MOOC Course - Introduction to R Software

July 2017

Solution to Assignment 2

1. To define a function, we use the syntax `function(vector of inputs) {expression}`.

Hence option d is correct.

2. We first need to type the following function on R console:

```
z=function(x,y)
{
sqrt(x^2+y^2)+exp(-(x^-2+y^-2))-(x^2+y^2)^(2/4)
}
```

and then type `z(12,14)` over the R console which assigns x = 12 and y = 14 to the function. This gives an outcome 0.9880258.

Hence option b is correct.

3. The syntax for defining a matrix is `matrix(vector, number of rows, number of columns)` and the extra command in the argument "`byrow=F`" (or "`byrow=T`") enter the values in column (or row) first. Therefore `x=matrix(1:9,3,3,byrow=F)` gives the required matrix.

Hence option c is correct.

4. The syntax for defining a matrix is **`matrix(number of rows, number of columns, data=vector)`**. We have to arrange the data **`c(5,6,7,8,9,10)`** in rows first. So an extra option "**`byrow=T`**" inside the argument of **`matrix()`** function is needed to enter the data in rows first. The default arrangement in **`matrix()`** is to enter the data in columns first.

Hence option a is correct.

5. Command for extracting r^{th} row (or r^{th} column) of a vector **`x`** is **`x[r,]`** (or **`x[,r]`**).

Hence option c is correct.

6. The given data is a sequence 1,2,3,4,5,6,7,8,9. The option **`byrow=F`** will not arrange the data by row as the given option to do this has been set to **`False (F)`**. Thus the syntax **`x<-matrix(1:9,3,3,byrow=F)`** returns a matrix

$$x = \begin{pmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{pmatrix}$$

and **`x[3,2]`** extracts its element having the position of third row and second column.

Hence option b is correct.

7. Each of the matrices **`x`** and **`y`** have the number of rows and the number of columns as 50 and 2, respectively. Hence the output for the command **`dim(x)`** and **`dim(y)`** to get the dimension of x and y, respectively, is as shown in option d.

Hence option d is correct.

8. The syntax `diag(3, nrow=2, ncol=2)` is a command to get a diagonal matrix with each diagonal entry as 3 and having 2 rows and 2 columns.

Hence option d is correct.

9. The command `t(x)` is used to find a transpose of a matrix `x`. Assigning the given matrix to `x` and executing the command `t(x)` gives the required result

```
     [,1] [,2] [,3]
[1,]    6    8   10
[2,]    7    9   11
```

Hence option a is correct.

10. For matrix multiplication between two matrices, the symbol `%*%` is used.

Hence option c is correct.

11. Options a, b and d do not provide correct command for the multiplication of two matrices. The correct command to multiply is `x%*%y`.

Hence option c is correct.

12. The command `2*x` is used to multiply each element of the matrix `x` by 2. the given command gives

```
     [,1] [,2]
[1,]    1    2
[2,]    3    4
```

as the output.

Hence option a is correct.

13. To add two matrices, the `+` sign is used between two matrices. So other options are not correct except option a.

Hence option a is correct.

14. For multiplying a constant to a matrix, only `*` sign is used between the constant and the matrix. Thus `2%*%x` is the wrong command and it returns error.

Hence option c is correct.

15. The command `X<-matrix(nrow=3, ncol=3, data = c(10,20,30,40, 50,60,70,80,90), byrow=F)` returns the matrix

```
     [,1] [,2] [,3]
[1,]   10   40   70
[2,]   20   50   80
[3,]   30   60   90
```

when executed over the R console and `X[ ,2]` provides the second column of the matrix.

Hence option a is correct.

16. The command `X[2:3,2:3]` extracts the sub matrix with row number from 2 to 3 and column number from 2 to 3 of the initial matrix `X`. The command

`X <-matrix(nrow = 3, ncol = 3, data = c(10,20,30,40,50,60,70, 80,90), byrow=F)` returns the matrix

```
     [,1] [,2] [,3]
[1,]   10   40   70
[2,]   20   50   80
[3,]   30   60   90
```

Hence option b is correct.

17. The command `X<-matrix(nrow=3, ncol=3, data=c(10,20,30,40,50, 60,70,80,90), byrow=F)` returns the matrix

```
     [,1] [,2] [,3]
[1,]   10   40   70
[2,]   20   50   80
[3,]   30   60   90
```

as an output and the sub matrix $\begin{pmatrix} 40 & 70 \\ 50 & 80 \end{pmatrix}$ which is basically the common part obtained from its first and second rows; and second and third columns. Hence `X[1:2,2:3]` provides the required sub matrix.

Hence option b is correct.

18. The function `solve()` is used to obtain the inverse of a matrix. So assigning the given matrix as `x` and executing the command `solve(x)` over the R console gives the inverse of `x`.

Hence option a is correct option.

19. The vector `x` includes one of its entry as `NA` and result of any calculation which includes `NA` always gives `NA` as an output. Therefore `mean(x)` is also returns `NA`.

Hence option d is correct.

20. First assign the value `x = 3`. The statement in question is based on the logical operators and truth table. It is executed as

```
(3 < 5)&& (3 >2) &  (3 < 5)|| (3 > 2)||(3 == 7)
```

which results into logical `TRUE`. Similarly assigning the value `x = -3` and executing it gives the result logical `FALSE`.

Hence option b is correct.

21. The logical operator `&` works as AND operator between two conditions and it checks every element of the vector. Consider `x=3`, then the condition `(x > 3)` is false and the condition `(x < 5)` is true. Hence `(x > 3)&(x < 5)` becomes false for this value of `x`. In the similar way, it checks for other values of `x` also.

Hence option a is correct.

22. First assign the values `x = 33:53` then execute the command `x[(x > 28) & (x < 59)]`. It counts which of the numbers in `x = 33:53` satisfy the condition `x > 28) || (x < 59)`? For example, if `x = 33` then `(33 > 28) || (33 < 59)` is executed. The answer is `TRUE`. So answer `x = 33` is added in the answer and all other numbers are similarly verified. Similarly the condition `x > 28) || (x < 59)` is checked.

Hence option b is correct.

23. The command `x[(x > 20) & (x < 50)]` shows only those elements of `x` which are more than 20 and less than 50. The explanation is the same as in question 22.

Hence option a is correct.

24. Assign `x = 53:97` then the conditions `(x > 92) && (x < 85)` and `(x > 92) || (x < 85)` are checked. This results in `FALSE` and `TRUE` respectively.

Hence option d is correct.

25. After assigning `x = 3:7,` the conditions `(x > 2) || (x < 5)` is checked and finally, `x[(x > 2) || (x < 5)]` returns those values of x which satisfies the condition. This results `3 4 5 6 7` as the output because all these values satisfy the condition.

Hence option c is correct.