Homework 1: Vectors, Matrices and Graphs

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Due date: September 5, 2016

Vectors

Enter the following commands, and then briefly explain what they do

a) `x <- c(0,1,2,3,4,5,6,7,8,9,10)`

b) `x <- 0:10`

c) `x <- seq(0,10,2)`

d) `x <- seq(10,0,-0.5)`

e) `x > 5`

f) `x[x>5]`

g) `x / 2`

h) `x %/% 2`

Create matrices

Enter the statements necessary to create the following matrices:

$$a = \begin{bmatrix} 1 & 5 & 5 \\ -1 & 3 & 6 \\ 2 & 0 & 2 \end{bmatrix} \quad b = \begin{bmatrix} 2 & -3 & 5 \\ 1 & 0 & 6 \\ 2 & 3 & 1 \end{bmatrix} \quad c = \begin{bmatrix} 5 & 1 & 9 & 0 \\ 4 & 0 & 6 & -2 \\ 3 & -1 & 2 & 4 \end{bmatrix} \quad d = \begin{bmatrix} 3 & 2 & 5 \\ 4 & 1 & 3 \\ 0 & 2 & 1 \\ -2 & 5 & 6 \end{bmatrix} \tag{1}$$

Matrix math

Using the matrices from above, compute the following using R, and record the results. If you receive an error message rather than a numerical result, explain the error.

a) `a + b`

b) `a - 2*b`

c) `(a - 2)*b`

d) `a^2`

e) `sqrt(a)`

f) `t(c)`

g) `c + d`

h) `t(c) + d`

i) `c %*% d`

j) `a - 2 * diag(1,3)`

k) `a - matrix(1,3,3)`

More Matrix math

Using the matrices from #1, enter the following commands, and then briefly explain what they do

a) `a[1,]`

b) `b[,2]`

c) `rbind(a,b)`

d) `cbind(a,b)`

e) `a[c(1,2),] <- a[c(2,1),]`

Order of operations

Which two lines of code are equivalent?

a)
```
x = aa + bb * cc + dd / ee;
```

b)
```
x = (aa + bb) * (cc + dd) / ee;
```

c)
```
x = aa + (bb * cc) + (dd / ee);
```

d)
```
x = (aa + (bb * cc) + dd) / ee;
```

Graphics

Use the ggplot2 package to create a plot that reveal something interesting about either the diamonds or mpg datasets (both are installed when you run `library(ggplot2)`). For each graph, include the code you used to create the plot, and a one paragraph description of what you found interesting.