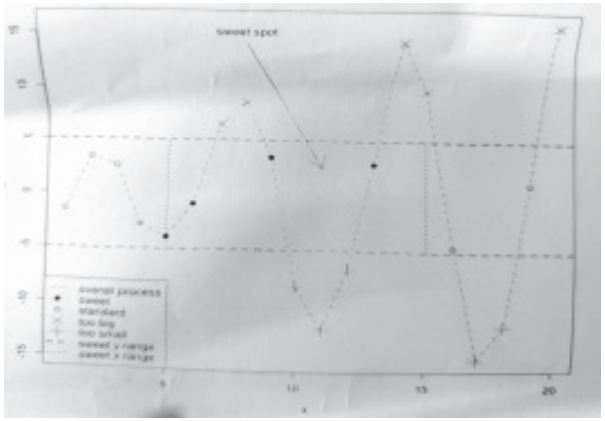
(iii) Use "flags" and the logical negation operator ! to extract the entries of "num" corresponsing to FALSE.

(iv) Overwrite the character string vector component of "oldlist" with the single character string "Don Quixote".

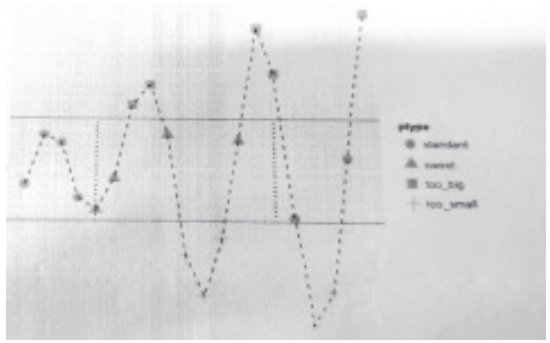
6+2+6=14

UNIT-V

9. Create the following plot using R programming. 14



10. Create the following using ggplot2 package. 14



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UG/Integrated Even Semester Examination, 2025

COMPUTER SCIENCE

(10th / 4th Semester)

Course No.: MCS-651

(Data Science)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

The figures in the right margin indicate full marks for the question. Answer any five questions selecting one from each unit.

UNIT-I

1. (a) Find the value of : 10

(i) 10^2+3*60/8–3

(ii) 2^(2+1)–4+64^((–2)^(2.25–1/4))

(iii) (0.44*(1–0.44)/34)^(1/2)

(iv) 5^3*(6–2)/(61–3+4)

(b) Compute the exponential transform of 10

(i) 2342151012900

(ii) 0.0000002533

2. (a) Using R programming 4

(i) Create an object that stores the value 3^2 x $4^{1/8}$

(ii) Overwrite your object in (i) by itself divided by 2.33. Print the result to the console.

(iii) Create a new object with the value

$-8.2x10^{-13}$

(iv) Print directly to the console the result of multoplying (ii) by (iii) 10

(b) Using R programming display the result.

(i) Repeat the vector c(3,62,8.3) thrice.

(ii) Repeat the vector c(3,62,8.3) thrice, with each element repeated 2 times. 4

UNIT-II

3. (a) Using R programming.

(i) Construct and store a 2 x 3 matrixx that's filled row-wise with the values 1, 2, 3, 4, 5 and 6 in that order.

(ii) Display the result of

R>mymat←rbind(c(1,3,4),5:3,c(100,20,90), 11:13)

R>mymat

(iii) Display the result of

R>cbind(c(1,4),c(2,5),c(3,6))

(iv) Create and store in object A, 3 x 3 matrix that's filled Col-wise with the values 0.3, 4.5, 55.3, 91, 0.1, 105.5, –4.2, 8.2, 27.9 in that order. Execute R>A[3,2] and display the result of R programming. 10

(i) Extract row elements 2 and 1 columns 2 and 3, in that order, of th logical matrix.

(ii) Use sub to overwrite "quixote" with "Quizote" and "don" with "Don" inside the list. Then using the newly overwritten list member, concatenate to the console screen the following statement exactly:

"Windmills! ATTACK!"
–\Don Quixote/-

(iii) Obtain all values from the sequence between –4 and 4 that are greater than 1.

(iv) Using which, determine which indexes in the factor vector are assigned the "MED" level.

(c) Create a new list with the factor vector from (a) as a component named "facs"; the numeric vector c(3,2,1,3,3,4,1,5,4,9) as a component namd "nums", and a nested list comprised of the first three members of the list from (a) (use list slicing to obtain this), named "oldlist". Then, do the following:

(i) Extract the elements of "facs" that correspond to elements of "nums" that are greater than or equal to 3.

(ii) Add a new member to the list namd "flags". This member should be a logical vector of length 6, obtained a a twofold repetition of the third column of the logical matrix in the "oldlist" component.

(ii) Return the elements of foo, excluding those that result in negative infinity when raised to a power of 75.

(b) Store the following 3 x 4 matrix as the object bar :

$$\begin{bmatrix} 77875.40 & 27551.45 & 23764.30 & -36478.88 \\ -35466.25 & -73333.85 & 36599.69 & -70685.69 \\ -39803.31 & 55976.34 & 76694.82 & 47032.00 \end{bmatrix}$$

Now, do the following :

(i) Identify the coordinate-specific indexes of the entries of bar that are NaN when you raise bar to a power of 65 and divide by infinity.

(ii) Return the values in bar that are NOT NaN when bar is raised to a power of 67 and infinity is added to the result. Confirm this is identical to identifying those values in bar that, when raised to a power of 67, are not equal to negative infinity.

(iii) Identify those values in bar that are either negative infinity OR finite when you raise bar to a power of 67.

5+9=14

8. (a) Create a list that contains, in this order, a sequence of 20 evenly spaced numbers between –4 and 4; a 3x3 matrix of the logical vector c(F,T,T,T,F,T,T,T,F,F) filed column-wise; a character vector with the two strings “don” and “quixote”, and a factor vector containing the observations c(“LOW”, “MED”, “LOW”, “MED”, “MED”, “HIGH”). Then do the following :

(b) Display the result of the R programming for the following (use Object A values created in question 3(a) (iv)) 4

(i) R>A[,2]

(ii) R>A[2:3,]

(iii) R>A[,c(3,1)]

(iv) R>diag(x=A)

4. (a) Calculate the following :

$$\frac{7}{2}\left(\begin{bmatrix} 1 & 2 \\ 2 & 4 \\ 7 & 6 \end{bmatrix} - \begin{bmatrix} 10 & 20 \\ 30 & 40 \\ 50 & 60 \end{bmatrix}\right)$$

(b) Store these two matrices

$$A=\begin{bmatrix} 1 \\ 2 \\ 7 \end{bmatrix} \qquad B=\begin{bmatrix} 3 \\ 4 \\ 8 \end{bmatrix}$$

Which of the following multiplicatons are possible? For thoe that are, compute the result.

(i) A, B

(ii) $A^T.B$

(iii) $B^T.\ (A.A^T)$

(iv) $(A.A^T).\ B^T$

(v) $[(B.B^T) + (A.A^T) - 100\ I_3)]^{-1}$

(c) For

$$A=\begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 5 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix}$$

Cofirm that A^{-1}, $A—I_4$ provides a 4 x 4 matrix of zeros. 2+10+2=14

UNIT-III

5. (a) Store the following vector of 15 values as an objct in your workspace :

c(6, 7, 9, 3, 6, 7, 9, 6, 3, 6, 6, 7, 1, 9, 1). Identity the following elements:

(i) Those equal to 6

(ii) Those greater than or equal to 6.

(iii) Those less than 6 + 2

(iv) Those not equal to 6

(b) Create a new vector from the one used in (a) by deleting its first three elements. With this new vector, fill a 2 x 2 x 3 array. Examine the array for the following entries :

(i) Those less than or equal to 6 divided by 2, plus 4

(ii) Those less than or equal to 6 divided by 2, plus 4, after increasing every element in the array by 2.

(c) Confirm the specific location of elements equal to 0 in the 10 x 10 identity matrix I_{10} (sec Section 3.3).

(d) Check whether any of the velues of the logical arrays created in (b) are TRUE. If they are, check whether they are all TRUE.

(e) By extracting the diagonal elements of the logical matrix created in (c), use any to confirm there are no TRUE entries.

8+3+3=14

6. (a) Store the vector c(7, 1, 7, 10, 5, 9, 10, 3, 10, 8) as foo. Identify the elements greater than 5 OR equal to 2.

(b) Store the vector c(8, 8, 4, 4, 5, 1, 5, 6, 6, 8) as bar. Identify the elements less than or equal to 6 AND not equal to 4.

(c) Identify the elements that satisfy (a) in foo AND satisfy (b) in bar.

(d) Store a third vector calld baz that is equal to the element-wise sum of foo and bar.

Determine the following :

(i) The elements of baz greater than or equal to 14 but not equal to 15.

(ii) The elements of the vector obtained via an element-wise division of baz by foo that are greater than 4 OR less than or equal to 2.

(e) Confirm that using the long version in all of the preceeding question 6 (a), (b), (c) and (d) performs only the first comparison (that is, the results each match the first entries of the previously obtained vectors).

2+2+2+6+2=14

UNIT-IV

7. (a) Store the following vector :

foo<–c(13563, –14156, –14319, 16981, 12921, 11979, 9568, 8833, –12968, 8133)

Then, do the following

(i) Output all elements of foo that, when raised to a power of 75, are NOT infinite.