Εργαστηριακή Άσκηση 1

Θέμα: Εισαγωγή στην R

1.

```
> install.packages("bootstrap")
> library("bootstrap")
```

2.

```
> R<-3:20
> volume<-rep(0,18)
> for(i in 1:18)
+ volume[i]<-4/3*pi*R[i]^3
> volume
 [1]   113.0973   268.0826   523.5988   904.7787  1436.7550  2144.6606
 [7]  3053.6281  4188.7902  5575.2798  7238.2295  9202.7721 11494.0403
[13] 14137.1669 17157.2847 20579.5263 24429.0245 28730.9120 33510.3216
> volume2<-4/3*pi*R^3
> volume2
 [1]   113.0973   268.0826   523.5988   904.7787  1436.7550  2144.6606
 [7]  3053.6281  4188.7902  5575.2798  7238.2295  9202.7721 11494.0403
[13] 14137.1669 17157.2847 20579.5263 24429.0245 28730.9120 33510.3216
```

3.

```
> res<-1
> for(i in 1:200)
+ res<-res*i
> res
[1] Inf
> prod(1:200)
[1] Inf
```

4.

```
> x<-c(2, 3, 1, 5, 6, 3, 2, 5, 7, 9, 10, 11, 9, 8)
> length(x)
[1] 14
> min(x)
[1] 1
> max(x)
[1] 11
> sort(x)
 [1]  1  2  2  3  3  5  5  6  7  8  9  9 10 11
```

```
> rank(x)
 [1]  2.5  4.5  1.0  6.5  8.0  4.5  2.5  6.5  9.0 11.5 13.0 14.0 11.5 10.0
> rank(x, ties.method="average")
 [1]  2.5  4.5  1.0  6.5  8.0  4.5  2.5  6.5  9.0 11.5 13.0 14.0 11.5 10.0
> rank(x, ties.method="first")
 [1]  2  4  1  6  8  5  3  7  9 11 13 14 12 10
> rank(x, ties.method="random")
 [1]  2  4  1  6  8  5  3  7  9 11 13 14 12 10
> rank(x, ties.method="min")
 [1]  2  4  1  6  8  4  2  6  9 11 13 14 11 10
> rank(x, ties.method="max")
 [1]  3  5  1  7  8  5  3  7  9 12 13 14 12 10
```

5.

```
> med<-function(x)
+ {
+ y<-sort(x)
+ n<-length(x)
+ if(n%%2==0)
+ z<-(y[n/2]+y[n/2+1])/2
+ else
+ z<-y[(n+1)/2]
+ return(z)
+ }
```

6.

```
> 22^300/21^250
[1] NaN
> exp(300*log(22)-250*log(21))
[1] 1.485869e+72
```

7.

```
> X<-
matrix(scan("http://www.math.ntua.gr/~loulakis/info/dataf11semfe_files/data1.txt",
ncol=6, byrow=T)
Read 186 items
> X
      [,1] [,2]  [,3] [,4] [,5] [,6]
 [1,] 33741   15 3.731 67.0    1    0
 [2,] 37251   17 3.500 62.0    0    0
 [3,] 37252   16 3.674 67.5    0    0
 [4,] 37441   17 5.633 73.0    1    0
 [5,] 44241   16 3.645 73.5    1    0
 [6,] 48152   15 2.887 63.0    0    0
 [7,] 52841   17 3.960 70.0    1    0
 [8,] 52842   16 4.299 66.0    1    0
 [9,] 55951   16 2.981 66.0    0    0
```

```
[10,] 63241   16 4.504 72.0    1    0
[11,] 71141   17 5.638 70.0    1    0
[12,] 73751   18 2.853 60.0    0    0
[13,] 77151   15 3.211 66.5    0    0
[14,] 45241    9 1.953 58.0    1    1
[15,]  4952   14 2.236 66.0    0    1
[16,] 10053   14 3.428 64.0    0    1
[17,] 11151   13 3.208 61.0    0    1
[18,] 11601   11 1.694 60.0    1    1
[19,] 11642   14 3.957 72.0    1    1
[20,] 11942   13 4.789 69.0    1    1
[21,] 15302   12 2.384 63.5    0    1
[22,] 15751   14 3.074 65.0    0    1
[23,] 16551   10 2.387 66.0    0    1
[24,] 19601   12 3.835 69.5    0    1
[25,] 23651   13 2.599 62.5    0    1
[26,] 24642   13 4.756 68.0    1    1
[27,] 27951   13 3.086 67.5    0    1
[28,] 30042   14 4.309 69.0    1    1
[29,] 30052   10 3.413 66.0    0    1
[30,] 31502   10 2.975 63.0    0    1
[31,] 34201   11 3.169 62.5    0    1
> Y<-X[,c(2,3)]
> Y
      [,1]  [,2]
 [1,]   15 3.731
 [2,]   17 3.500
 [3,]   16 3.674
 [4,]   17 5.633
 [5,]   16 3.645
 [6,]   15 2.887
 [7,]   17 3.960
 [8,]   16 4.299
 [9,]   16 2.981
[10,]   16 4.504
[11,]   17 5.638
[12,]   18 2.853
[13,]   15 3.211
[14,]    9 1.953
[15,]   14 2.236
[16,]   14 3.428
[17,]   13 3.208
[18,]   11 1.694
[19,]   14 3.957
[20,]   13 4.789
[21,]   12 2.384
[22,]   14 3.074
[23,]   10 2.387
[24,]   12 3.835
[25,]   13 2.599
```

```
[26,]   13 4.756
[27,]   13 3.086
[28,]   14 4.309
[29,]   10 3.413
[30,]   10 2.975
[31,]   11 3.169
> write(t(Y), "Y.txt", ncol=2)
> apply(X,1,sum)
 [1] 33827.731 37333.500 37339.174 37537.633 44335.145 48232.887 52932.960
 [8] 52929.299 56035.981 63334.504 71234.638 73831.853 77235.711 45311.953
[15]  5035.236 10135.428 11229.208 11675.694 11733.957 12030.789 15380.884
[22] 15834.074 16630.387 19687.335 23730.099 24729.756 28035.586 30131.309
[29] 30132.413 31578.975 34278.669
> Xdata<-as.data.frame(X)
> Xdata
      V1 V2    V3   V4 V5 V6
1  33741 15 3.731 67.0  1  0
2  37251 17 3.500 62.0  0  0
3  37252 16 3.674 67.5  0  0
4  37441 17 5.633 73.0  1  0
5  44241 16 3.645 73.5  1  0
6  48152 15 2.887 63.0  0  0
7  52841 17 3.960 70.0  1  0
8  52842 16 4.299 66.0  1  0
9  55951 16 2.981 66.0  0  0
10 63241 16 4.504 72.0  1  0
11 71141 17 5.638 70.0  1  0
12 73751 18 2.853 60.0  0  0
13 77151 15 3.211 66.5  0  0
14 45241  9 1.953 58.0  1  1
15  4952 14 2.236 66.0  0  1
16 10053 14 3.428 64.0  0  1
17 11151 13 3.208 61.0  0  1
18 11601 11 1.694 60.0  1  1
19 11642 14 3.957 72.0  1  1
20 11942 13 4.789 69.0  1  1
21 15302 12 2.384 63.5  0  1
22 15751 14 3.074 65.0  0  1
23 16551 10 2.387 66.0  0  1
24 19601 12 3.835 69.5  0  1
25 23651 13 2.599 62.5  0  1
26 24642 13 4.756 68.0  1  1
27 27951 13 3.086 67.5  0  1
28 30042 14 4.309 69.0  1  1
29 30052 10 3.413 66.0  0  1
30 31502 10 2.975 63.0  0  1
31 34201 11 3.169 62.5  0  1
> names(Xdata)<-c('ID', 'AGE', 'FEV', 'HEIGHT', 'SEX', 'SMOKING')
> Xdata
```

```
   ID AGE   FEV HEIGHT SEX SMOKING
1   33741  15 3.731   67.0   1       0
2   37251  17 3.500   62.0   0       0
3   37252  16 3.674   67.5   0       0
4   37441  17 5.633   73.0   1       0
5   44241  16 3.645   73.5   1       0
6   48152  15 2.887   63.0   0       0
7   52841  17 3.960   70.0   1       0
8   52842  16 4.299   66.0   1       0
9   55951  16 2.981   66.0   0       0
10 63241   16 4.504   72.0   1       0
11 71141   17 5.638   70.0   1       0
12 73751   18 2.853   60.0   0       0
13 77151   15 3.211   66.5   0       0
14 45241    9 1.953   58.0   1       1
15  4952   14 2.236   66.0   0       1
16 10053   14 3.428   64.0   0       1
17 11151   13 3.208   61.0   0       1
18 11601   11 1.694   60.0   1       1
19 11642   14 3.957   72.0   1       1
20 11942   13 4.789   69.0   1       1
21 15302   12 2.384   63.5   0       1
22 15751   14 3.074   65.0   0       1
23 16551   10 2.387   66.0   0       1
24 19601   12 3.835   69.5   0       1
25 23651   13 2.599   62.5   0       1
26 24642   13 4.756   68.0   1       1
27 27951   13 3.086   67.5   0       1
28 30042   14 4.309   69.0   1       1
29 30052   10 3.413   66.0   0       1
30 31502   10 2.975   63.0   0       1
31 34201   11 3.169   62.5   0       1
```

8.

```
> matrix_function<-function(x)
+ {
+ n<-nrow(X)
+ p<-ncol(X)
+ if(n!=p)
+ stop("Your Matrix is not Square")
+ if(det(X)==0)
+ stop("The Determinant of your matrix is zero")
+ y<-list(determinant=det(X), inverse=solve(X))
+ return(y)
+ }

> X<-matrix(1:4, ncol=2)
> X
```

```
     [,1] [,2]
[1,]    1    3
[2,]    2    4
> matrix_function(X)
$determinant
[1] -2

$inverse
     [,1] [,2]
[1,]   -2  1.5
[2,]    1 -0.5

> X<-rbind(X,1)
> X
     [,1] [,2]
[1,]    1    3
[2,]    2    4
[3,]    1    1
> matrix_function(X)
Error in matrix_function(X) : Your Matrix is not Square
> X<-matrix(c(1,2,1,2), ncol=2)
> X
     [,1] [,2]
[1,]    1    1
[2,]    2    2
> matrix_function(X)
Error in matrix_function(X) : The Determinant of your matrix is zero
```

Επίσης ελέγξτε την συνάρτηση σας με τους παρακάτω πίνακες:

$$\begin{pmatrix} -1 & 1 & 2 \\ 3 & 5 & 9 \\ 1 & 7 & 13 \end{pmatrix} \qquad \begin{pmatrix} -1 & 2 & 1 \\ 3 & 5 & 2 \\ -1 & 1 & 3 \end{pmatrix} \qquad \begin{pmatrix} -1 & 2 & 1 & 3 \\ 3 & 5 & 2 & 3 \\ -1 & 1 & 3 & 2 \end{pmatrix}$$