

General Instructions

- Maintain a proper observation of the experiments you perform in lab sessions.
- Keep your code with proper hierarchical structure for your future reference.

Experiment 1

Write a C program that accepts two inputs - A (datatype: int) and B (datatype: char) and prints patterns. Sample patterns below: a) *Input* A = 4, B = '*', b) *Input* A = 3, B = '#'

```

a)      *  *  *  *
        *  *  *
        *  *
        *

b)      #  #  #
        #  #  #
        #  #  #
        #
  
```

Experiment 2

In this experiment, we will write a C program that sorts an array of integers. Note: There exist much faster algorithms than the one described below:

- Write a function that computes the largest element in the segment of the array, 'arr', i.e., the function must be *int largest(int arr[start], int arr[end])*.
- Write a function called *swap_int(int *a, int *b)* that swaps the data in the variables *a* and *b*.
- Now, the sorting algorithm can be written as follows: first, find the largest element in the array, swap the first element with the largest and place the first element at the location of the largest element. Repeat the above by considering the array from *arr[1]* to *arr[n - 1]*. Hurray!! You have programmed the “selection sort” algorithm.

Test case

- Goto the Generate Vector
- Set the following parameters: Number of vector elements=25, Lower Bound=1, Upper Bound=100, Separate row vector by symbol = “ ”.

Experiment 3

In the field of Time series analysis, one of the basic methods that helps understand the seasonal trend in the data is finding its Moving Average. A simple look at how it works through an example is given below:

Data	Moving Average	Seasonal Trend
120		
200	$\frac{120+200+246}{3}=188.66$	$188.66-200 = -11.34$
246	200	46
154	206	-52
220		

Write a C program that accepts the inputs 1)an array (datatype: float) of length 'n' 2) season length 'b' (In the above example, season length was taken as 3) and prints the **Moving Average** and **Seasonal trend**.

Test case

- Use the following time series data:
[83.255, 83.256, 83.03, 82.702, 82.24, 82.096, 82.69, 81.745, 82.185, 82.645, 81.769, 82.745, 81.374, 82.78, 81.522, 79.511, 79.351, 78.965, 77.598, 76.535, 75.928, 75.52, 74.556, 74.486]
- The above data is the monthly average of the cost conversion from USD to INR

Experiment 4

1) Write a C program that computes the following operations on the matrix A of size $M \times M$ (datatype: float).

- **Trace of the matrix:** Sum of the diagonal entries
- Max element of the matrix
- Write a function that computes the sum of each row, stores it in a 1D array, and returns the maximum of that array. This is called the **1-norm of the matrix A**.

2) Write a C program that calculates A^2 . Modify the program to check whether the matrix is Idempotent (i.e., $A^2 = A$).

Test case

- Goto the website Generate Matrix
- Set the following parameters: Number of rows=25, Number of Columns=25, Lower Bound=1, Upper Bound=100.