Subject: PRF192 - Programming Fundamental with C
Workshop 3

Objectives:

In this workshop, you will:

- To understand how to manipulate and process arrays in C.
- To practice using functions for modular programming: data input, search, display, and calculations.
- To implement a search function that allows users to find a specific number within the array.
- To perform basic calculations on the array such as sum, average, maximum, and minimum values.
- To display results clearly and efficiently.

Problem Overview:

In this problem, the user is required to manage an array of numbers and perform various tasks on it. The program should allow the user to:

1. **Input Data**: The user will input a set of numbers and store them in an array.
2. **Display Data**: Display the contents of the array.
3. **Search Function**: Search for a specific number within the array and return the index where it is located.
4. **Calculations**:
   - Calculate the sum of all elements in the array.
   - Calculate the average of the array elements.
   - Find the maximum and minimum values in the array.
5. **Output**: The program should output the results of the display, search, and calculations.

Situation Description:

This problem can be related to real-world scenarios, such as:

- **Sales Data**: A store might need to input sales data for different products over the month, display the data, search for specific sales values, and calculate the total and average sales.
- **Grades Data**: A teacher might want to calculate the average score of students in a class, find the highest and lowest grades, and search for specific student scores.

- **Weather Data**: A meteorologist could use the program to input temperature readings for a week, search for specific days, and calculate the average and extremes.

The ability to manipulate and process arrays effectively is critical in many data-driven applications.

Syntax Use in the Problem:

1. **Array Declaration**: Arrays are used to store the list of numbers that the user inputs.
2. **Functions**: The program is divided into functions that perform specific tasks, such as input, display, search, and calculation.
3. **Loops:**
   - `for` loops will be used to iterate over the array for tasks such as input, searching, displaying, and calculating.
4. **Conditional Statements**:
   - `if` and `else` statements will be used to check whether the search value is found and for handling conditions like checking if the array is empty.
5. **Basic Arithmetic Operations**: Simple arithmetic is used to calculate the sum, average, and extremes of the array values.

Specific Requirements:

1. **Input**:
   - The user must input the number of elements in the array (within the range of 1 to 100).
   - The user will then input the actual values of the array elements.
2. **Display**:
   - After the user inputs the data, the program will display all the values in the array.
3. **Search**:
   - The program will allow the user to input a value to search for in the array.
   - The program will display the index of the value if found; if not found, it will display a message saying the value is not present.
4. **Calculations**:
   - The program should calculate:

- **Sum**: The sum of all elements.
- **Average**: The average of the elements.
- **Maximum and Minimum**: The maximum and minimum values from the array.

5. **Modular Programming**:
   - Each task (input, display, search, and calculations) will be handled by separate functions, making the program clear, maintainable, and reusable.
6. **Edge Case Handling**:
   - The program should handle an empty array or an array with only one element.
   - It should also validate the input for correct number of elements.

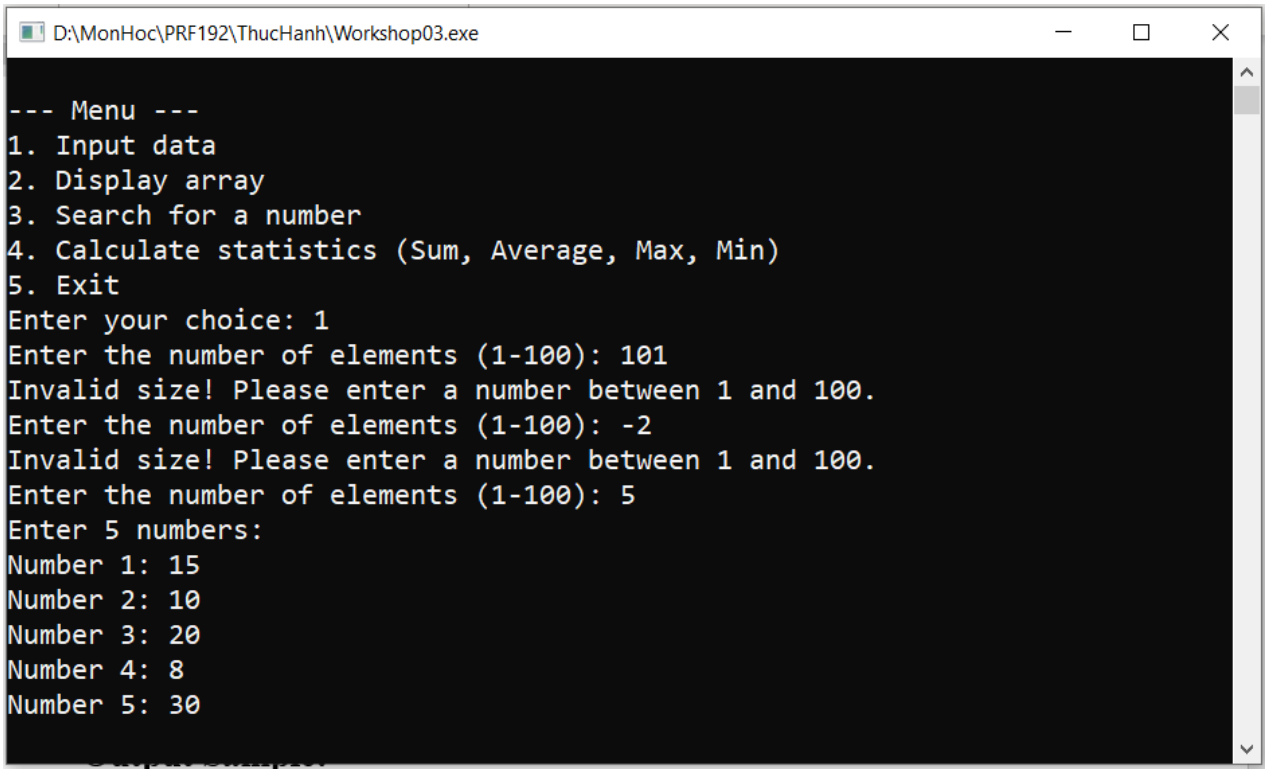
Hint: Code Design

```c
#include <stdio.h>

#define MAX_SIZE 100

// Function prototypes
void inputArray(int arr[], int *size);
void displayArray(int arr[], int size);
int searchValue(int arr[], int size, int target);
void calculateStatistics(int arr[], int size);

int main() {
    int arr[MAX_SIZE], size = 0, target, index, choice;

    // Menu loop
    do {
        // Display the menu
        printf("\n--- Menu ---\n");
        printf("1. Input data\n");
        printf("2. Display array\n");
        printf("3. Search for a number\n");
        printf("4. Calculate statistics (Sum, Average, Max, Min)\n");
        printf("5. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch(choice) {
            case 1:
                // Input data
                inputArray(arr, &size);
                break;
            case 2:
                // Display array
                if (size > 0) {
                    displayArray(arr, size);
                } else {
                    printf("No data to display. Please input data first.\n");
                }
                break;
```

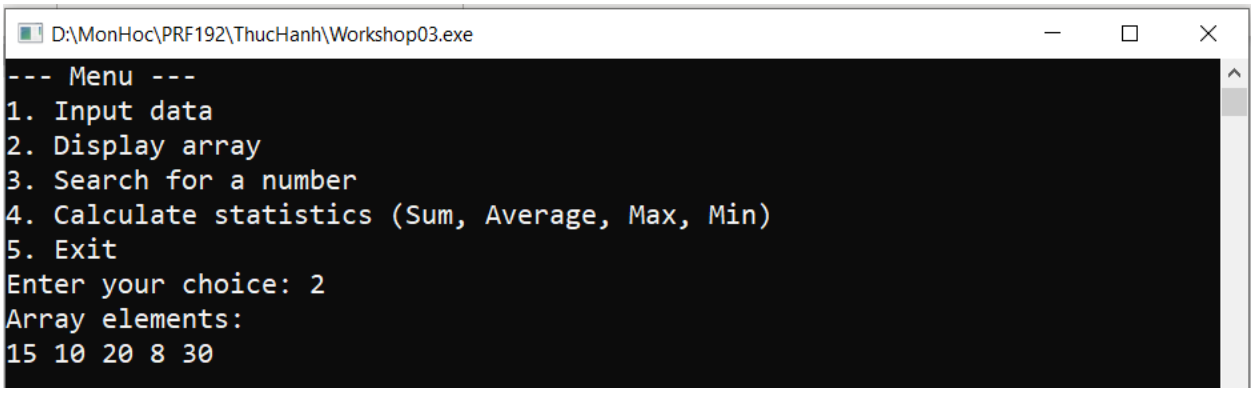
```c
            case 3:
                // Search for a number
                if (size > 0) {
                    printf("Enter the number you want to search for: ");
                    scanf("%d", &target);
                    index = searchValue(arr, size, target);
                    if (index == -1) {
                        printf("The number %d is not found in the array.\n", target);
                    } else {
                        printf("The number %d is found at index %d.\n", target, index);
                    }
                } else {
                    printf("No data available to search. Please input data first.\n");
                }
                break;
            case 4:
                // Calculate statistics
                if (size > 0) {
                    calculateStatistics(arr, size);
                } else {
                    printf("No data available to calculate statistics. Please input data first.\n");
                }
                break;
            case 5:
                // Exit
                printf("Exiting the program.\n");
                break;
            default:
                printf("Invalid choice. Please try again.\n");
        }
    } while (choice != 5);

    return 0;
}

// Function to input array data
void inputArray(int arr[], int *size) {
    // ...
}

// Function to display array elements
void displayArray(int arr[], int size) {
    // ...
}

// Function to search for a value in the array
int searchValue(int arr[], int size, int target) {
    // ...
}

// Function to calculate and display statistics (sum, average, max, min)
void calculateStatistics(int arr[], int size) {
    // ...
}
```

Output Sample:

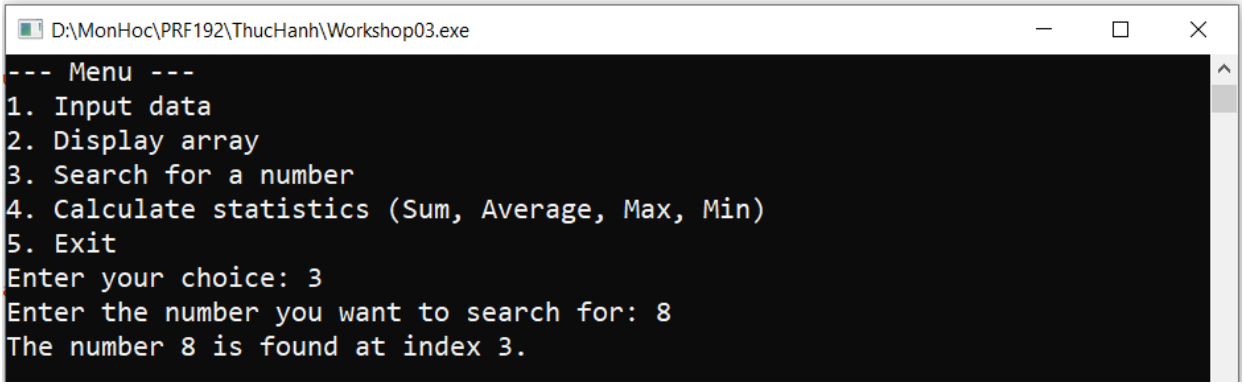
1. Input Data



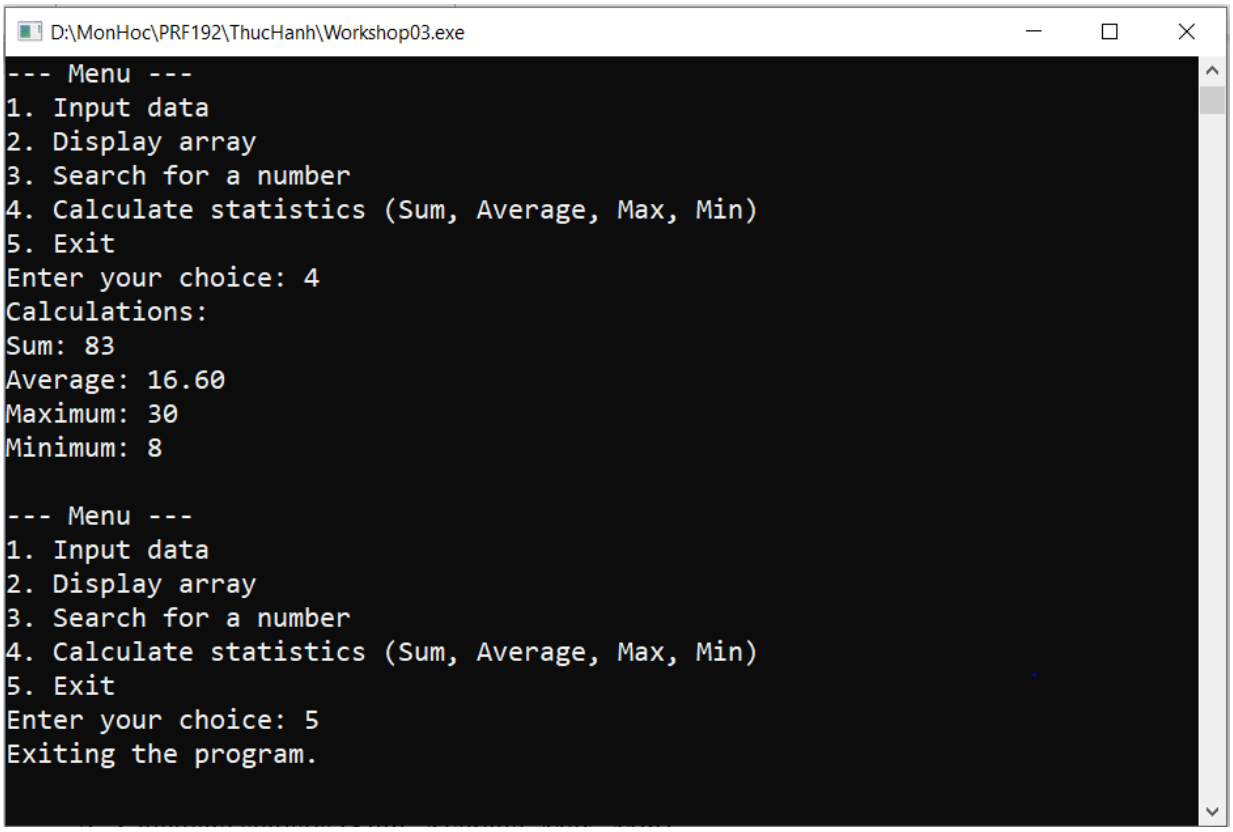
2. Display array



3. Search for a number



4. Calculate statistis (Sum, Average, Max, Min) and Exit Program


D:\MonHoc\PRF192\ThucHanh\Workshop03.exe
--- Menu ---
1. Input data
2. Display array
3. Search for a number
4. Calculate statistics (Sum, Average, Max, Min)
5. Exit
Enter your choice: 4
Calculations:
Sum: 83
Average: 16.60
Maximum: 30
Minimum: 8
--- Menu ---
1. Input data
2. Display array
3. Search for a number
4. Calculate statistics (Sum, Average, Max, Min)
5. Exit
Enter your choice: 5
Exiting the program.