

## Homework: Module 1

Due 10AM on Tuesday 1/16/24 via canvas upload.

Please read

- the canvas assignment directions before submitting your homework.
- Homework FAQ canvas page

1. (12 points) Short Answer. *You can turn in the answer only. No R code is needed*

(a) Suppose we have two vectors:

```
> v<-4:9
```

```
> y<-c(TRUE,FALSE,TRUE)
```

What is the result of  $v-2*y$  ?

Answer (a) :

2 5 4 5 8 7

(b) What truth value is returned by the R command  $!(0<3) \mid (4==7)$  ?

Answer (b) :

False

(c) Suppose I define the following matrix in R:

```
> M<-matrix(1:100,nrow=10)
```

Write down the number of rows and number of columns for the matrix  $M[c(-1,-3),4:8]$

Answer (C) :

Above scenario gives 8 rows and 5 columns matrix. Here is the output from R console :

|      | [,1] | [,2] | [,3] | [,4] | [,5] |
|------|------|------|------|------|------|
| [1,] | 32   | 42   | 52   | 62   | 72   |
| [2,] | 34   | 44   | 54   | 64   | 74   |
| [3,] | 35   | 45   | 55   | 65   | 75   |
| [4,] | 36   | 46   | 56   | 66   | 76   |
| [5,] | 37   | 47   | 57   | 67   | 77   |
| [6,] | 38   | 48   | 58   | 68   | 78   |
| [7,] | 39   | 49   | 59   | 69   | 79   |
| [8,] | 40   | 50   | 60   | 70   | 80   |

(d) In R, we have the following:

```
> x<-10  
> g<-function(y){  
+ x<-2  
+ 11*x+4*cos(pi*y)  
+ }
```

After running the above lines, what are the values of  $g(9)$  and  $x+4$  ?

Answer (d) :

$g(9)$  Values is 18 and  $x+4$  Value is 14

2. (14 points) Answer each question and use R for each part.

*Include the R commands in your HW 1 R script file submitted in canvas.*

- (a) Create a vector  $X$  with 16 different even integers between  $-20$  and  $20$ . (*Feel free to include  $-20$  and/or  $20$  in vector  $X$ , if desired.*) Define  $Y$  to be  $X^2 - 5X$ .
- (b) Find the maximum value of  $Y$ .
- (c) Find the minimum value of  $Y$ .
- (d) Find the sum of the 16 values in vector  $Y$ .
- (e) How many (out of 16) of the values in  $Y$  are negative?

Answer 2:

- (a)  $x <- \text{seq}(\text{from} = -20, \text{to} = 20, \text{by} = 2)[1:16]$   
 $y <- x^2 - 5*x$
- (b) 500
- (c) -6
- (d) 2160
- (e) 2

3. (4 points) Use R to calculate the sum  $\sum_{n=1}^{20} 2^n = 2^1 + 2^2 + 2^3 + \dots + 2^{20}$ .

*Include the R commands in your HW 1 R script file submitted in canvas.*

Answer 3

2097150

4. (20 points) Write an R script for parts (a), (b) and (c). (see next page) Run the script and hand in your R execution results.

*Include the R commands in your HW 1 R script file submitted in canvas.*

(a) Create a matrix  $A$  with 25 rows, 2 columns, and all entries equal 1.

(b) Reassign the first column of  $A$  so that the entry in the  $k$ th row and first column is:  $2k$ .

That is, the row  $k$ , column 1-entry of  $A$  is reassigned to  $2k$  for  $k = 1, 2, 3, \dots, 25$ . (c) Using a for() loop, reassign the entries of the second column of  $A$  as follows:

- For odd  $k$ , reassign row  $k$ , column 2 of  $A$  as:  $\sqrt{k}$ .

- For even  $k$ , reassign row  $k$ , column 2 of  $A$  as:  $\int_e^k \log t \, dt$ .

*This is the log with base  $e = \exp(1)$ . You may want to use \$value at the end of the line.*

Hint: The operator %% gives remainder after division and may be used to determine even and odd. For instance:

```
> 4%%2
```

```
[1] 0
```

```
> 5%%2
```

```
[1] 1
```

#### Answer 4

(A) code:

```
matrix_A <- matrix(1, nrow = 25, ncol = 2)
```

(B) code:

```
matrix_A <- matrix(1, 1, nrow = 25, ncol = 2)
```

```
matrix_A[, 1] <- 2 * (1:25)
```

( c) code:

```
for (k in 1:25)
{
  if (k %% 2 != 0)
  { matrix_A[k, 2] <- sqrt(k)
  }
  else {
    matrix_A[k, 2] <- integrate(log, lower = exp(1), upper = k)$value
  }
}

print(matrix_A)
```