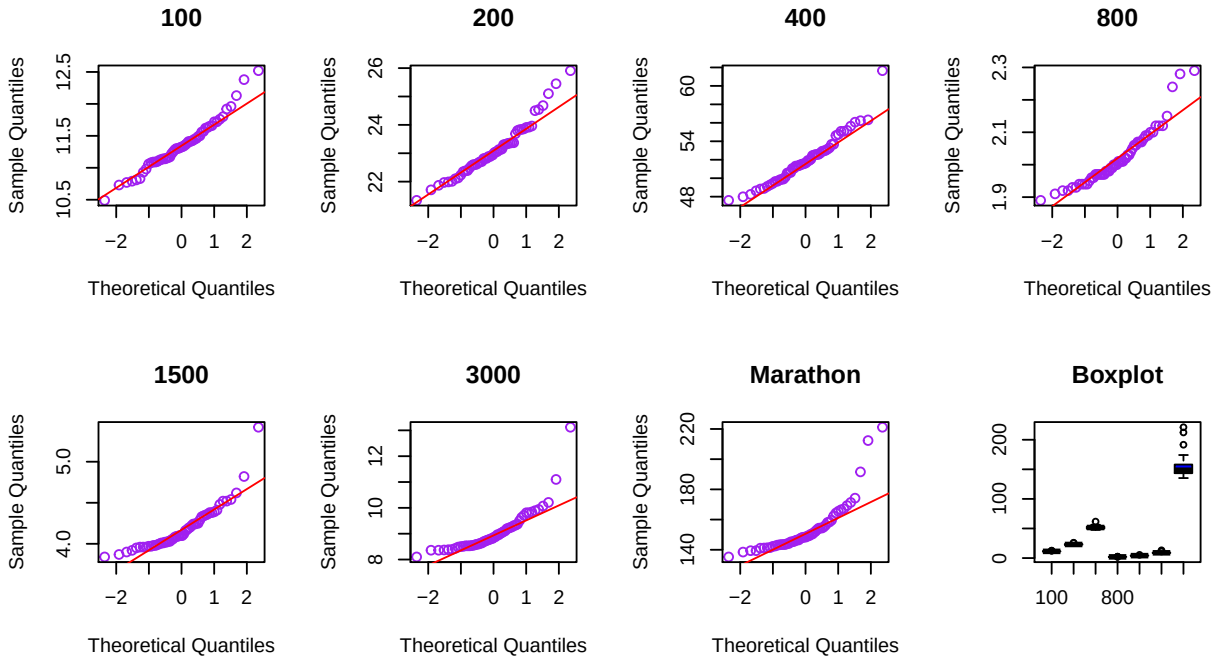
b)

Dot plot for each variable to investigate if any extreme values can be found.



An interpretation of the dot plots is that extreme values can be seen in most of the graphs. The most extreme countries seem to be Samoa and Cook Islands who has the most extreme values for several variables.

Examining if the variables seem to be normally distributed by looking at the following plots.



It is concluded that the observated values for all the variables are lying quite well along the red line except for at the highest values. Especially the varialbles "800m" and "Marathon" seem to have...

Assigment 2

a)

Covariance and correlation matrices:

```
##                  100        200        400         800       1500
## 100       0.15531572  0.3445608  0.8912960 0.027703564 0.08389119
## 200       0.34456080  0.8630883  2.1928363 0.066165898 0.20276331
## 400       0.89129602  2.1928363  6.7454576 0.181807932 0.50917683
## 800       0.02770356  0.0661659  0.1818079 0.007546925 0.02141457
## 1500      0.08389119  0.2027633  0.5091768 0.021414570 0.07418270
## 3000      0.23388281  0.5543502  1.4268158 0.061379315 0.21615514
## Marathon 4.33417757 10.3849876 28.9037314 1.219654647 3.53983732
##                 3000   Marathon
## 100       0.23388281   4.334178
## 200       0.55435017  10.384988
## 400       1.42681579  28.903731
## 800       0.06137932   1.219655
## 1500      0.21615514   3.539837
## 3000      0.66475793  10.706091
## Marathon 10.70609113 270.270150
```

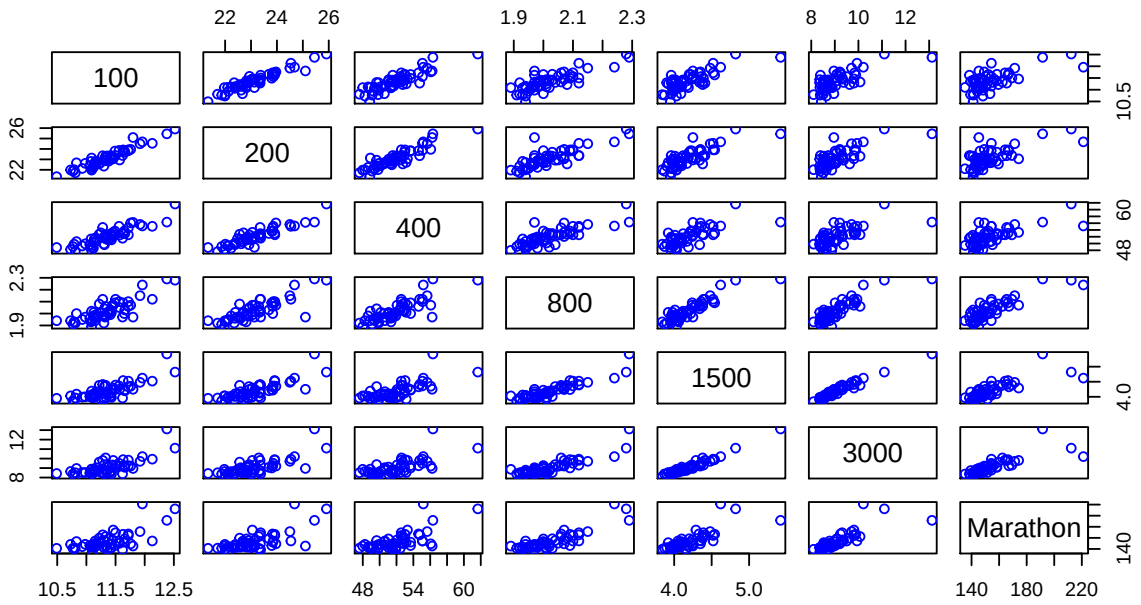
```
##                100       200       400       800       1500      3000
## 100      1.0000000 0.9410886 0.8707802 0.8091758 0.7815510 0.7278784
## 200      0.9410886 1.0000000 0.9088096 0.8198258 0.8013282 0.7318546
## 400      0.8707802 0.9088096 1.0000000 0.8057904 0.7197996 0.6737991
```

```
## 800      0.8091758 0.8198258 0.8057904 1.0000000 0.9050509 0.8665732
## 1500     0.7815510 0.8013282 0.7197996 0.9050509 1.0000000 0.9733801
## 3000     0.7278784 0.7318546 0.6737991 0.8665732 0.9733801 1.0000000
## Marathon 0.6689597 0.6799537 0.6769384 0.8539900 0.7905565 0.7987302
##           Marathon
## 100       0.6689597
## 200       0.6799537
## 400       0.6769384
## 800       0.8539900
## 1500      0.7905565
## 3000      0.7987302
## Marathon 1.0000000
```

The correlation is stronger for more similar distances. For example the 100m have the strongest correlation to 200m, second strongest to 400m and so on. Regarding the variance it seem to be rising for longer distances.

b)

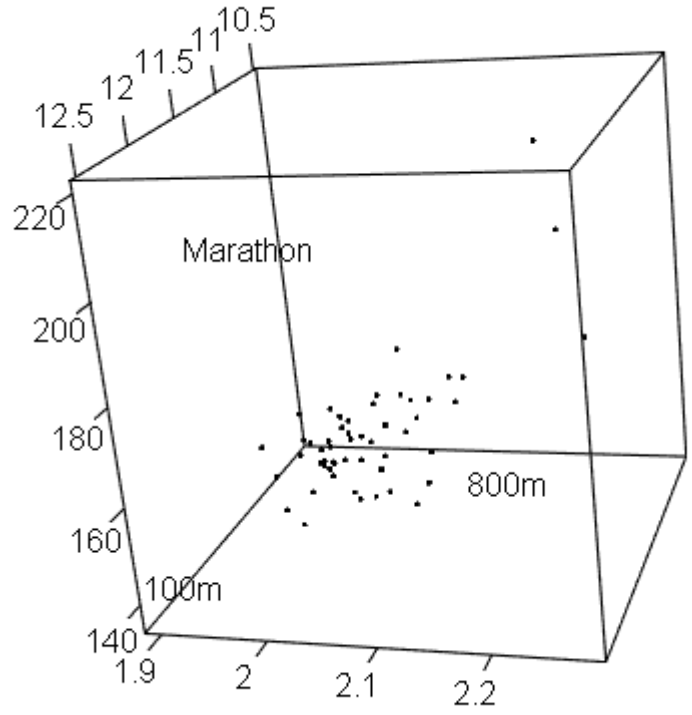
A scatterplot matrix

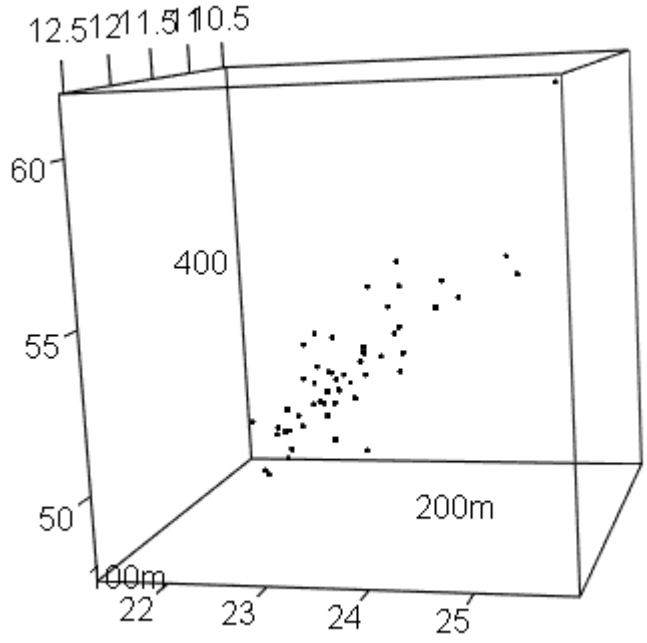


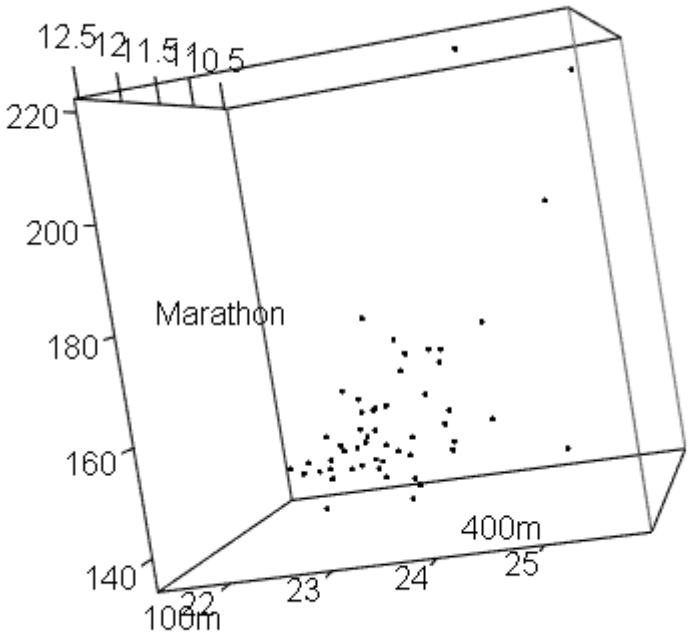
The longer distance, the more apparent extreme values. When looking at for example Marathon versus the other variables there are three extreme values and for 3000m there are at least one extreme value.

c)

Another way of visually investigating which countries that are the most extreme is by looking at three-dimensional scatterplots.


10.5
11
11.5
12
12.5
220
Marathon
200
180
800m
160
100m
140
1.9
2
2.1
2.2


12.5
12
11.5
11
10.5
60
400
55
200m
50
100m
22
23
24
25



Assignment 3

a)

b)

```
##    data...1. sqDiagdistance
## 40       PNG      4573.5413
## 11       COK      3553.9691
## 46       SAM      1484.1570
## 5        BER       425.0219
## 19       GBR       345.6425
```

c)

```
##    data...1. newSqDistance
## 46       SAM      75.58280
## 11       COK      64.60116
## 40       PNG      34.22891
## 54       USA      12.87689
## 47       SIN      11.44486
```

d)

```
##    data...1. MahanabisD
## 46       SAM   35.01406
## 40       PNG   30.50725
## 31    KOR, N   26.16714
## 11       COK   19.83400
```

```
## 35       MEX   14.23093
```

e)

The countries Samoa, Cook Islands and Papua New Guinea are at the top five for all of the computed measures, but as mentioned in the exercise the results differ between the respective distance measures. For example Sweden are are ranked at place 48 in b, 50 in c and 54 in d.