Solutions to Module 1 Homework

Problem 1 (40 points) Choose the answers in the following question.

(a) What is the class of the object defined be vec <-c(5,TRUE) ?

• Numeric

• Integer

• Matrix

• Logical

Answer: The Class of the object is Numeric.

(b) Suppose I have vectors x <- 1:4 and y <- 1:2. What is the result of the expression x + y?

• A numeric vector with the values 1, 2, 5, 7

• A numeric vector with the values 2, 4, 2, 4

• An integer vector with the values 2, 4, 4, 6

• An error

Answer: • An integer vector with the values 2, 4, 4, 6

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

fsin<-function(x) sin(pi*x)

What will be returned by fsin(1) ?

• The number 0 is returned

• The number 1 is returned

• A warning is given with no value returned

• An error is returned because 'pi' is not specified in the call to 'fsin'.

Answer: the value returned is 1.224606e-16. This value sin(pi) is 0.

(d) What is returned by the R command c(1,2) %*% t(c(1,2)) ?

- The number 5
- A one by two matrix
- **A two by two matrix**
- An error is returned because the dimensions mismatch

Answer: • A two by two matrix

(e) Suppose I define the following function in R:

```
f <- function(x) {
 g <- function(y) {
 y + z
 }
 z <- 4
 x + g(x)
}
```

If I then run in R the following statements

```
z <- 15
f(3)
```

What value is returned?

- 16
- 7
- **10**
- 4

Answer: the value returned is 10

Problem 2 (20 points)

Use R to calculate $\sum_{x=1}^{1000} x^2 = 1^2 + 2^2 + \ldots + 1000^2$.

Please hand in your R commands and the results you produce by running those commands.

Answer:
```
> x=1:1000
> y<-sum(x^2)
[1] 333833500
```

Question 3 (40 points)

Write an R script that does all of the following:

a) Create a vector X of length 20, with the kth element in X = 2k, for k=1…20. Print out the values of X.

Answer:

```
v=(1:20)
k<-v
X<-(2*k)
print(X)
```

b) Create a vector Y of length 20, with all elements in Y equal to 0. Print out the values of Y

Answer:

```
Y<-rep(0,20)
print (Y)
```

c) Using a for loop, reassigns the value of the k-th element in Y, for k = 1…20. When k < 12, the kth element of Y is reassigned as the cosine of k. When the k ≥ 12, the kth element of Y is reassigned as the value of integral $\int_0^k \sqrt{t}dt$

Answer:

```
integrand<-function(t)sqrt(t)
for(K in 1:20){
   if (k < 12) {
     Y[k] = cos(k)}
   else  {
    Y[k]<-integrate(integrand, lower=0, upper=k)
         }
}
print (Y)
```