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ITA0448 Statistics with R programming

Assignment 2 day 2

SET 1

1. Will the following code return any error? State the reason behind your answer and explain the logic behind the code

```
val &lt;- numeric()
result &lt;- vector(&quot;list&quot;,  length(val))
for (index in 1:length(val)) {
result[index] &lt;- val[index] ^ 2
}
```

ANSWER:

The code will not return any error.

The code initializes an empty numeric vector val, and then creates a list of length val called result using the vector function. The for loop iterates over the indices of val, and for each index, it assigns the

squared value of the corresponding element in val to the corresponding element in result.

However, since val is empty, the loop will not execute any iterations, and result will remain a list of length zero. To avoid this, val should be initialized with some values before running the loop.

2. What is the value of equation1(3) for the following R code and explain the logic.

```
&gt; num &lt;- 4
&gt; equation1  &lt;- function (val)
+ {
+ num &lt;- 3
+ num^3 + g (val)
+ }
&gt; equation2  &lt;- function (val)
+ {
+ val*num
+ }
}
```

ANSWER:

The given R code defines two functions equation1 and equation2.

The equation1 function takes an argument val and returns the result of the expression num^3 + g(val), where num is defined as a local variable within the function and assigned a value of 3, and g(val) is assumed to be a function that takes val as an argument and returns some value. Since g(val) is not defined within the equation1 function, this code would result in an error if called as it is.

On the other hand, the equation2 function takes an argument val and returns the result of the expression val * num, where num is the global variable defined outside both functions and assigned a value of 4.

So, if we call equation1(3), the function first assigns num a local value of 3 and then calculates num^3 + g(3). Since g(val) is undefined, this function would result in an error.

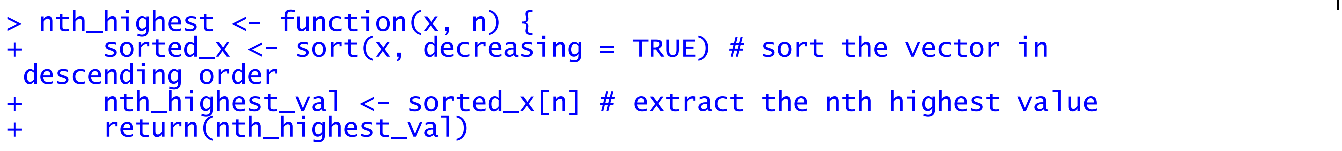
If we call equation2(3), the function returns the value 3 * 4 = 12, as num is the global variable defined outside both functions and assigned a value of 4. Therefore, the value of equation2(3) is 12.

3. Write R function to find nth highest value of a vector in the R program.

PROGRAM:

```
 nth_highest <- function(x, n) {
  sorted_x <- sort(x, decreasing = TRUE) # sort the vector in descending order
  nth_highest_val <- sorted_x[n] # extract the nth highest value
  return(nth_highest_val)
}
```

OUTPUT:



```
> nth_highest <- function(x, n) {
+     sorted_x <- sort(x, decreasing = TRUE) # sort the vector in
 descending order
+     nth_highest_val <- sorted_x[n] # extract the nth highest value
+     return(nth_highest_val)
```

5. Write R Program to find maximum and minimum value of a given vector using contr
ol
statement.

PROGRAM:

```
# Define a vector of values
vector <- c(5, 8, 2, 10, 4, 7)

# Set the initial values for max and min
max_value <- vector[1]
min_value <- vector[1]

# Use a for loop to iterate through the vector and update max and min values
for (i in 2:length(vector)) {
  if (vector[i] > max_value) {
    max_value <- vector[i]
  }
  if (vector[i] < min_value) {
    min_value <- vector[i]
  }
}

# Print the results
cat("Maximum value:", max_value, "\n")
cat("Minimum value:", min_value, "\n")
```

OUTPUT:

```
> # Define a vector of values
> vector <- c(5, 8, 2, 10, 4, 7)
> 
> # Set the initial values for max and min
> max_value <- vector[1]
> min_value <- vector[1]
> 
> # Use a for loop to iterate through the vector and update max and min values
> for (i in 2:length(vector)) {
+     if (vector[i] > max_value) {
+         max_value <- vector[i]
+     }
+     if (vector[i] < min_value) {
+         min_value <- vector[i]
+     }
+ }
```

```
>
> # Print the results
> cat("Maximum value:", max_value, "\n")
Maximum value: 10
> cat("Minimum value:", min_value, "\n")
Minimum value: 2
```

SET 2

1. Create the following matrices (i) Square Matrix (ii) Identity Matrix (iii)diagonal Matrix

ANSWER:

(i) Square Matrix

PROGRAM:

```
# Create a square matrix of size 3x3
square_matrix <- matrix(c(1, 2, 3, 4, 5, 6, 7, 8, 9), nrow = 3, ncol = 3)
# Print the matrix
square_matrix
```

OUTPUT:

```
> # Create a square matrix of size 3x3
> square_matrix <- matrix(c(1, 2, 3, 4, 5, 6, 7, 8, 9), nrow = 3, ncol = 3)
> # Print the matrix
> square_matrix
     [,1] [,2] [,3]
[1,]    1    4    7
[2,]    2    5    8
[3,]    3    6    9
```

(ii) Identity Matrix

PROGRAM:

```
# Create an identity matrix of size 3x3
identity_matrix <- diag(3)

# Print the matrix
identity_matrix
```

OUTPUT:

```
> # Create an identity matrix of size 3x3
> identity_matrix <- diag(3)
> 
> # Print the matrix
> identity_matrix
     [,1] [,2] [,3]
[1,]    1    0    0
[2,]    0    1    0
[3,]    0    0    1

> 
```

(iii)diagonal Matrix

PROGRAM:

```
# Create a diagonal matrix of size 3x3
diagonal_matrix <- diag(c(1, 2, 3))

# Print the matrix
diagonal_matrix
```

OUTPUT:

```
> # Create a diagonal matrix of size 3x3
> diagonal_matrix <- diag(c(1, 2, 3))
> 
> # Print the matrix
> diagonal_matrix
     [,1] [,2] [,3]
[1,]    1    0    0
[2,]    0    2    0
[3,]    0    0    3
```

2. Using sapply, check that all elements of the list are vectors of the same length. Also calculate the sum of each element.

PROGRAM:

```
# Example list
my_list <- list(c(1, 2, 3), c(4, 5, 6), c(7, 8, 9))
```

```
# Check if all elements of the list are vectors of the same length
if (length(unique(sapply(my_list, length))) == 1) {
  print("All elements of the list are vectors of the same length")
} else {
  print("Elements of the list are not vectors of the same length")
}

# Calculate the sum of each element using sapply
sums <- sapply(my_list, sum)

# Print the sums
Sums
```

OUTPUT

```
> # Example list
> my_list <- list(c(1, 2, 3), c(4, 5, 6), c(7, 8, 9))
> 
> # Check if all elements of the list are vectors of the same length
> if (length(unique(sapply(my_list, length))) == 1) {
+     print("All elements of the list are vectors of the same length")
+ } else {
+     print("Elements of the list are not vectors of the same length")
+ }
[1] "All elements of the list are vectors of the same length"
> 
> # Calculate the sum of each element using sapply
> sums <- sapply(my_list, sum)
> 
> # Print the sums
> sums
[1]  6 15 24
```

3. We found out that the blood pressure instrument is under-recording each measure and all measurement incorrect by 0.1. How would you add 0.1 to all values in the blood vector?

PROGRAM:

```
# Example vector
blood_pressure <- c(120, 130, 140, 150, 160)

# Add 0.1 to all values in the vector
blood_pressure <- blood_pressure + 0.1

# Print the updated vector
blood_pressure
```

OUTPUT:

```
> # Example vector
> blood_pressure <- c(120, 130, 140, 150, 160)
>
> # Add 0.1 to all values in the vector
> blood_pressure <- blood_pressure + 0.1
>
> # Print the updated vector
> blood_pressure
[1] 120.1 130.1 140.1 150.1 160.1
```

4. We found out that the first patient is 33 years old. How would you change the first element of the vector age to 33 years?

PROGRAM:

```
# Example vector
age <- c(25, 30, 35, 40, 45)

# Change the first element of the vector to 33 years
age[1] <- 33

# Print the updated vector
age
```

OUTPUT:

```
> # Example vector
> age <- c(25, 30, 35, 40, 45)
>
> # Change the first element of the vector to 33 years
> age[1] <- 33
>
> # Print the updated vector
> age
[1] 33 30 35 40 45

>
```

5. Suppose A = [1 1 3 5 2 6 −2 −1 −3] (a) Check that A 3 = 0 where 0 is a 3 × 3 matrix with every entry equal to 0. (b) Replace the third column of A by the sum of the second and third columns

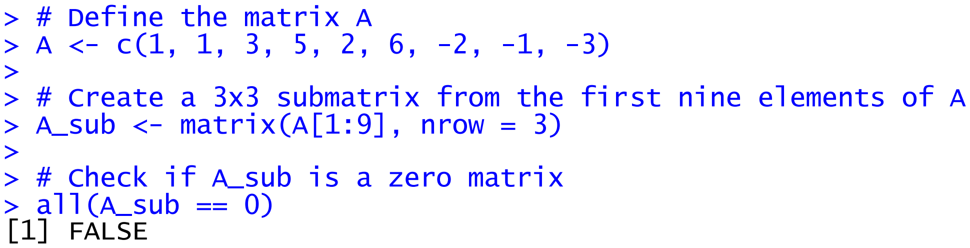
PROGRAM

```
# Define the matrix A
A <- c(1, 1, 3, 5, 2, 6, -2, -1, -3)

# Create a 3x3 submatrix from the first nine elements of A
A_sub <- matrix(A[1:9], nrow = 3)

# Check if A_sub is a zero matrix
all(A_sub == 0)
```

OUTPUT:



```
> # Define the matrix A
> A <- c(1, 1, 3, 5, 2, 6, -2, -1, -3)
> 
> # Create a 3x3 submatrix from the first nine elements of A
> A_sub <- matrix(A[1:9], nrow = 3)
> 
> # Check if A_sub is a zero matrix
> all(A_sub == 0)
[1] FALSE
```

SET 3

1.a. The numbers below are the first ten days of rainfall amounts in 1996. Read them into a vector using

the c() function

1.1 0.6 33.8 1.9 9.6 4.3 33.7 0.3 0.0 0.1

b. What was the mean rainfall, how about the standard deviation?

c. Which day saw the highest rainfall (write code to get the answer)?

d. The 26 letters of the Roman alphabet are conveniently accessible in R via letters and LETTERS. These

are not functions, but vectors that are always loaded. What is the 18th letter of the alphabet?

e. What is the last letter of the alphabet (don't guess, write code)

PROGRAM:

1.a. The numbers below are the first ten days of rainfall amounts in 1996. Read them into a vector using

the c() function
1.1 0.6 33.8 1.9 9.6 4.3 33.7 0.3 0.0 0.1

```
rainfall <- c(1.1, 0.6, 33.8, 1.9, 9.6, 4.3, 33.7, 0.3, 0.0, 0.1)
```

b) To find the mean rainfall and standard deviation, we can use the mean() and sd() functions in R, respectively:

PROGRAM:

```
mean(rainfall)   # Mean rainfall
sd(rainfall)     # Standard deviation of rainfall
```

OUTPUT:

```
[1] 7.54
[1] 13.20124
```

c) To find the day with the highest rainfall, we can use the which.max() function, which returns the index of the maximum value in a vector:

PROGRAM:

```
which.max(rainfall)  # Index of the day with the highest rainfall
```

OUTPUT:

```
[1] 3
```

d) To find the 18th letter of the alphabet, we can use the letters vector in R:

PROGRAM:

```
letters[18]
```

OUTPUT:

```
[1] "r"
```

e) To find the last letter of the alphabet, we can use the LETTERS vector in R:

PROGRAM:

```
LETTERS[26]
```

OUTPUT:

```
[1] "Z"
```