C PROGRAMMING ASSIGNMENT 2

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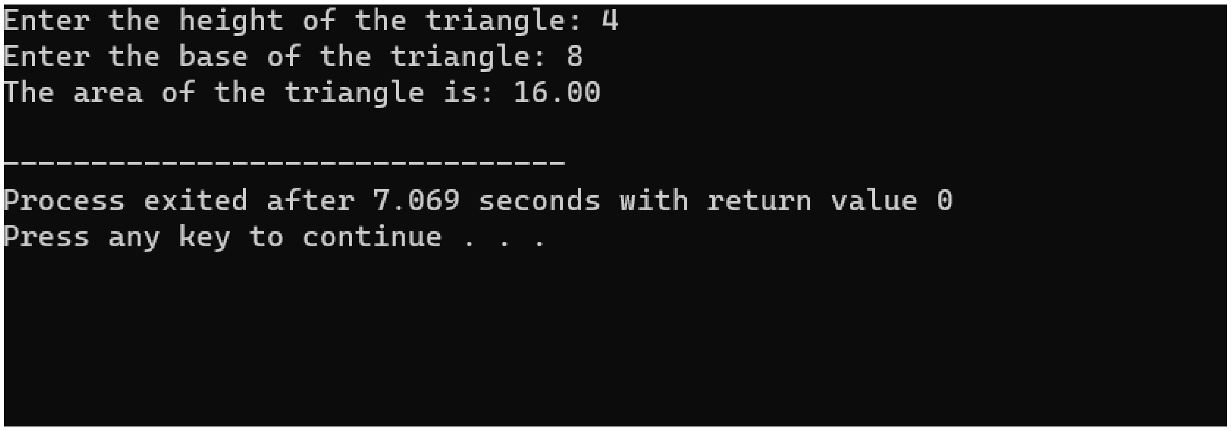
WORKSHEET WEEK 1

Q1. Write a program to accept height and base of triangle and calculate area of Triangle Note: area =(h*b)/2.

Ans

```
#include <stdio.h>
int main() {
   float height, base;


printf("Enter the height of the triangle: ");
scanf("%f", &height);
printf("Enter the base of the triangle: ");
scanf("%f", &base);


   float area = (height * base) / 2;
printf("The area of the triangle is: %.2f\n", area);


   return 0;
}
```

Output



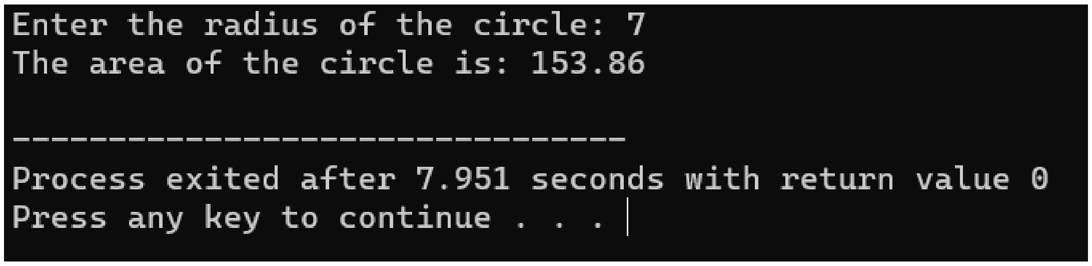
```
Enter the height of the triangle: 4
Enter the base of the triangle: 8
The area of the triangle is: 16.00

--------------------------------
Process exited after 7.069 seconds with return value 0
Press any key to continue . . .
```

Q.2 Write a program to accept radius of circle and calculate area of circle Note: area =pi * r2

Ans.

```
#include <stdio.h>

#include <math.h>


#define PI 3.14


int main() {


   float radius;


printf("Enter the radius of the circle: ");

scanf("%f", &radius);


   float area = PI * pow(radius, 2);

printf("The area of the circle is: %.2f\n", area);


   return 0;

}
```

Output



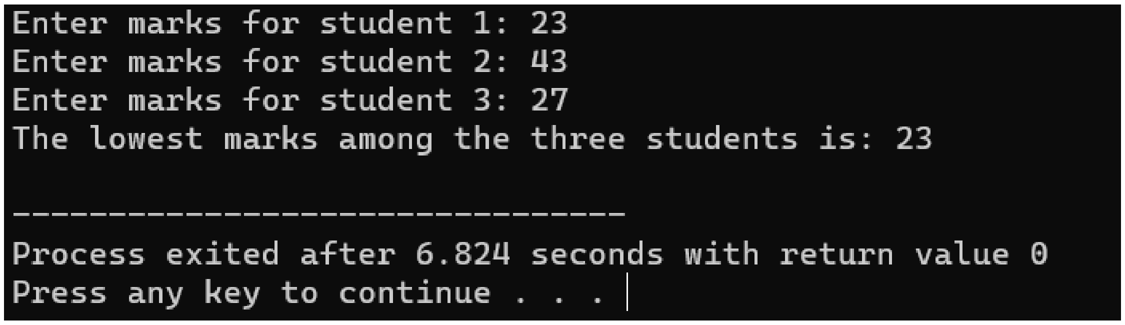
```
Enter the radius of the circle: 7
The area of the circle is: 153.86

--------------------------------
Process exited after 7.951 seconds with return value 0
Press any key to continue . . .
```

Q. Write a program to find the lowest marks of three students using conditional operator.

Ans.

```
#include <stdio.h>

int main() {

   int marks1, marks2, marks3;
printf("Enter marks for student 1: ");
scanf("%d", &marks1);

printf("Enter marks for student 2: ");
scanf("%d", &marks2);
printf("Enter marks for student 3: ");
scanf("%d", &marks3);

  int lowestMarks = (marks1 < marks2) ? ((marks1 < marks3) ? marks1 : marks3) : ((marks2 < marks3) ?
marks2 : marks3);
printf("The lowest marks among the three students is: %d\n", lowestMarks);

   return 0;
}
```

Output

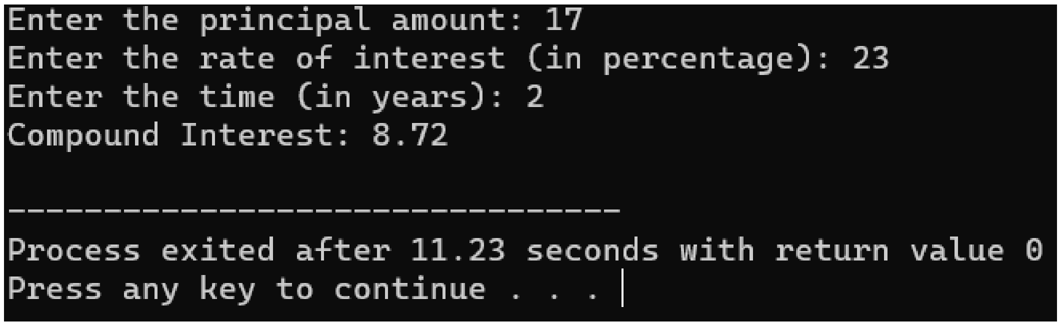

```
Enter marks for student 1: 23
Enter marks for student 2: 43
Enter marks for student 3: 27
The lowest marks among the three students is: 23

--------------------------------
Process exited after 6.824 seconds with return value 0
Press any key to continue . . .
```

Q. Write a program to Calculate Compound Interest.

Ans.

```
#include <stdio.h>

#include <math.h>


int main() {

   float principal, rate, time, compoundInterest;


printf("Enter the principal amount: ");

scanf("%f", &principal);

printf("Enter the rate of interest (in percentage): ");

scanf("%f", &rate);

printf("Enter the time (in years): ");

scanf("%f", &time);


compoundInterest = principal * pow((1 + rate / 100), time) - principal;


printf("Compound Interest: %.2f\n", compoundInterest);


   return 0;

}
```

Output



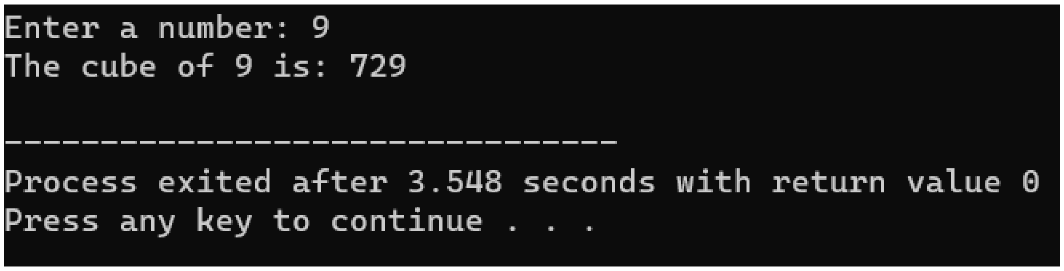
```
Enter the principal amount: 17
Enter the rate of interest (in percentage): 23
Enter the time (in years): 2
Compound Interest: 8.72

--------------------------------
Process exited after 11.23 seconds with return value 0
Press any key to continue . . .
```

Q5. Write a program to Calculate Cube of a Number.

Ans.

```
#include <stdio.h>


int main() {


   int number, cube;


printf("Enter a number: ");

scanf("%d", &number);

   cube = number * number * number;

printf("The cube of %d is: %d\n", number, cube);


   return 0;

}
```

Output



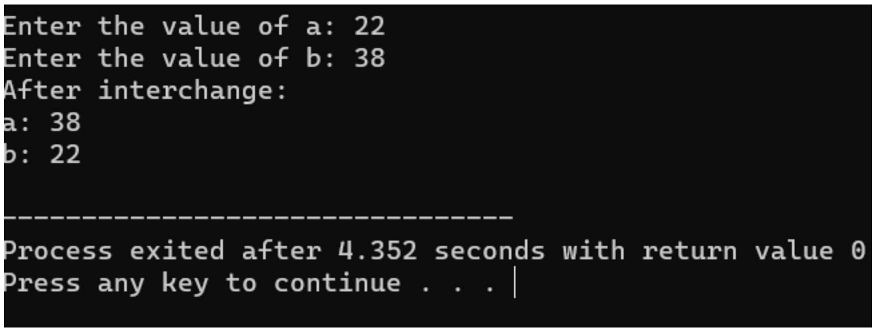
```
Enter a number: 9
The cube of 9 is: 729

--------------------------------
Process exited after 3.548 seconds with return value 0
Press any key to continue . . .
```

WORKSHEET WEEK 2

Q.1 Write a program to interchange two values by using Assignment Operator.

Ans.

```
#include <stdio.h>

int main() {


   int a, b;


printf("Enter the value of a: ");

scanf("%d", &a);

printf("Enter the value of b: ");

scanf("%d", &b);


   a = a + b;
   b = a - b;
   a = a - b;
printf("After interchange:\n");
printf("a: %d\n", a);
printf("b: %d\n", b);

   return 0;
}
```

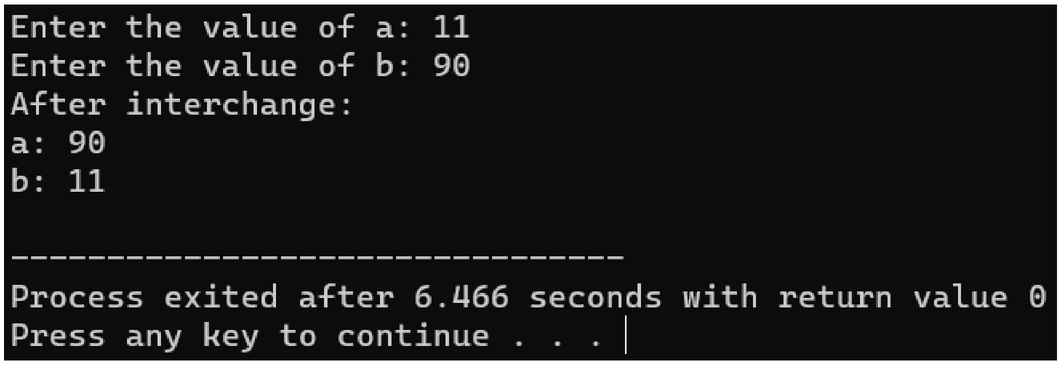


```
Enter the value of a: 22
Enter the value of b: 38
After interchange:
a: 38
b: 22

--------------------------------
Process exited after 4.352 seconds with return value 0
Press any key to continue . . .
```

Q. Write a program to interchange two values by using Arithmetic Operator.

Ans.

```
#include <stdio.h>

int main() {
   int a, b;
printf("Enter the value of a: ");
scanf("%d", &a);
printf("Enter the value of b: ");
scanf("%d", &b);

   a = a + b;
   b = a - b;
   a = a - b;
printf("After interchange:\n");
printf("a: %d\n", a);

printf("b: %d\n", b);


   return 0;

}
```



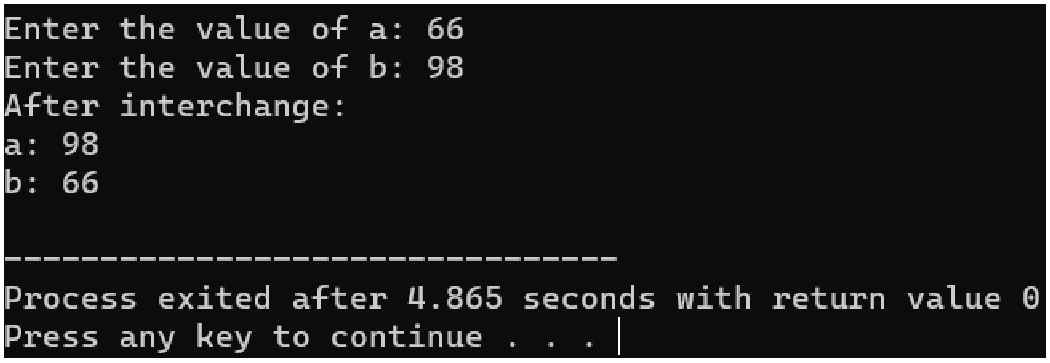
```
Enter the value of a: 11
Enter the value of b: 90
After interchange:
a: 90
b: 11

--------------------------------
Process exited after 6.466 seconds with return value 0
Press any key to continue . . .
```

Q. Write a program to interchange two values by using Bitwise Operator.

Ans.

```
#include <stdio.h>


int main() {

   int a, b;


printf("Enter the value of a: ");

scanf("%d", &a);


printf("Enter the value of b: ");

scanf("%d", &b);


   a = a ^ b;

   b = a ^ b;
```

```
    a = a ^ b;

printf("After interchange:\n");

printf("a: %d\n", a);

printf("b: %d\n", b);


    return 0;

}
```



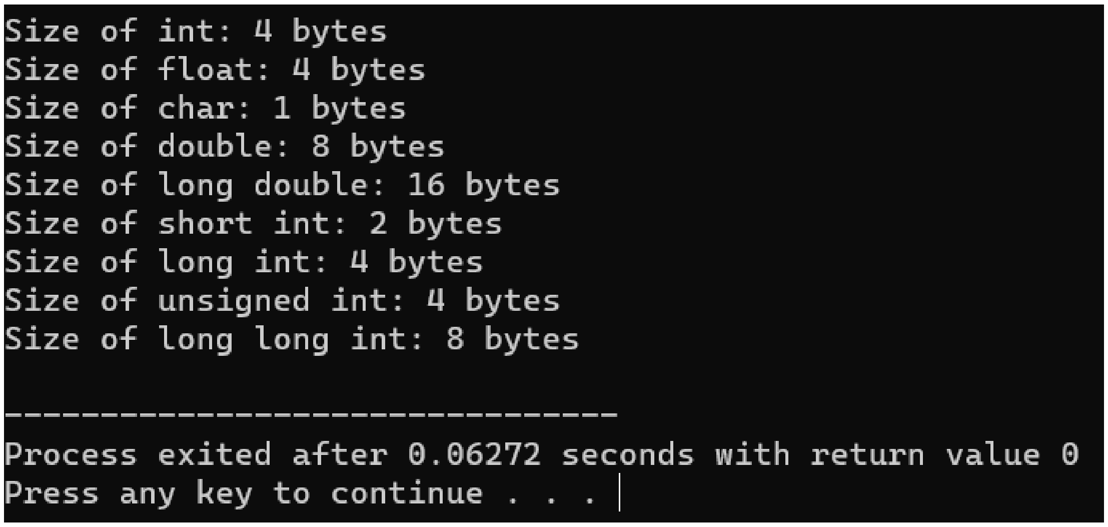
```
Enter the value of a: 66
Enter the value of b: 98
After interchange:
a: 98
b: 66

--------------------------------
Process exited after 4.865 seconds with return value 0
Press any key to continue . . .
```

Q. Write a program to find the size of all data types (Int, Float, Char, Double, Long Double, Short Int etc.).

Ans.

```
#include <stdio.h>


int main() {

printf("Size of int: %lu bytes\n", sizeof(int));

printf("Size of float: %lu bytes\n", sizeof(float));

printf("Size of char: %lu bytes\n", sizeof(char));

printf("Size of double: %lu bytes\n", sizeof(double));

printf("Size of long double: %lu bytes\n", sizeof(long double));

printf("Size of short int: %lu bytes\n", sizeof(short int));

printf("Size of long int: %lu bytes\n", sizeof(long int));

printf("Size of unsigned int: %lu bytes\n", sizeof(unsigned int));

printf("Size of long long int: %lu bytes\n", sizeof(long long int));
```

```
   return 0;

}
```



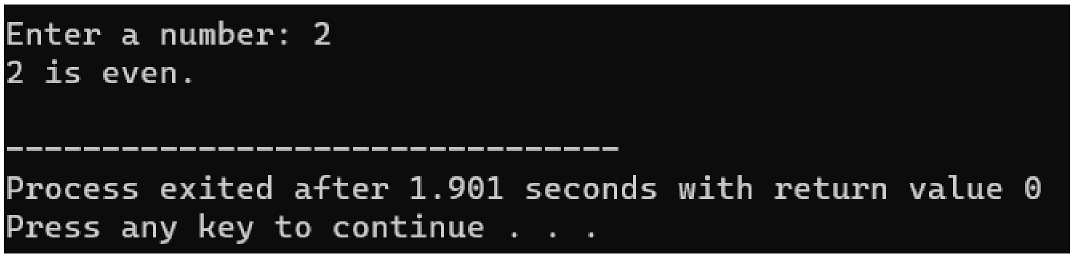
```
Size of int: 4 bytes
Size of float: 4 bytes
Size of char: 1 bytes
Size of double: 8 bytes
Size of long double: 16 bytes
Size of short int: 2 bytes
Size of long int: 4 bytes
Size of unsigned int: 4 bytes
Size of long long int: 8 bytes

--------------------------------
Process exited after 0.06272 seconds with return value 0
Press any key to continue . . .
```

Q. Write a program to find out whether input number is even or odd without using arithmetic operators.

Ans.

```
#include <stdio.h>


int isEven(int num) {

   // Using bitwise AND operator to check the least significant bit

   return (num & 1) == 0;

}


int main() {

   int number;


   // Prompt user for input

printf("Enter a number: ");

scanf("%d", &number);
```

```
   // Check if the number is even or odd using the isEven function
   if (isEven(number)) {
printf("%d is even.\n", number);
   } else {
printf("%d is odd.\n", number);
   }
   return 0;
}
```



```
Enter a number: 2
2 is even.

--------------------------------
Process exited after 1.901 seconds with return value 0
Press any key to continue . . .
```

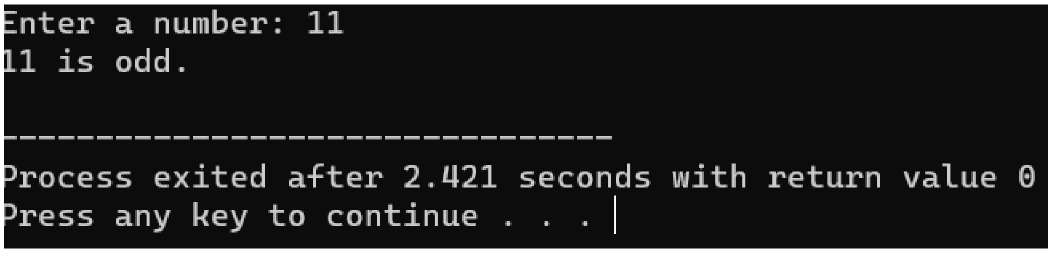
WORKSHEET WEEK 3

Q. Write a C program to check whether a given number is even or odd.

Ans.

```
#include <stdio.h>


int main() {
   int number;
printf("Enter a number: ");
scanf("%d", &number);


   if (number % 2 == 0) {
printf("%d is even.\n", number);
   } else {
printf("%d is odd.\n", number);
   }
```

```
    return 0;

}
```



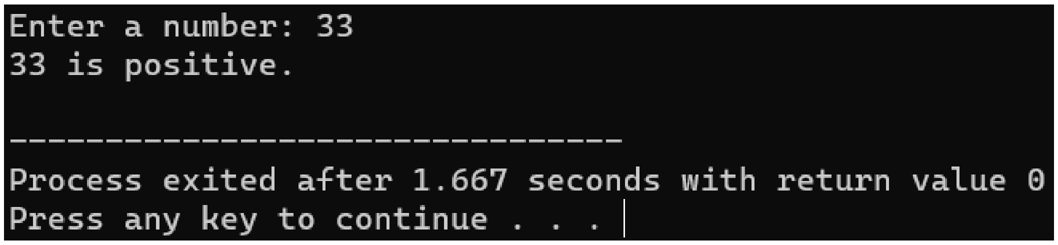
```
Enter a number: 11
11 is odd.

--------------------------------
Process exited after 2.421 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to check whether a given number is positive or negative.

Ans.

```
#include <stdio.h>


int main() {

    int number;

printf("Enter a number: ");

scanf("%d", &number);


    if (number > 0) {

printf("%d is positive.\n", number);

    } else if (number < 0) {

printf("%d is negative.\n", number);

    } else {

printf("The number is zero.\n");
```

```
   }
   return 0;
}
```



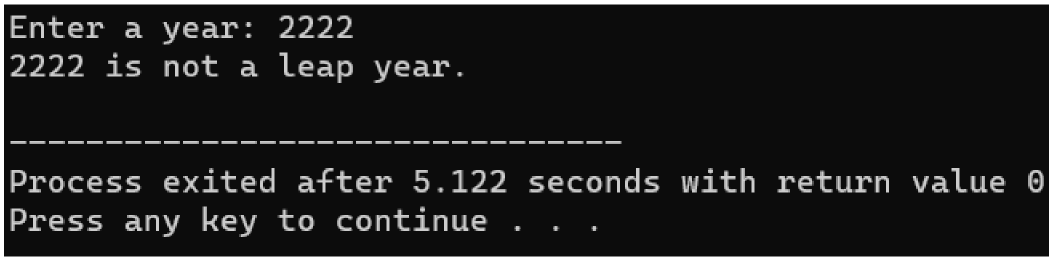
```
Enter a number: 33
33 is positive.

--------------------------------
Process exited after 1.667 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to find whether a given year is a leap year or not.

Ans.

```
#include <stdio.h>

int main() {
   int year;

printf("Enter a year: ");
scanf("%d", &year);

      if ((year % 4 == 0 && year % 100 != 0) || (year % 400 == 0)) {
printf("%d is a leap year.\n", year);
   } else {
printf("%d is not a leap year.\n", year);
   }
```

```
    return 0;

}
```

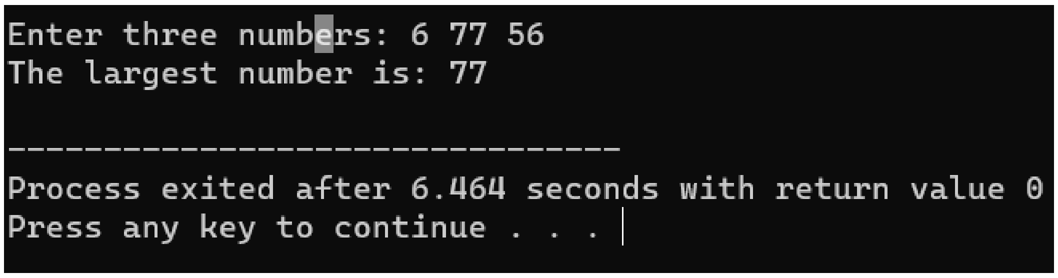


```
Enter a year: 2222
2222 is not a leap year.

--------------------------------
Process exited after 5.122 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to find the largest of three numbers.

Ans.

```
#include <stdio.h>


int main() {

    int num1, num2, num3;

printf("Enter three numbers: ");

scanf("%d %d %d", &num1, &num2, &num3);

    int largest = (num1 > num2) ? ((num1 > num3) ? num1 : num3) : ((num2 > num3) ? num2 : num3);


printf("The largest number is: %d\n", largest);


    return 0;

}
```



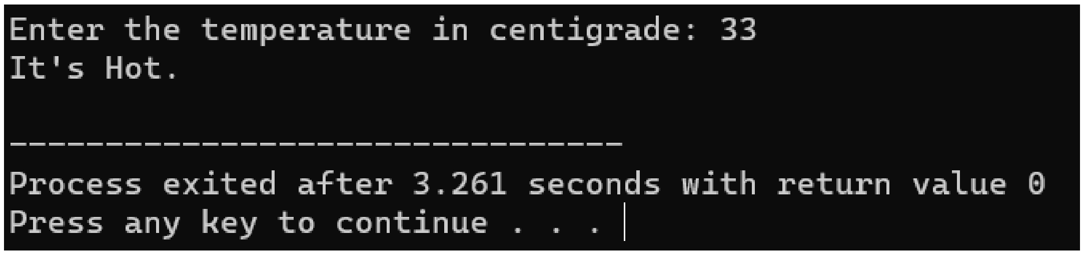
```
Enter three numbers: 6 77 56
The largest number is: 77

--------------------------------
Process exited after 6.464 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to read temperature in centigrade and display a suitable message.

Ans.

```
#include <stdio.h>

int main() {

   float temperature;


printf("Enter the temperature in centigrade: ");

scanf("%f", &temperature);

   if (temperature < 0) {

printf("Freezing weather.\n");

   } else if (temperature >= 0 && temperature <= 10) {

printf("Very Cold weather.\n");

   } else if (temperature > 10 && temperature <= 20) {

printf("Cold weather.\n");
```

```
    } else if (temperature > 20 && temperature <= 30) {
printf("Normal in Temp.\n");
    } else if (temperature > 30 && temperature <= 40) {
printf("It's Hot.\n");
    } else {
printf("It's Very Hot.\n");
    }
    return 0;
}
```



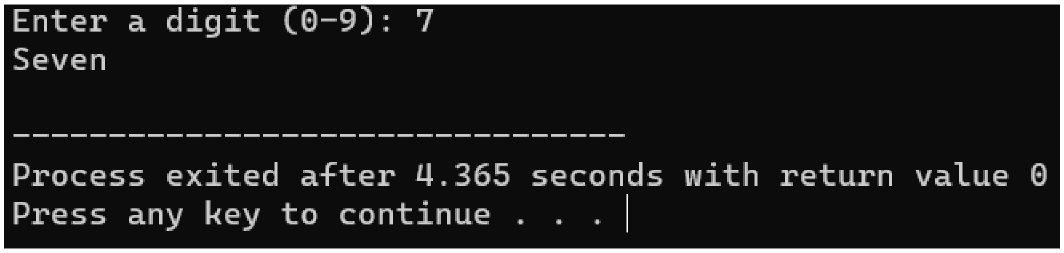
```
Enter the temperature in centigrade: 33
It's Hot.

--------------------------------
Process exited after 3.261 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to read any digit and display it in the word.

Ans

```
#include <stdio.h>

int main() {
    int digit;

printf("Enter a digit (0-9): ");
scanf("%d", &digit);

    switch (digit) {
        case 0:
printf("Zero\n");
            break;
    case 1:
printf("One\n");
      break;
    case 2:
printf("Two\n");
      break;
    case 3:
printf("Three\n");
      break;
    case 4:
printf("Four\n");
      break;
    case 5:
printf("Five\n");
      break;
    case 6:
printf("Six\n");
      break;
    case 7:
printf("Seven\n");
      break;
    case 8:
printf("Eight\n");
      break;
    case 9:
printf("Nine\n");
      break;
    default:
printf("Invalid digit\n");
```

```
   }


   return 0;
}
```



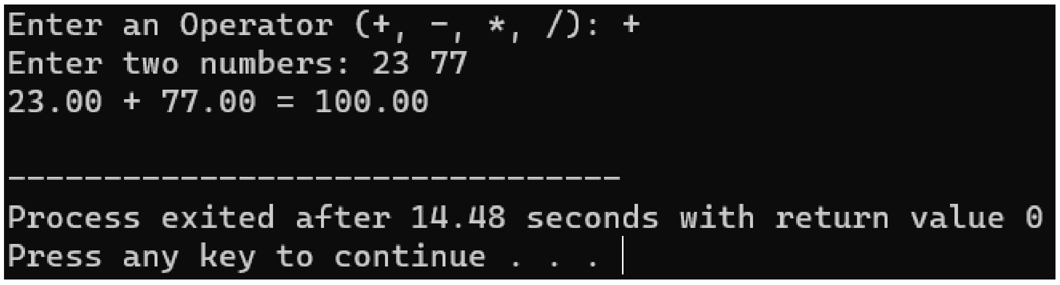
```
Enter a digit (0-9): 7
Seven

--------------------------------
Process exited after 4.365 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to create a Simple Calculator using a switch case.

Ans

```
#include <stdio.h>


int main() {
   char Operator;
   double num1, num2;


printf("Enter an Operator (+, -, *, /): ");
scanf(" %c", &Operator);


printf("Enter two numbers: ");
scanf("%lf %lf", &num1, &num2);
```

```
   switch (Operator) {
      case '+':
printf("%.2f + %.2f = %.2f\n", num1, num2, num1 + num2);
         break;
      case '-':
printf("%.2f - %.2f = %.2f\n", num1, num2, num1 - num2);
         break;
      case '*':
printf("%.2f * %.2f = %.2f\n", num1, num2, num1 * num2);
         break;
      case '/':
         if (num2 != 0) {
printf("%.2f / %.2f = %.2f\n", num1, num2, num1 / num2);
         } else {
printf("Error! Division by zero.\n");
         }
         break;
      default:
printf("Invalid Operator.\n");
   }

   return 0;
}
```



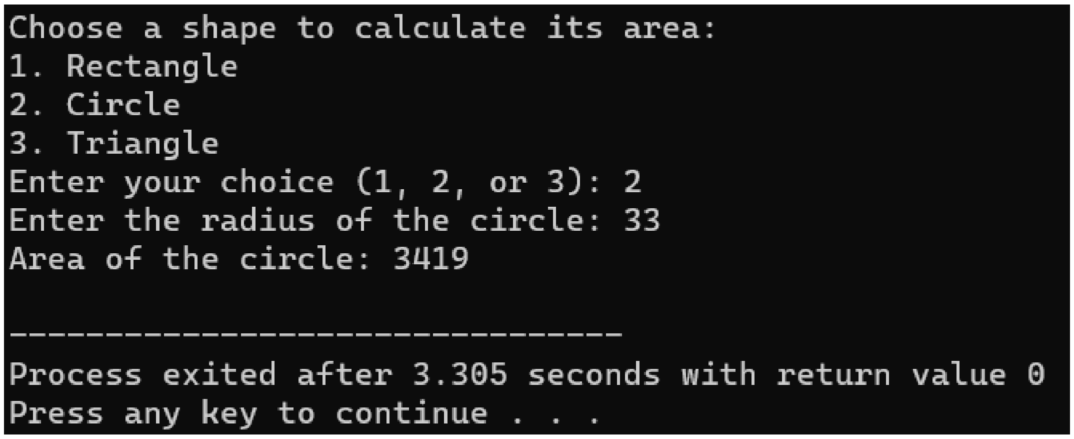
```
Enter an Operator (+, -, *, /): +
Enter two numbers: 23 77
23.00 + 77.00 = 100.00

--------------------------------
Process exited after 14.48 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program using C Switch…Case to Calculate the Area of Rectangle/Circle/Triangle.

Ans.

```
#include <stdio.h>


#define PI 3.14


int main() {
   int choice;
   int area, base, height, radius;


printf("Choose a shape to calculate its area:\n");
printf("1. Rectangle\n");
printf("2. Circle\n");
printf("3. Triangle\n");
printf("Enter your choice (1, 2, or 3): ");
scanf("%d", &choice);

    switch (choice) {
        case 1:

printf("Enter the length of the rectangle: ");
scanf("%d", &base);
printf("Enter the width of the rectangle: ");
scanf("%d", &height);
            area = base * height;
printf("Area of the rectangle: %d\n", area);
            break;

        case 2:

printf("Enter the radius of the circle: ");
scanf("%d", &radius);
            area = PI * radius * radius;
printf("Area of the circle: %d\n", area);
            break;

        case 3
printf("Enter the base of the triangle: ");
scanf("%d", &base);
printf("Enter the height of the triangle: ");
scanf("%d", &height);
            area = base * height / 2;
printf("Area of the triangle: %d\n", area);
```

```
          break;


        default:
printf("Invalid choice. Please enter 1, 2, or 3.\n");
    }
    return 0;
}
```

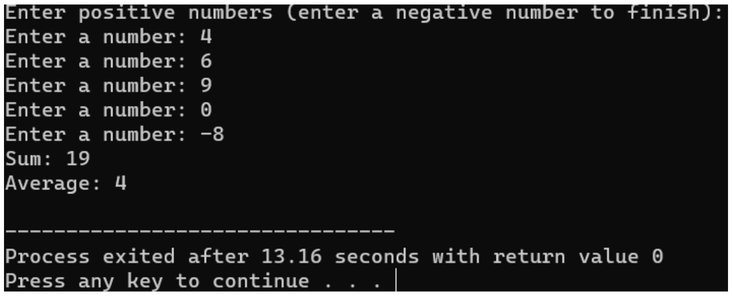


```
Choose a shape to calculate its area:
1. Rectangle
2. Circle
3. Triangle
Enter your choice (1, 2, or 3): 2
Enter the radius of the circle: 33
Area of the circle: 3419

--------------------------------
Process exited after 3.305 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to calculate the sum and average of positive numbers.

Ans.

```
#include <stdio.h>
int main() {
    int num, count = 0, sum = 0;
printf("Enter positive numbers (enter a negative number to finish):\n");
    while (1) {
printf("Enter a number: ");
scanf("%d", &num);
        if (num < 0) {
          break;
        }
        sum += num;
        count++;
    }

    if (count > 0) {

        int average = sum / count;

printf("Sum: %d\n", sum);

printf("Average: %d\n", average);

    } else {

printf("No positive numbers were entered.\n");

    }

    return 0;

}
```

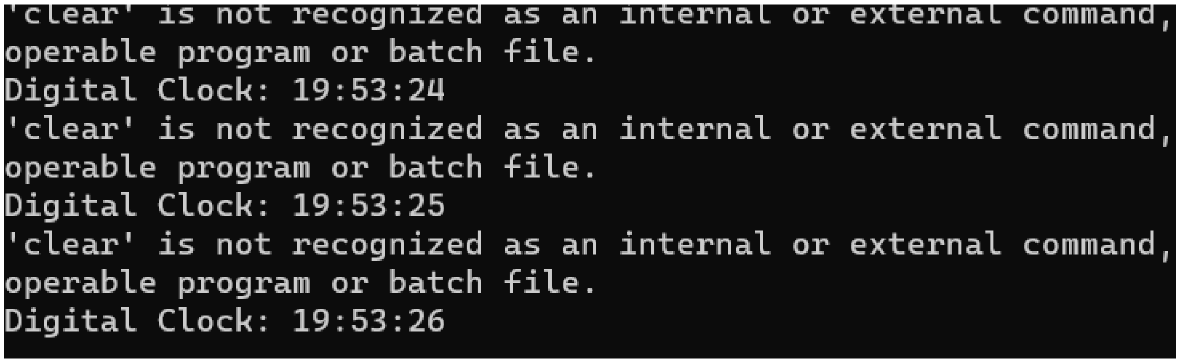


```
Enter positive numbers (enter a negative number to finish):
Enter a number: 4
Enter a number: 6
Enter a number: 9
Enter a number: 0
Enter a number: -8
Sum: 19
Average: 4

--------------------------------
Process exited after 13.16 seconds with return value 0
Press any key to continue . . .
```

Q.

Ans.

```
#include <stdio.h>

#include <stdlib.h>

#include <unistd.h>

#include <time.h>


int main() {

    int hours, minutes, seconds;


    while (1) {

        system("clear");

time_t now;

        time(&now);
        hours = (now / 3600) % 24;

        minutes = (now / 60) % 60;

        seconds = now % 60;

printf("Digital Clock: %02d:%02d:%02d\n", hours, minutes, seconds);

sleep(1);

    }


    return 0;

}
```



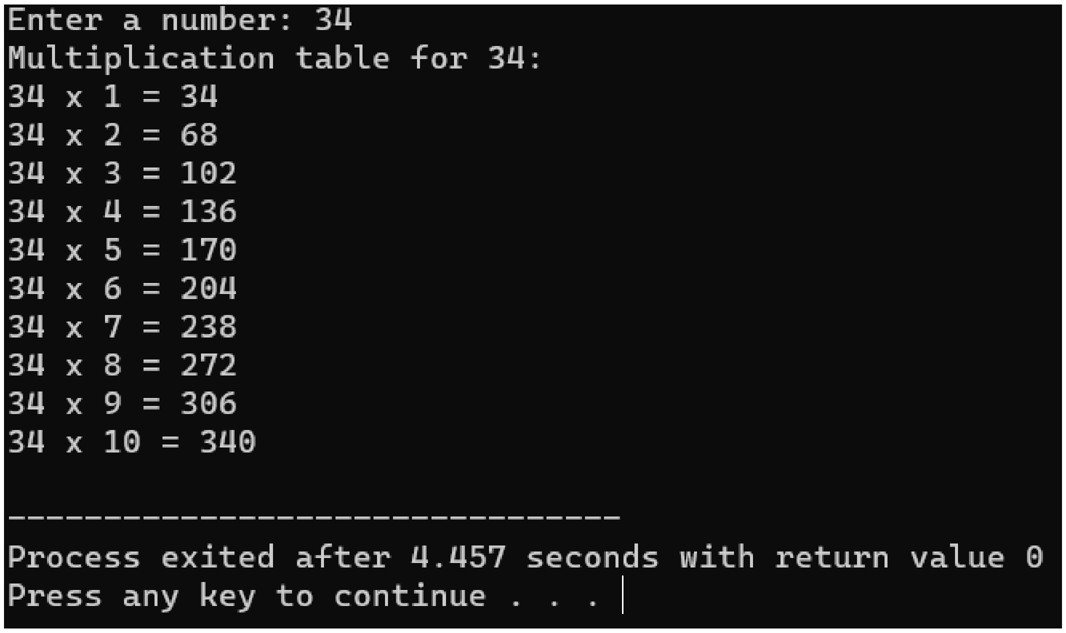
```
'clear' is not recognized as an internal or external command,
operable program or batch file.
Digital Clock: 19:53:24
'clear' is not recognized as an internal or external command,
operable program or batch file.
Digital Clock: 19:53:25
'clear' is not recognized as an internal or external command,
operable program or batch file.
Digital Clock: 19:53:26
```

WORKSHEET WEEK 4

Q. Write a C program to print multiplication table of a number.

Ans.

```
#include <stdio.h>


int main() {
   int num, i;


printf("Enter a number: ");
scanf("%d", &num);


printf("Multiplication table for %d:\n", num);
   for (i = 1; i<= 10; ++i) {
printf("%d x %d = %d\n", num, i, num * i);
   }


   return 0;
}
```

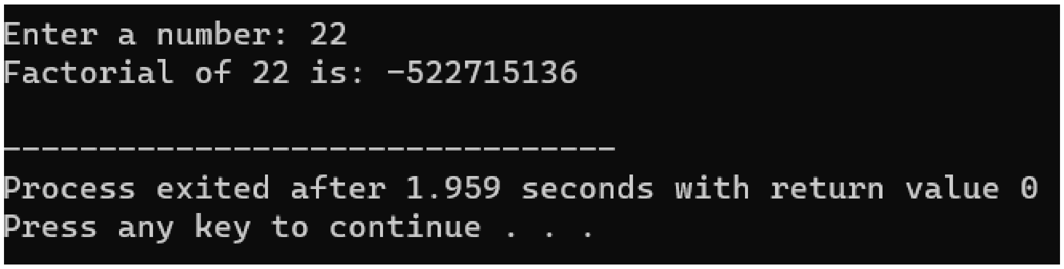


```
Enter a number: 34
Multiplication table for 34:
34 x 1 = 34
34 x 2 = 68
34 x 3 = 102
34 x 4 = 136
34 x 5 = 170
34 x 6 = 204
34 x 7 = 238
34 x 8 = 272
34 x 9 = 306
34 x 10 = 340

--------------------------------
Process exited after 4.457 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to calculate factorial of a number.

Ans.

```
#include <stdio.h>
int factorial(int n) {
  if (n == 0 || n == 1) {
    return 1;
  } else {
    return n * factorial(n - 1);
  }
}
int main() {
  int num;
printf("Enter a number: ");
scanf("%d", &num);
printf("Factorial of %d is: %d\n", num, factorial(num));
  return 0;
}
```



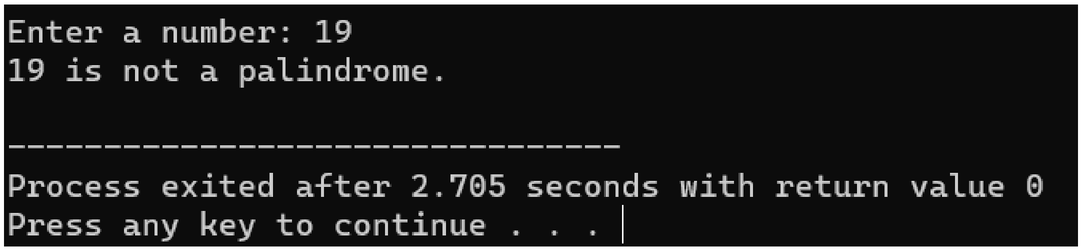
```
Enter a number: 22
Factorial of 22 is: -522715136

--------------------------------
Process exited after 1.959 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to check whether a number is palindrome or not.

Ans.

```
#include <stdio.h>
int isPalindrome(int num) {
    int reversed = 0, original = num;
    while (num != 0) {
        reversed = reversed * 10 + num % 10;
        num /= 10;
    }
    return reversed == original;
}
int main() {
    int num;
printf("Enter a number: ");
scanf("%d", &num);
    if (isPalindrome(num)) {
printf("%d is a palindrome.\n", num);
```

```
    } else {
printf("%d is not a palindrome.\n", num);
    }
    return 0;
}
```



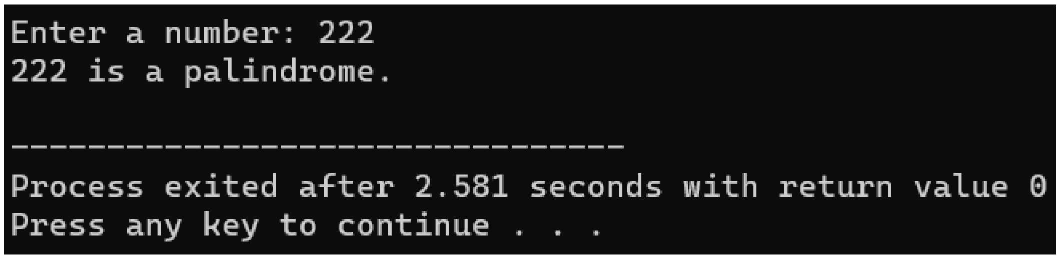
```
Enter a number: 19
19 is not a palindrome.

--------------------------------
Process exited after 2.705 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to count frequency of digits in a given number.

Ans

```
#include <stdio.h>


int isPalindrome(int num) {
    int reversed = 0, original = num;


    while (num != 0) {
        reversed = reversed * 10 + num % 10;
        num /= 10;
    }
    return reversed == original;
}
int main() {
    int num;
printf("Enter a number: ");
scanf("%d", &num);
```

```
    if (isPalindrome(num)) {
printf("%d is a palindrome.\n", num);
    } else {
printf("%d is not a palindrome.\n", num);
    }
    return 0;
}
```

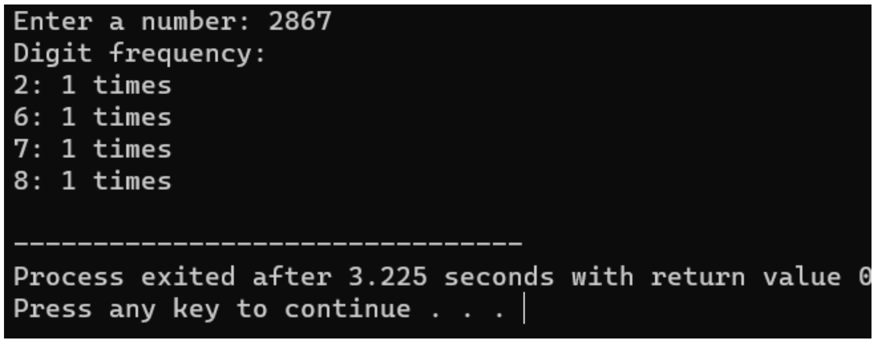


```
Enter a number: 222
222 is a palindrome.

--------------------------------
Process exited after 2.581 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to find HCF(GCD) AND LCM of two numbers.

Ans.

```
#include <stdio.h>
void countDigits(int num) {
    int count[10] = {0};
    while (num != 0) {
count[num % 10]++;
        num /= 10;
    }
printf("Digit frequency:\n");
    for (int i = 0; i< 10; ++i) {
        if (count[i] > 0) {
printf("%d: %d times\n", i, count[i]);
        }
    }
}
int main() {
    int num;

printf("Enter a number: ");

scanf("%d", &num);

countDigits(num);

    return 0;

}
```



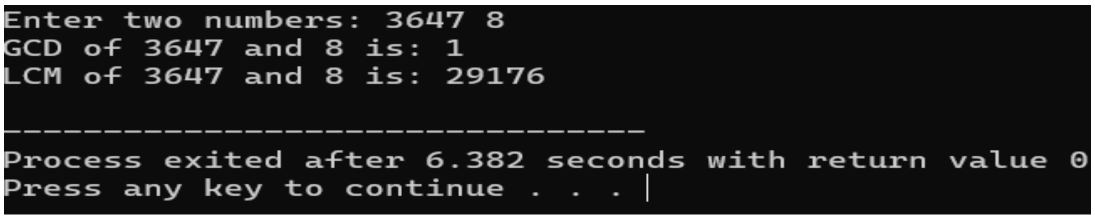
```
Enter a number: 2867
Digit frequency:
2: 1 times
6: 1 times
7: 1 times
8: 1 times

--------------------------------
Process exited after 3.225 seconds with return value 0
Press any key to continue . . .
```

Q.

Ans.

```
#include <stdio.h

int findGCD(int a, int b) {

    while (a != b) {

        if (a > b) {

            a -= b;

        } else {

            b -= a;

        }

    }

    return a;

}

int findLCM(int a, int b) {

    return (a * b) / findGCD(a, b);

}
```

```c
int main() {
   int num1, num2;
printf("Enter two numbers: ");
scanf("%d %d", &num1, &num2);
printf("GCD of %d and %d is: %d\n", num1, num2, findGCD(num1, num2));
printf("LCM of %d and %d is: %d\n", num1, num2, findLCM(num1, num2));
   return 0;
}
```

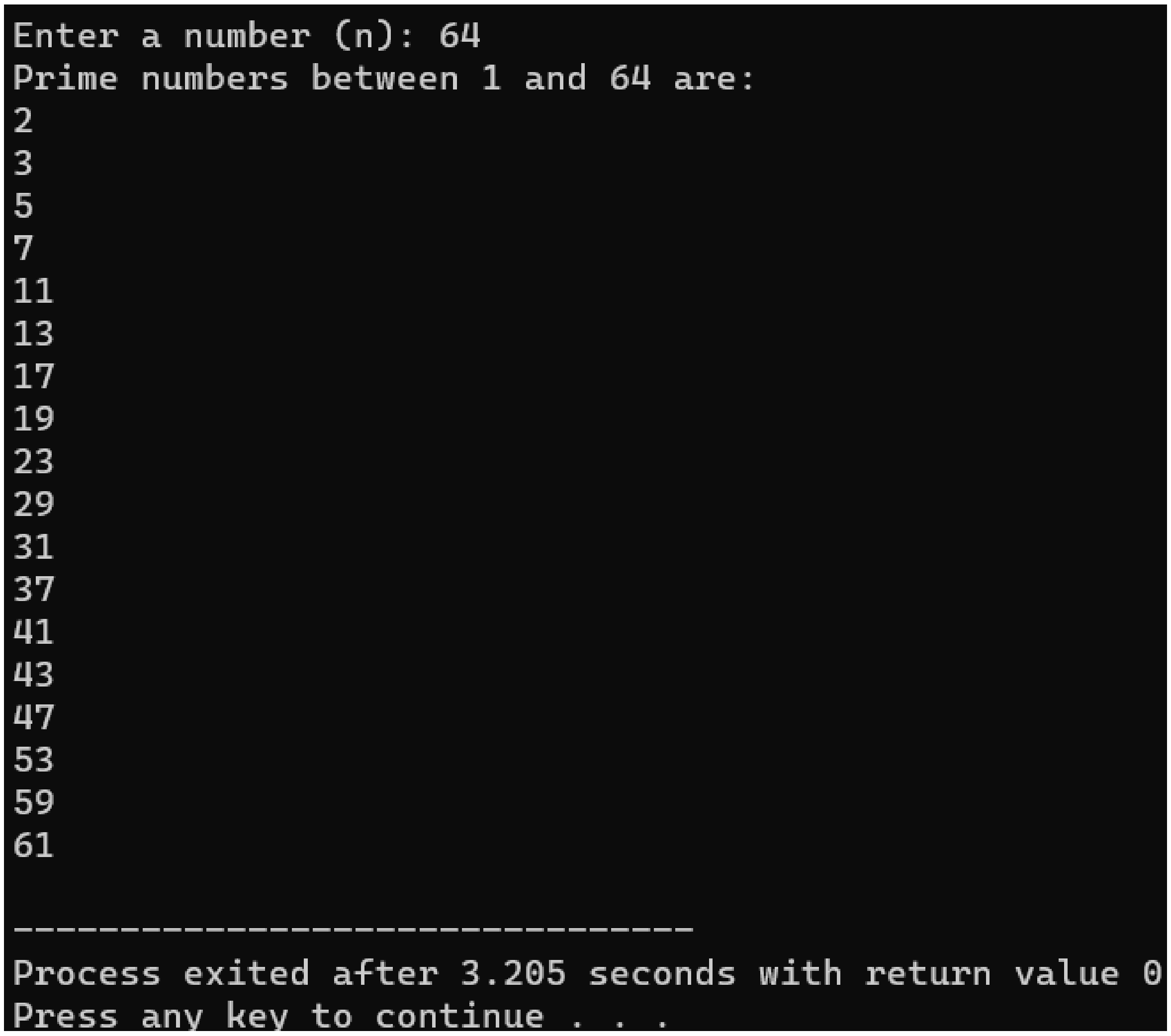


```
Enter two numbers: 3647 8
GCD of 3647 and 8 is: 1
LCM of 3647 and 8 is: 29176

--------------------------------
Process exited after 6.382 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to print all prime numbers between 1 to n.

Ans.

```c
#include <stdio.h>
int isPrime(int num) {
   if (num < 2) {
      return 0;
   }
   for (int i = 2; i * i<= num; ++i) {
      if (num % i == 0) {
         return 0;
      }
   }
   return 1;
}
int main() {
   int n;
printf("Enter a number (n): ");
scanf("%d", &n);
printf("Prime numbers between 1 and %d are:\n", n);
   for (int i = 2; i<= n; ++i) {
       if (isPrime(i)) {
printf("%d\n", i);
       }
   }
   return 0;
}
```

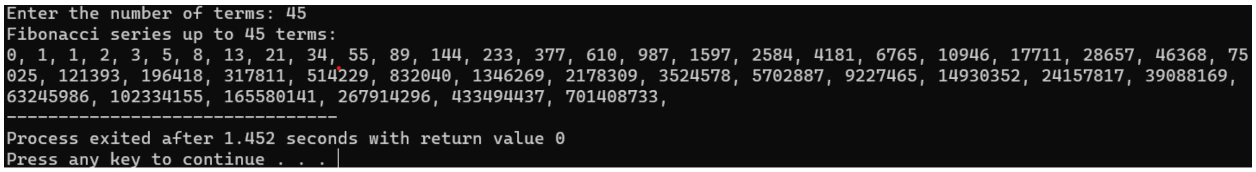


```
Enter a number (n): 64
Prime numbers between 1 and 64 are:
2
3
5
7
11
13
17
19
23
29
31
37
41
43
47
53
59
61

--------------------------------
Process exited after 3.205 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to print Fibonacci series up to n terms.

Ans.

```
#include <stdio.h>
void fibonacci(int n) {
   int a = 0, b = 1, next;
printf("Fibonacci series up to %d terms:\n", n);
   for (int i = 0; i< n; ++i) {
printf("%d, ", a);
      next = a + b;
      a = b;
      b = next;
   }
}
int main() {
   int terms;
printf("Enter the number of terms: ");
scanf("%d", &terms);
fibonacci(terms);
   return 0;
}
```

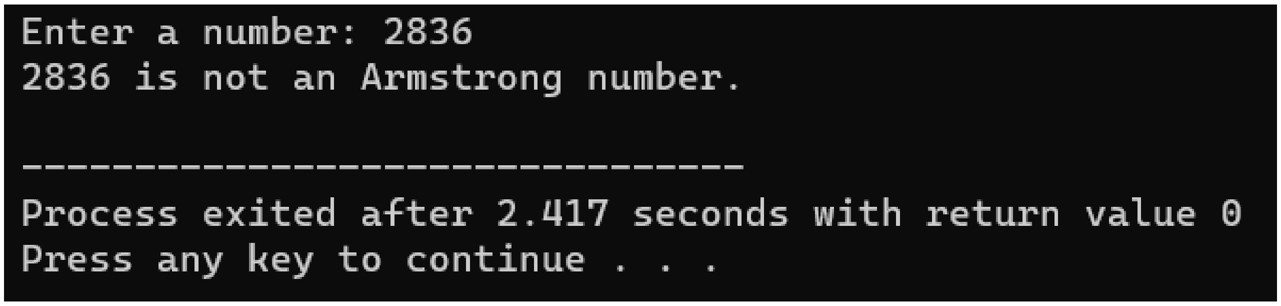


```
Enter the number of terms: 45
Fibonacci series up to 45 terms:
0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946, 17711, 28657, 46368, 75
025, 121393, 196418, 317811, 514229, 832040, 1346269, 2178309, 3524578, 5702887, 9227465, 14930352, 24157817, 39088169,
63245986, 102334155, 165580141, 267914296, 433494437, 701408733,
--------------------------------
Process exited after 1.452 seconds with return value 0
Press any key to continue . . .
```

Q.Write a C program to print Armstrong numbers from 1 to n AND check a given number is Armstrong numbers or not.

Ans.

```
#include <stdio.h>
#include <math.h>
int isArmstrong(int num) {
   int original = num, result = 0, n = 0;
   while (original != 0) {
      original /= 10;
      ++n;  }
   original = num;
   while (original != 0) {
      int remainder = original % 10;
      result += pow(remainder, n);
      original /= 10;
   }
   return result == num;
}
int main() {
   int num;
printf("Enter a number: ");
scanf("%d", &num);
    if (isArmstrong(num)) {
printf("%d is an Armstrong number.\n", num);
    } else {
printf("%d is not an Armstrong number.\n", num);
    }
    return 0;
}
```

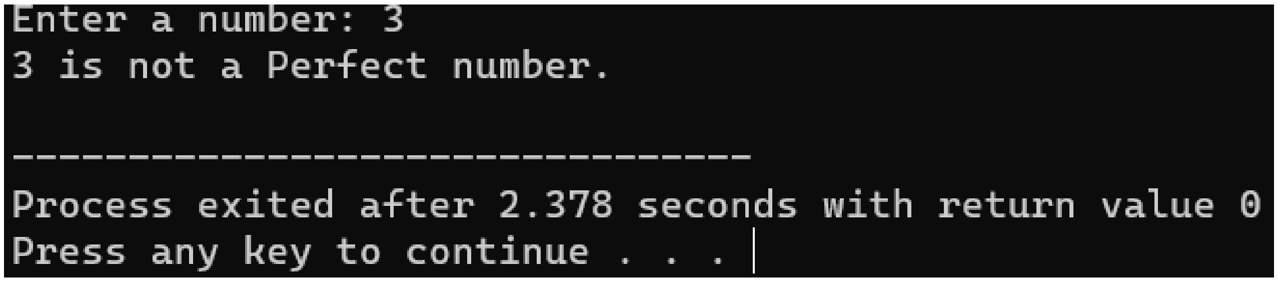


```
Enter a number: 2836
2836 is not an Armstrong number.

--------------------------------
Process exited after 2.417 seconds with return value 0
Press any key to continue . . .
```

Q.

Ans.

```
#include <stdio.h>
int isPerfect(int num) {
    int sum = 0;

    for (int i = 1; i<= num / 2; ++i) {
        if (num % i == 0) {
            sum += i;
        }
    }
    return sum == num;
}
void printPerfectNumbers(int n) {
printf("Perfect numbers between 1 and %d are:\n", n);
    for (int i = 1; i<= n; ++i) {
        if (isPerfect(i)) {
printf("%d\n", i);
        }
    }
}
int main() {
   int num;
printf("Enter a number: ");
scanf("%d", &num);

   if (isPerfect(num)) {
printf("%d is a Perfect number.\n", num);
   } else {
printf("%d is not a Perfect number.\n", num);
   }
   return 0;
}
```

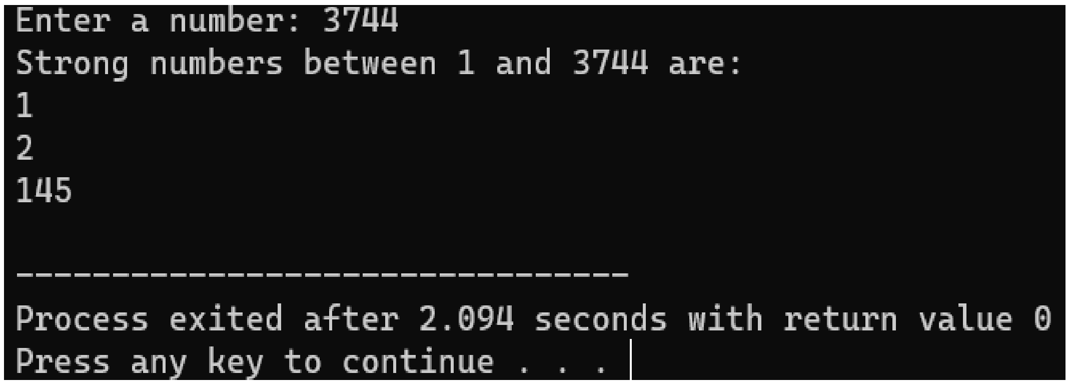


```
Enter a number: 3
3 is not a Perfect number.

--------------------------------
Process exited after 2.378 seconds with return value 0
Press any key to continue . . .
```

Q. Write a C program to print all Strong Numbers between 1 to n.

Ans

```
#include <stdio.h>


int factorial(int n) {
    if (n == 0 || n == 1) {
        return 1;
    } else {
        return n * factorial(n - 1);
    }
}
int isStrong(int num) {
    int original = num, sum = 0;
    while (num != 0) {
        int digit = num % 10;
        sum += factorial(digit);
        num /= 10;
    }

    return sum == original;
}
void printStrongNumbers(int n) {
printf("Strong numbers between 1 and %d are:\n", n);
   for (int i = 1; i<= n; ++i) {
      if (isStrong(i)) {
printf("%d\n", i);
      }
   }
}
int main() {
   int num;
printf("Enter a number: ");
scanf("%d", &num);

printStrongNumbers(num);
   return 0;
}
```

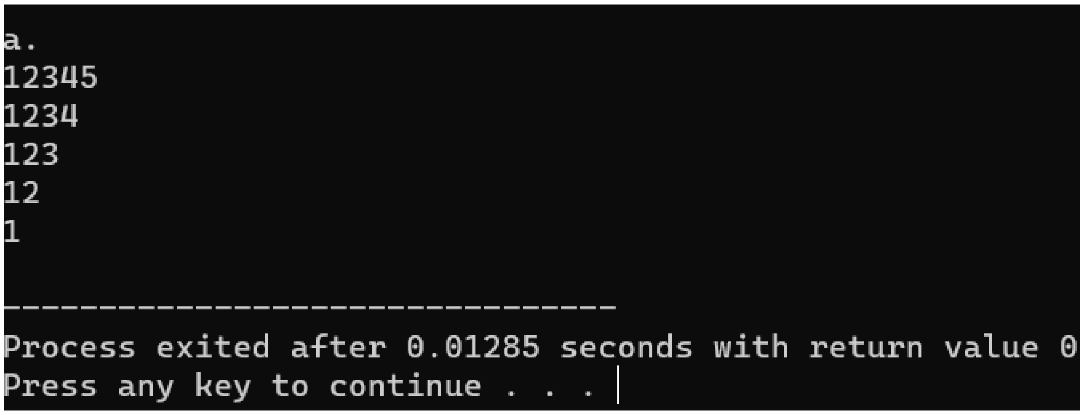


```
Enter a number: 3744
Strong numbers between 1 and 3744 are:
1
2
145

--------------------------------
Process exited after 2.094 seconds with return value 0
Press any key to continue . . .
```

WORKSHEET WEEK 5

Pattern A

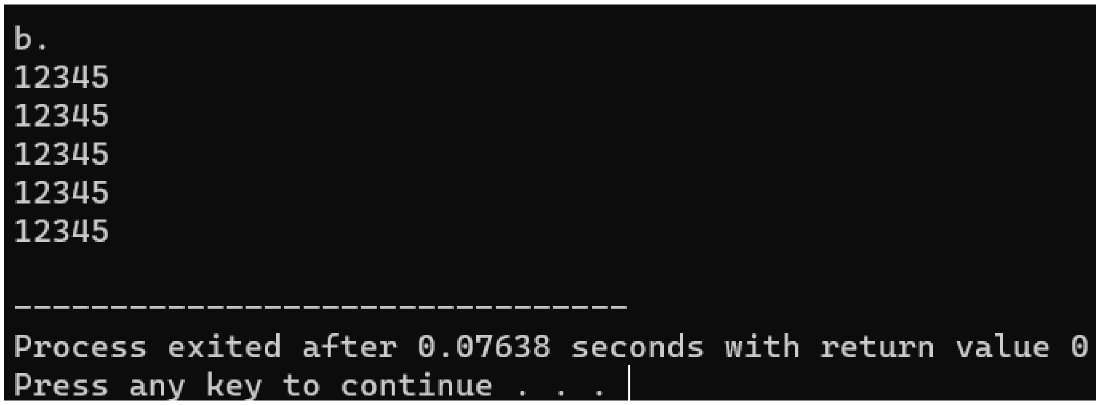
```
#include <stdio.h>


int main() {
printf("a.\n");
   for (int i = 5; i>= 1; i--) {
      for (int j = 1; j <= i; j++) {
printf("%d", j);
      }
printf("\n");
   }


   return 0;
}
```



```
a.
12345
1234
123
12
1

--------------------------------
Process exited after 0.01285 seconds with return value 0
Press any key to continue . . .
```

Pattern B

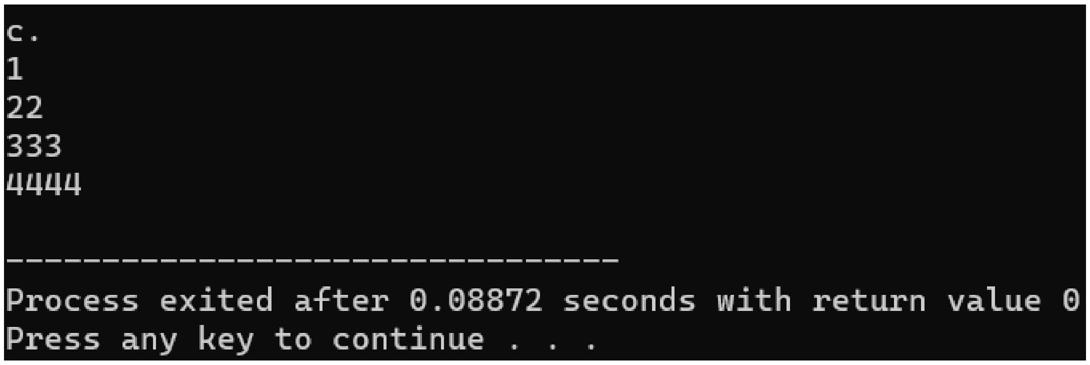
```
#include <stdio.h>


int main() {
printf("b.\n");
   for (int i = 5; i>= 1; i--) {
      for (int j = 1; j <= 5; j++) {
printf("%d", j);
      }
printf("\n");
   }


   return 0;
}
```



```
b.
12345
12345
12345
12345
12345

--------------------------------
Process exited after 0.07638 seconds with return value 0
Press any key to continue . . .
```

Pattern C

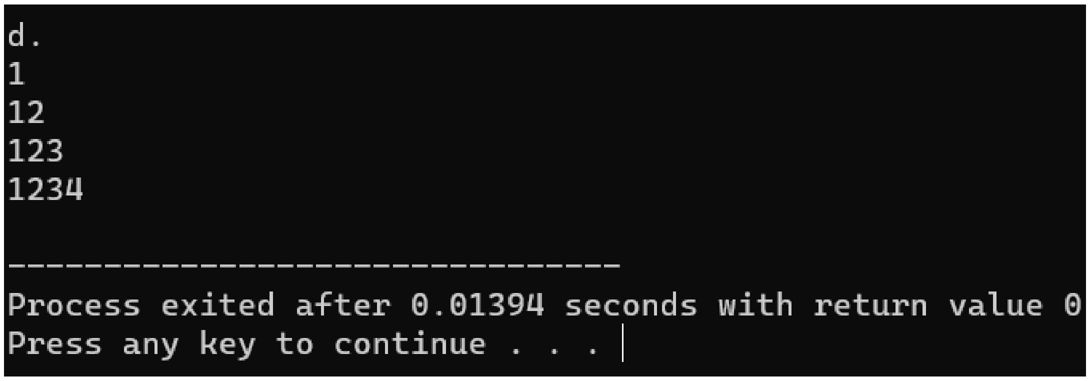
```
#include <stdio.h>


int main() {
printf("c.\n");
   for (int i = 1; i<= 4; i++) {
      for (int j = 1; j <= i; j++) {
printf("%d", i);
      }
printf("\n");
   }


   return 0;
}
```



```
c.
1
22
333
4444

--------------------------------
Process exited after 0.08872 seconds with return value 0
Press any key to continue . . .
```

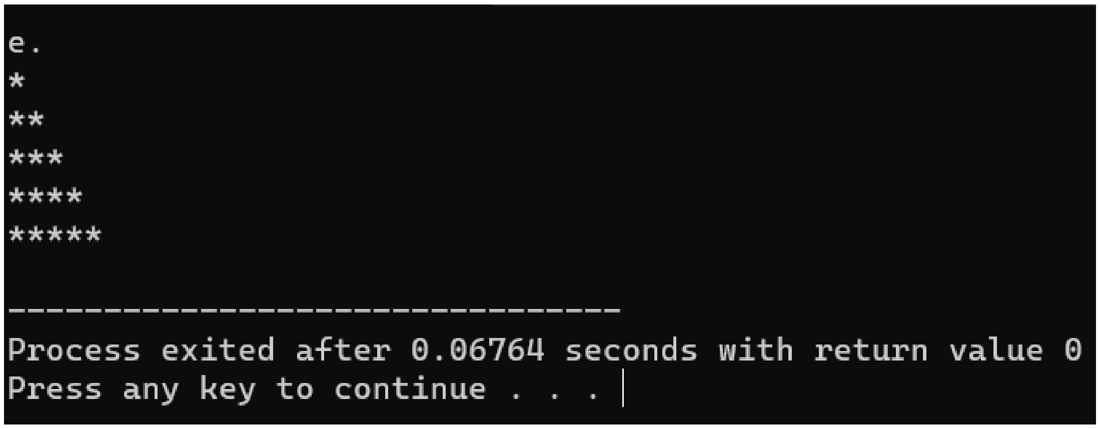
Pattern D

```
#include <stdio.h>


int main() {

printf("d.\n");

   for (int i = 1; i<= 4; i++) {

      for (int j = 1; j <= i; j++) {

printf("%d", j);

      }

printf("\n");

   }


   return 0;

}
```


```
d.
1
12
123
1234

--------------------------------
Process exited after 0.01394 seconds with return value 0
Press any key to continue . . .
```

Pattern E

```
#include <stdio.h>


int main() {
printf("e.\n");
   for (int i = 1; i<= 5; i++) {
       for (int j = 1; j <= i; j++) {
printf("*");
       }
printf("\n");
   }


   return 0;
}
```



```
e.
*
**
***
****
*****

--------------------------------
Process exited after 0.06764 seconds with return value 0
Press any key to continue . . .
```

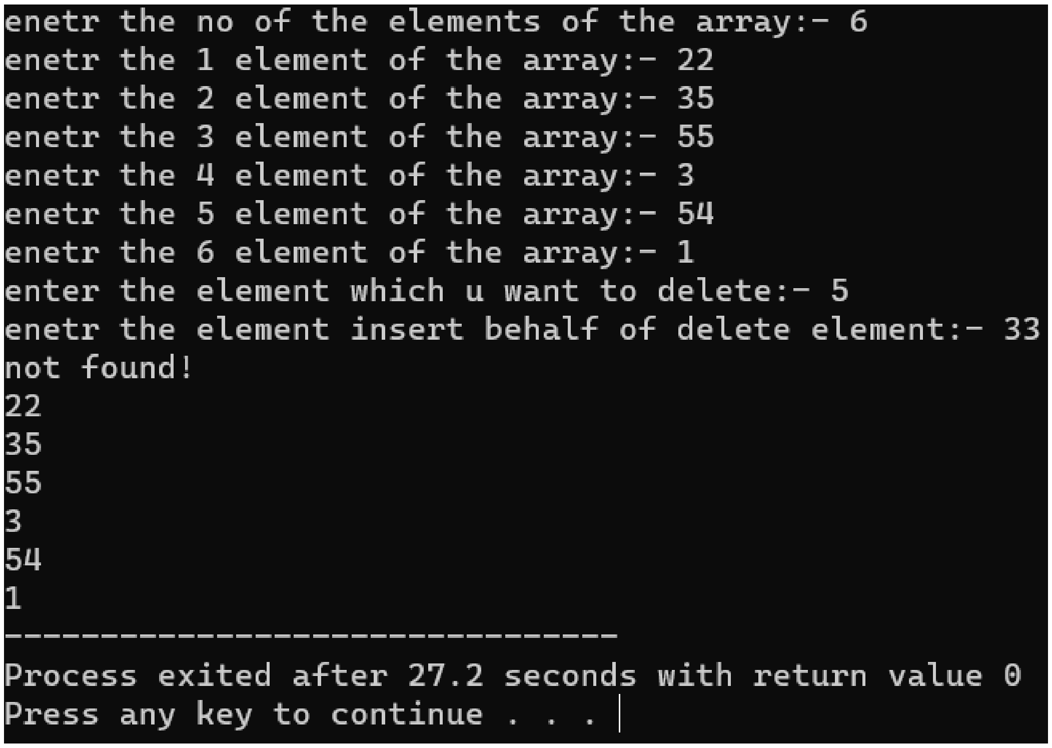
WORKSHEET WEEK 6

Q.

Ans.

```
# include <stdio.h>
int main ()
{
   int a;
printf("enter the no of the elements of the array:- ");
scanf("%d",&a);
   int n[a];
for(int i=0;i<a;i++)
   {
printf("enter the %d element of the array:- ",i+1);
scanf("%d",&n[i]);
```

```
   }
   int k;
printf("enter the element which u want to delete:- ");
scanf("%d",&k);
   int g;
printf("enter the element insert behalf of delete element:- ");
scanf("%d",&g);
for(int i=0;i<a;i++)
   {
      if(n[i]==k)
{  n[i]=g;
      }
         else
      {
printf("not found!");
         break;
      }
   }
for(int i=0;i<a;i++)
   {
printf("\n%d ",n[i]);
   }
   return 0;
}
```



```
enetr the no of the elements of the array:- 6
enetr the 1 element of the array:- 22
enetr the 2 element of the array:- 35
enetr the 3 element of the array:- 55
enetr the 4 element of the array:- 3
enetr the 5 element of the array:- 54
enetr the 6 element of the array:- 1
enter the element which u want to delete:- 5
enetr the element insert behalf of delete element:- 33
not found!
22
35
55
3
54
1
--------------------------------
Process exited after 27.2 seconds with return value 0
Press any key to continue . . .
```

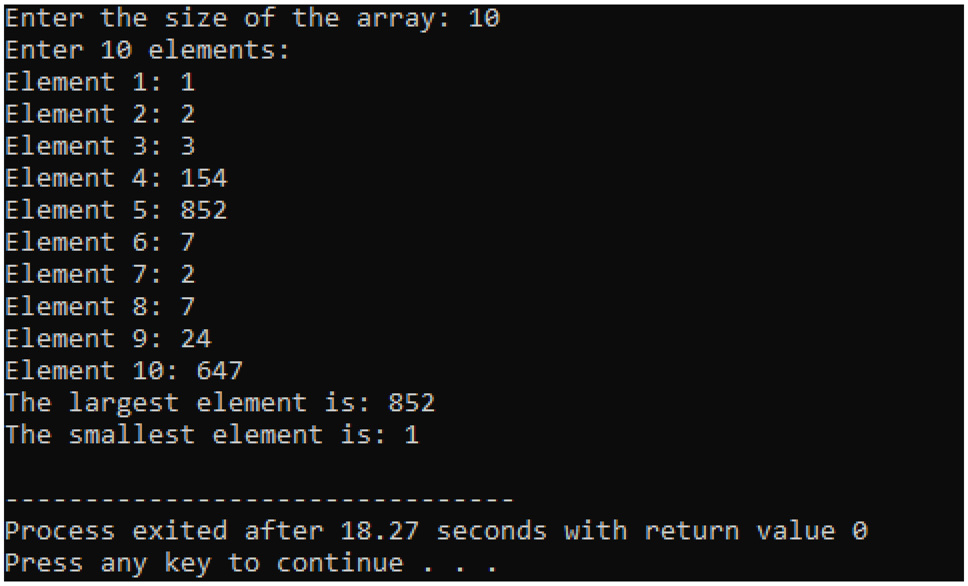
Q2. Write the program to print the biggest and smallest element in an array.

```
#include <stdio.h>


int main() {
   int size;



printf("Enter the size of the array: ");
scanf("%d", &size);
```

```
    if (size <= 0) {
printf("Invalid array size. Exiting...\n");
        return 1;
    }

    int arr[size];
printf("Enter %d elements:\n", size);
    for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &arr[i]);
    }

    int largest = arr[0];
    int smallest = arr[0];

    for (int i = 1; i< size; i++) {
        if (arr[i] > largest) {
            largest = arr[i];
        }
        if (arr[i] < smallest) {
            smallest = arr[i];
        }
    }

printf("The largest element is: %d\n", largest);
printf("The smallest element is: %d\n", smallest);

    return 0;
```

}

Output



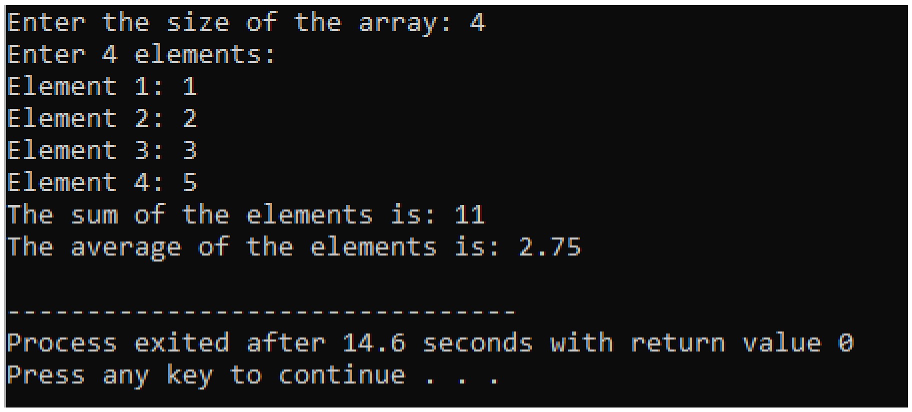
```
Enter the size of the array: 10
Enter 10 elements:
Element 1: 1
Element 2: 2
Element 3: 3
Element 4: 154
Element 5: 852
Element 6: 7
Element 7: 2
Element 8: 7
Element 9: 24
Element 10: 647
The largest element is: 852
The smallest element is: 1

--------------------------------
Process exited after 18.27 seconds with return value 0
Press any key to continue . . .
```

Q3. Write the program to print the sum and average of an array.

```
#include <stdio.h>


int main() {
   int size;


printf("Enter the size of the array: ");
scanf("%d", &size);


   if (size <= 0) {
printf("Invalid array size. Exiting...\n");
       return 1;
   }
```

```
    int arr[size];

printf("Enter %d elements:\n", size);
    for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &arr[i]);
    }

    int sum = 0;
    for (int i = 0; i< size; i++) {
        sum += arr[i];
    }

    float average = (float)sum / size;

printf("The sum of the elements is: %d\n", sum);
printf("The average of the elements is: %.2f\n", average);

    return 0;
}
```

Output



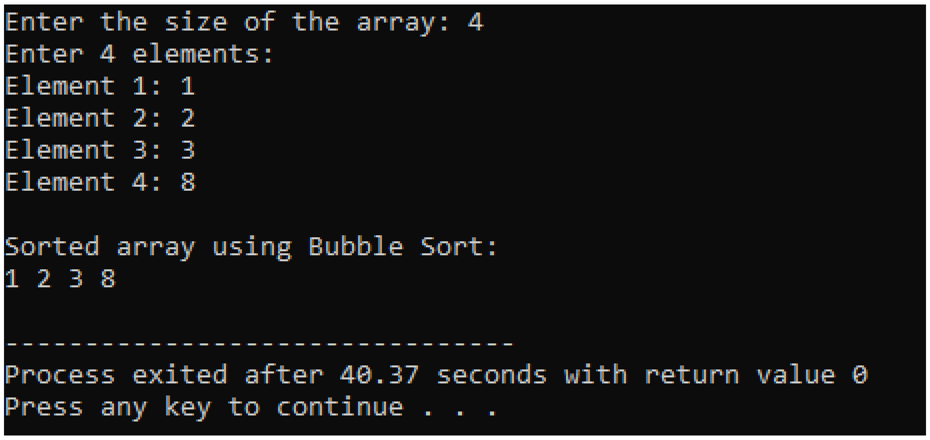
```
Enter the size of the array: 4
Enter 4 elements:
Element 1: 1
Element 2: 2
Element 3: 3
Element 4: 5
The sum of the elements is: 11
The average of the elements is: 2.75

--------------------------------
Process exited after 14.6 seconds with return value 0
Press any key to continue . . .
```

Q4. Write the program to sort an array using bubble sort.

```
#include <stdio.h>

void swap(int *a, int *b) {
  int temp = *a;
  *a = *b;
  *b = temp;
}

void bubbleSort(int arr[], int size) {
  for (int i = 0; i< size - 1; i++) {
    for (int j = 0; j < size - i - 1; j++) {
      if (arr[j] >arr[j + 1]) {
        swap(&arr[j], &arr[j + 1]);
      }
    }
  }
}

int main() {
  int size;

printf("Enter the size of the array: ");
scanf("%d", &size);

  if (size <= 0) {
printf("Invalid array size. Exiting...\n");
    return 1;
```

```
   }

   int arr[size];

printf("Enter %d elements:\n", size);
   for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &arr[i]);
   }

bubbleSort(arr, size);

printf("\nSorted array using Bubble Sort:\n");
   for (int i = 0; i< size; i++) {
printf("%d ", arr[i]);
   }
printf("\n");

   return 0;
}
```

Output



```
Enter the size of the array: 4
Enter 4 elements:
Element 1: 1
Element 2: 2
Element 3: 3
Element 4: 8

Sorted array using Bubble Sort:
1 2 3 8

--------------------------------
Process exited after 40.37 seconds with return value 0
Press any key to continue . . .
```

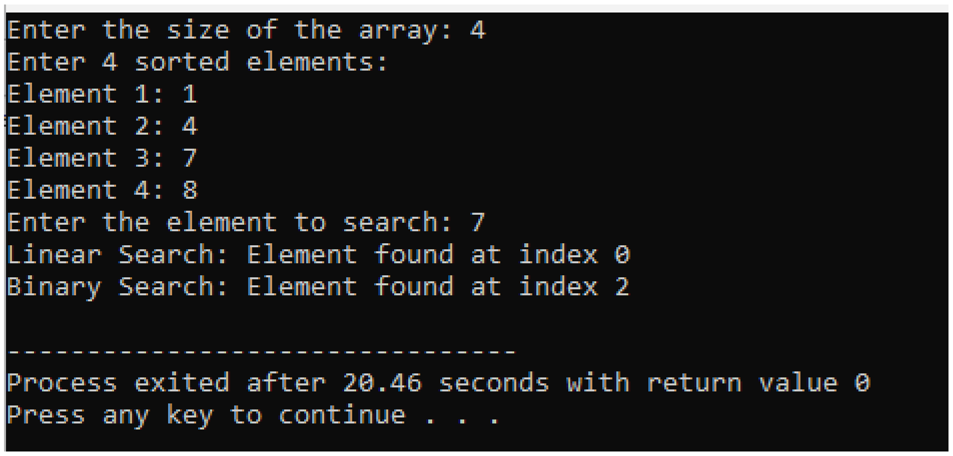
Q5. Write the program to search an element using linear search as well as binary search.

```
#include <stdio.h>


int linearSearch(int arr[], int size, int key) {
   for (int i = 0; i< size; i++) {
      if (arr[i] == key) {
         return 0;
      }
   }
   return -1;
}


int binarySearch(int arr[], int size, int key) {
   int low = 0, high = size - 1;


   while (low <= high) {
      int mid = low + (high - low) / 2;


      if (arr[mid] == key) {
         return mid;
```

```
        } else if (arr[mid] < key) {
            low = mid + 1;
        } else {
            high = mid - 1;
        }
    }

    return -1;
}

int main() {
    int size, key;

printf("Enter the size of the array: ");
scanf("%d", &size);

    if (size <= 0) {
printf("Invalid array size. Exiting...\n");
        return 1;
    }

    int arr[size];

printf("Enter %d sorted elements:\n", size);
    for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &arr[i]);
    }
```

```
printf("Enter the element to search: ");
scanf("%d", &key);

    int linearIndex = linearSearch(arr, size, key);
    if (linearIndex != -1) {
printf("Linear Search: Element found at index %d\n", linearIndex);
    } else {
printf("Linear Search: Element not found\n");
    }
    int binaryIndex = binarySearch(arr, size, key);
    if (binaryIndex != -1) {
printf("Binary Search: Element found at index %d\n", binaryIndex);
    } else {
printf("Binary Search: Element not found\n");
    }

    return 0;
}
```

Output



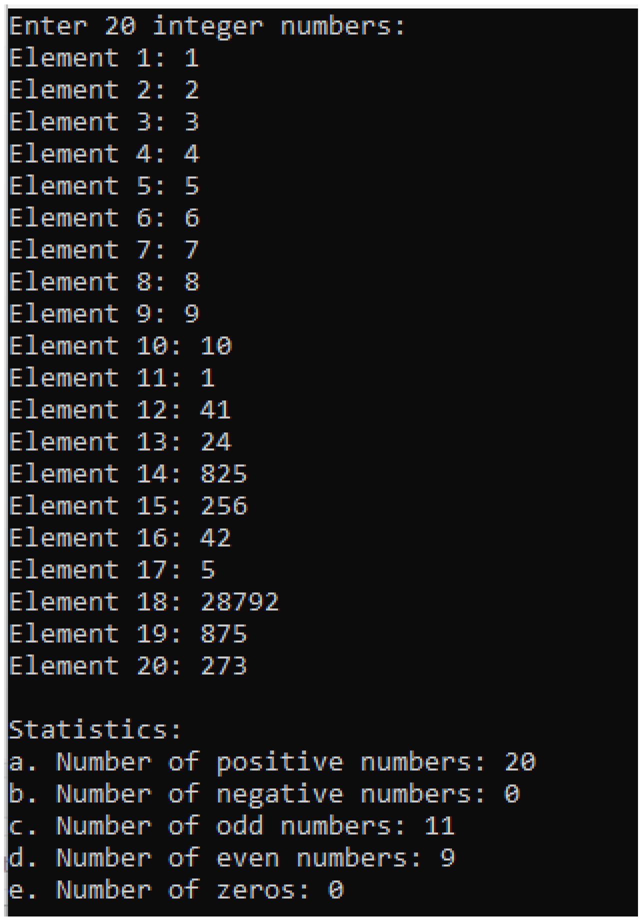
```
Enter the size of the array: 4
Enter 4 sorted elements:
Element 1: 1
Element 2: 4
Element 3: 7
Element 4: 8
Enter the element to search: 7
Linear Search: Element found at index 0
Binary Search: Element found at index 2

--------------------------------
Process exited after 20.46 seconds with return value 0
Press any key to continue . . .
```

Q6. Take an array of 20 integer inputs from user and print the following: a. number of positive numbers b. number of negative numbers c. number of odd numbers d. number of even numbers e. number of 0.

```
#include <stdio.h>


int main() {
   const int size = 20;
   int numbers[size];


printf("Enter %d integer numbers:\n", size);
   for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &numbers[i]);
   }


   int positiveCount = 0, negativeCount = 0, oddCount = 0, evenCount = 0, zeroCount = 0;


   for (int i = 0; i< size; i++) {
      if (numbers[i] > 0) {
positiveCount++;
      } else if (numbers[i] < 0) {
negativeCount++;
      }


      if (numbers[i] % 2 == 0) {
evenCount++;
      } else {
oddCount++;
      }
```

```
        if (numbers[i] == 0) {
zeroCount++;
        }
    }

printf("\nStatistics:\n");
printf("a. Number of positive numbers: %d\n", positiveCount);
printf("b. Number of negative numbers: %d\n", negativeCount);
printf("c. Number of odd numbers: %d\n", oddCount);
printf("d. Number of even numbers: %d\n", evenCount);
printf("e. Number of zeros: %d\n", zeroCount);

    return 0;
}
```

Output


```
Enter 20 integer numbers:
Element 1: 1
Element 2: 2
Element 3: 3
Element 4: 4
Element 5: 5
Element 6: 6
Element 7: 7
Element 8: 8
Element 9: 9
Element 10: 10
Element 11: 1
Element 12: 41
Element 13: 24
Element 14: 825
Element 15: 256
Element 16: 42
Element 17: 5
Element 18: 28792
Element 19: 875
Element 20: 273

Statistics:
a. Number of positive numbers: 20
b. Number of negative numbers: 0
c. Number of odd numbers: 11
d. Number of even numbers: 9
e. Number of zeros: 0
```

Q7. Take an array of 10 elements. Split it into middle and store the elements in two different arrays.

```
#include <stdio.h>


int main() {

   const int size = 10;

   int originalArray[size];

   int firstArray[size / 2], secondArray[size / 2];


printf("Enter %d integer numbers:\n", size);

   for (int i = 0; i< size; i++) {

printf("Element %d: ", i + 1);

scanf("%d", &originalArray[i]);
```

```
    }

    for (int i = 0; i< size / 2; i++) {
firstArray[i] = originalArray[i];
secondArray[i] = originalArray[size / 2 + i];
    }

printf("\nOriginal Array:\n");
    for (int i = 0; i< size; i++) {
printf("%d ", originalArray[i]);
    }

printf("\n\nSplit Arrays:\n");
printf("First Array:\n");
    for (int i = 0; i< size / 2; i++) {
printf("%d ", firstArray[i]);
    }

printf("\nSecond Array:\n");
    for (int i = 0; i< size / 2; i++) {
printf("%d ", secondArray[i]);
    }

    return 0;
}
```

Q8. Write the program to count frequency of each element in an array.

```
#include <stdio.h>
```

```
int main() {
   const int size = 10;
   int arr[size];

printf("Enter %d integer numbers:\n", size);
   for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &arr[i]);
   }

   int frequency[size];

   for (int i = 0; i< size; i++) {
      frequency[i] = -1;
   }

   for (int i = 0; i< size; i++) {
      int count = 1;

      for (int j = i + 1; j < size; j++) {
         if (arr[i] == arr[j]) {
            count++;
            frequency[j] = 0;
         }
      }

      if (frequency[i] != 0) {
         frequency[i] = count;
      }
```

```
    }

printf("\nFrequency of each element:\n");
    for (int i = 0; i< size; i++) {
        if (frequency[i] != 0) {
printf("%d occurs %d times\n", arr[i], frequency[i]);
        }
    }

    return 0;
}
```

<u>WORKSHEET WEEK 7</u>

Q1. Write the program to print row major and column major matrix.

```
#include <stdio.h>

int main() {
    int rows, cols;

printf("Enter the number of rows: ");
scanf("%d", &rows);

printf("Enter the number of columns: ");
scanf("%d", &cols);

    if (rows <= 0 || cols <= 0) {
printf("Invalid matrix size. Exiting...\n");
```

```
        return 1;
    }

    int matrix[rows][cols];

printf("Enter the matrix elements:\n");
    for (int i = 0; i< rows; i++) {
        for (int j = 0; j < cols; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &matrix[i][j]);
        }
    }

printf("\nRow-Major Order:\n");
    for (int i = 0; i< rows; i++) {
        for (int j = 0; j < cols; j++) {
printf("%d ", matrix[i][j]);
        }
printf("\n");
    }

printf("\nColumn-Major Order:\n");
    for (int j = 0; j < cols; j++) {
        for (int i = 0; i< rows; i++) {
printf("%d ", matrix[i][j]);
        }
printf("\n");
    }
```

```
   return 0;
}
```

Q2. Write the program to print sum of a whole matrix.

```
#include <stdio.h>

int main() {
   int rows, cols;
printf("Enter the number of rows: ");
scanf("%d", &rows);

printf("Enter the number of columns: ");
scanf("%d", &cols);

   if (rows <= 0 || cols <= 0) {
printf("Invalid matrix size. Exiting...\n");
      return 1;
   }

   int matrix[rows][cols];

printf("Enter the matrix elements:\n");
   for (int i = 0; i< rows; i++) {
      for (int j = 0; j < cols; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &matrix[i][j]);
      }
   }
   int sum = 0;
   for (int i = 0; i< rows; i++) {
      for (int j = 0; j < cols; j++) {
         sum += matrix[i][j];
      }
   }

printf("\nSum of the matrix: %d\n", sum);

   return 0;
}
```

Q3. Write a program to add and multiply two 3x3 matrices. You can use 2D array to create a matrix.

```
#include <stdio.h>

void addMatrices(int mat1[3][3], int mat2[3][3], int result[3][3]) {
   for (int i = 0; i< 3; i++) {
      for (int j = 0; j < 3; j++) {
         result[i][j] = mat1[i][j] + mat2[i][j];
      }
   }
}

void multiplyMatrices(int mat1[3][3], int mat2[3][3], int result[3][3]) {
   for (int i = 0; i< 3; i++) {
      for (int j = 0; j < 3; j++) {
         result[i][j] = 0;
         for (int k = 0; k < 3; k++) {
            result[i][j] += mat1[i][k] * mat2[k][j];
            }
        }
    }
}

void printMatrix(int mat[3][3]) {
    for (int i = 0; i< 3; i++) {
        for (int j = 0; j < 3; j++) {
printf("%d ", mat[i][j]);
        }
printf("\n");
    }
}

int main() {
    int matrix1[3][3], matrix2[3][3], resultAddition[3][3], resultMultiplication[3][3];

printf("Enter elements for the first matrix (3x3):\n");
    for (int i = 0; i< 3; i++) {
        for (int j = 0; j < 3; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &matrix1[i][j]);
        }
    }

printf("\nEnter elements for the second matrix (3x3):\n");
    for (int i = 0; i< 3; i++) {
        for (int j = 0; j < 3; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
```

```
scanf("%d", &matrix2[i][j]);
        }
    }

addMatrices(matrix1, matrix2, resultAddition);

multiplyMatrices(matrix1, matrix2, resultMultiplication);

printf("\nMatrix Addition:\n");
printMatrix(resultAddition);

printf("\nMatrix Multiplication:\n");
printMatrix(resultMultiplication);

    return 0;
}
```

Q4. Write the program to print sum of all diagonal elements, upper triangular matrix and lower triangular matrix.

```
#include <stdio.h>

int main() {
    int size;

printf("Enter the size of the square matrix: ");
scanf("%d", &size);

    if (size <= 0) {
```

```
printf("Invalid matrix size. Exiting...\n");
        return 1;
    }

    int matrix[size][size];

printf("Enter the matrix elements (%dx%d):\n", size, size);
    for (int i = 0; i< size; i++) {
        for (int j = 0; j < size; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &matrix[i][j]);
        }
    }

    int diagonalSum = 0;
    for (int i = 0; i< size; i++) {
diagonalSum += matrix[i][i];
    }

    int upperTriangularSum = 0;
    for (int i = 0; i< size; i++) {
        for (int j = i + 1; j < size; j++) {
upperTriangularSum += matrix[i][j];
        }
    }

    int lowerTriangularSum = 0;
    for (int i = 0; i< size; i++) {
        for (int j = 0; j <i; j++) {
```

```
lowerTriangularSum += matrix[i][j];
        }
    }

printf("\nSum of Diagonal Elements: %d\n", diagonalSum);
printf("Sum of Upper Triangular Matrix: %d\n", upperTriangularSum);
printf("Sum of Lower Triangular Matrix: %d\n", lowerTriangularSum);

    return 0;
}
```

Q5. Write the program to find the frequency of odd and even elements in matrix.

```
#include <stdio.h>

int main() {
    int rows, cols;

printf("Enter the number of rows: ");
scanf("%d", &rows);

printf("Enter the number of columns: ");
scanf("%d", &cols);
    if (rows <= 0 || cols <= 0) {
printf("Invalid matrix size. Exiting...\n");
        return 1;
    }

    int matrix[rows][cols];
printf("Enter the matrix elements:\n");
   for (int i = 0; i< rows; i++) {
      for (int j = 0; j < cols; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &matrix[i][j]);
      }
   }

   int evenCount = 0, oddCount = 0;
   for (int i = 0; i< rows; i++) {
      for (int j = 0; j < cols; j++) {
         if (matrix[i][j] % 2 == 0) {
evenCount++;
         } else {
oddCount++;
         }
      }
   }

printf("\nFrequency of even elements: %d\n", evenCount);
printf("Frequency of odd elements: %d\n", oddCount);

   return 0;
}
```

Q6. Write the program to find sum of each row and sum of each column of matrix.

```
#include <stdio.h>

int main() {
    int rows, cols;

printf("Enter the number of rows: ");
scanf("%d", &rows);

printf("Enter the number of columns: ");
scanf("%d", &cols);

    if (rows <= 0 || cols <= 0) {
printf("Invalid matrix size. Exiting...\n");
        return 1;
    }

    int matrix[rows][cols];

printf("Enter the matrix elements:\n");
    for (int i = 0; i< rows; i++) {
        for (int j = 0; j < cols; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &matrix[i][j]);
        }
    }

printf("\nSum of each row:\n");
    for (int i = 0; i< rows; i++) {
        int rowSum = 0;
        for (int j = 0; j < cols; j++) {
rowSum += matrix[i][j];
        }
printf("Row %d: %d\n", i + 1, rowSum);
  }

printf("\nSum of each column:\n");
  for (int j = 0; j < cols; j++) {
      int colSum = 0;
      for (int i = 0; i< rows; i++) {
colSum += matrix[i][j];
      }
printf("Column %d: %d\n", j + 1, colSum);
  }

  return 0;
}
```

Q7. Initialize a 2D array of 3*3 matrix.

```
#include <stdio.h>

int main() {
  int matrix[3][3] = {
      {1, 2, 3},
      {4, 5, 6},
      {7, 8, 9}
  };

printf("Initialized 3x3 Matrix:\n");
  for (int i = 0; i< 3; i++) {
      for (int j = 0; j < 3; j++) {
printf("%d ", matrix[i][j]);
```

```
        }
printf("\n");
    }


    return 0;
}
```

Q8. A square matrix, one having the same number of rows and columns, is called a diagonal matrix if it's only non-zero elements are on the diagonal from upper left to lower right. It is called upper triangular matrix if all elements bellow the diagonal are zeroes, and lower triangular matrix, if all the elements above the diagonal are zeroes. Write a program that reads a matrix and determines if it is one of the above mentioned three special matrices.

```
#include <stdio.h>


int isDiagonalMatrix(int matrix[3][3], int size) {
    for (int i = 0; i< size; i++) {
        for (int j = 0; j < size; j++) {
            if (i != j && matrix[i][j] != 0) {
                return 0;
            }
        }
    }
    return 1;
}


int isUpperTriangularMatrix(int matrix[3][3], int size) {


    for (int i = 0; i< size; i++) {
        for (int j = 0; j <i; j++) {
            if (matrix[i][j] != 0) {
                return 0;
            }
        }
    }
    return 1;
}

int isLowerTriangularMatrix(int matrix[3][3], int size) {
    for (int i = 0; i< size; i++) {
        for (int j = i + 1; j < size; j++) {
            if (matrix[i][j] != 0) {
                return 0;
            }
        }
    }
    return 1;
}

int main() {
    int size;

printf("Enter the size of the square matrix: ");
scanf("%d", &size);

    if (size <= 0) {
printf("Invalid matrix size. Exiting...\n");
        return 1;
    }
```

```
   int matrix[3][3];

printf("Enter the matrix elements (%dx%d):\n", size, size);
   for (int i = 0; i< size; i++) {
      for (int j = 0; j < size; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &matrix[i][j]);
      }
   }

   if (isDiagonalMatrix(matrix, size)) {
printf("The matrix is a diagonal matrix.\n");
   } else if (isUpperTriangularMatrix(matrix, size)) {
printf("The matrix is an upper triangular matrix.\n");
   } else if (isLowerTriangularMatrix(matrix, size)) {
printf("The matrix is a lower triangular matrix.\n");
   } else {
printf("The matrix is not one of the specified special matrices.\n");
   }

   return 0;
}
```

Q9. Write the program to check whether the matrix is sparse matrix or not.

```
#include <stdio.h>

#define MAX_SIZE 10
```

```
int isSparseMatrix(int matrix[MAX_SIZE][MAX_SIZE], int rows, int cols) {
  int zeroCount = 0;

  for (int i = 0; i< rows; i++) {
    for (int j = 0; j < cols; j++) {
      if (matrix[i][j] == 0) {
zeroCount++;
      }
    }
  }

  double threshold = 0.6;

  double zeroPercentage = (double)zeroCount / (rows * cols);
  if (zeroPercentage> threshold) {
    return 1; // Sparse matrix
  } else {
    return 0;
  }
}

int main() {
  int rows, cols;

printf("Enter the number of rows: ");
scanf("%d", &rows);

printf("Enter the number of columns: ");
scanf("%d", &cols);

   if (rows <= 0 || cols <= 0 || rows > MAX_SIZE || cols > MAX_SIZE) {
printf("Invalid matrix size. Exiting...\n");
       return 1;
   }

   int matrix[MAX_SIZE][MAX_SIZE];

printf("Enter the matrix elements (%dx%d):\n", rows, cols);
   for (int i = 0; i< rows; i++) {
       for (int j = 0; j < cols; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &matrix[i][j]);
       }
   }

   if (isSparseMatrix(matrix, rows, cols)) {
printf("The matrix is a sparse matrix.\n");
   } else {
printf("The matrix is not a sparse matrix.\n");
   }

   return 0;
}
```

<u>WORKSHEET WEEK 8</u>

Q1. Write a C program to create, initialize and use pointers.

```
#include <stdio.h>


int main() {


   int number = 42;

   float floatNumber = 3.14;

   char character = 'A';


   int *intPointer;

   float *floatPointer;

   char *charPointer;


intPointer = &number;

floatPointer = &floatNumber;
charPointer = &character;


printf("Original values:\n");
printf("Number: %d\n", number);
printf("Float Number: %.2f\n", floatNumber);
printf("Character: %c\n\n", character);


   *intPointer = 100;
   *floatPointer = 2.718;
   *charPointer = 'B';


printf("Modified values using pointers:\n");
printf("Number: %d\n", number);
printf("Float Number: %.2f\n", floatNumber);
printf("Character: %c\n\n", character);
   int anotherNumber = 10;
   int *resultPointer = &number;


   *resultPointer += anotherNumber;


printf("Result of adding %d to the original number using pointers: %d\n", anotherNumber,
*resultPointer);


   return 0;
}
```

Q2. Write a C program to add two numbers using pointers.

```
#include <stdio.h>
```

```
int main() {
   int num1, num2, sum;
   int *ptr1, *ptr2;

   ptr1 = &num1;
   ptr2 = &num2;

printf("Enter the first number: ");
scanf("%d", ptr1);

printf("Enter the second number: ");
scanf("%d", ptr2);

   sum = *ptr1 + *ptr2;

printf("Sum of %d and %d is: %d\n", *ptr1, *ptr2, sum);

   return 0;
}
```

Q3. Write a C program to swap two numbers using pointers.

```
#include <stdio.h>

void swap(int *num1, int *num2) {
   int temp = *num1;
   *num1 = *num2;
   *num2 = temp;
}

int main() {
    int num1, num2;

printf("Enter the first number: ");
scanf("%d", &num1);

printf("Enter the second number: ");
scanf("%d", &num2);
printf("\nOriginal values:\n");
printf("First number: %d\n", num1);
printf("Second number: %d\n", num2);

swap(&num1, &num2);

printf("\nSwapped values:\n");
printf("First number: %d\n", num1);
printf("Second number: %d\n", num2);

    return 0;
}
```

Q. 4 Write a C program to input and print array elements using pointer.

```
#include <stdio.h>

int main() {
    int size;
printf("Enter the size of the array: ");
scanf("%d", &size);

   if (size <= 0) {
printf("Invalid array size. Exiting...\n");
      return 1;
   }

   int arr[size];
printf("Enter %d elements for the array:\n", size);
   for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &(*(arr + i)));
   }

printf("\nArray elements using pointers:\n");
   for (int i = 0; i< size; i++) {
printf("%d ", *(arr + i));
   }

   return 0;
}
```

Q. 5 Write a C program to copy one array to another using pointer.

```
#include <stdio.h>

void copyArray(int *source, int *destination, int size) {
  for (int i = 0; i< size; i++) {
    *(destination + i) = *(source + i);
  }
}

int main() {
  int size;

printf("Enter the size of the array: ");
scanf("%d", &size);

  if (size <= 0) {
printf("Invalid array size. Exiting...\n");
    return 1;
  }

  int sourceArray[size];
  int destinationArray[size];

printf("Enter %d elements for the source array:\n", size);
  for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &(*(sourceArray + i)));
  }

copyArray(sourceArray, destinationArray, size);

printf("\nSource Array elements:\n");
  for (int i = 0; i< size; i++) {
```

```
printf("%d ", *(sourceArray + i));
   }

printf("\nDestination Array elements (copied from source):\n");
   for (int i = 0; i< size; i++) {
printf("%d ", *(destinationArray + i));
   }

   return 0;
}
```

Q. 6 Write a C program to swap two arrays using pointers.

```
#include <stdio.h>

void swapArrays(int *arr1, int *arr2, int size) {
   for (int i = 0; i< size; i++) {

      int temp = *(arr1 + i);
      *(arr1 + i) = *(arr2 + i);
      *(arr2 + i) = temp;
   }
}

void printArray(int *arr, int size) {
   for (int i = 0; i< size; i++) {
printf("%d ", *(arr + i));
   }
printf("\n");
```

```
}

int main() {
   int size;



printf("Enter the size of the arrays: ");
scanf("%d", &size);

   if (size <= 0) {
printf("Invalid array size. Exiting...\n");
       return 1;
   }

   int array1[size], array2[size];



printf("Enter %d elements for the first array:\n", size);
   for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &(*(array1 + i)));
   }



printf("\nEnter %d elements for the second array:\n", size);
   for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &(*(array2 + i)));
   }
```

```
printf("\nOriginal Arrays:\n");
printf("Array 1: ");
printArray(array1, size);
printf("Array 2: ");
printArray(array2, size);


swapArrays(array1, array2, size);


printf("\nSwapped Arrays:\n");
printf("Array 1: ");
printArray(array1, size);
printf("Array 2: ");
printArray(array2, size);

  return 0;
}
```

Q. 7 Write a C program to reverse an array using pointers.

```
#include <stdio.h>

void reverseArray(int *arr, int size) {
  int *start = arr;
  int *end = arr + size - 1;
```

```
    while (start < end) {
        int temp = *start;
        *start = *end;
        *end = temp;

        start++;
        end--;
    }
}

void printArray(int *arr, int size) {
    for (int i = 0; i< size; i++) {
printf("%d ", *(arr + i));
    }
printf("\n");
}

int main() {
    int size;

printf("Enter the size of the array: ");
scanf("%d", &size);

    if (size <= 0) {
printf("Invalid array size. Exiting...\n");
        return 1;
    }

    int array[size];
```

```
printf("Enter %d elements for the array:\n", size);
    for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &(*(array + i)));
    }



printf("\nOriginal Array:\n");
printArray(array, size);

reverseArray(array, size);

printf("\nReversed Array:\n");
printArray(array, size);

    return 0;
}
```

Q. 8 Write a C program to add two matrix using pointers.

```
#include <stdio.h>

#define MAX_SIZE 10

void addMatrices(int *matrix1, int *matrix2, int *result, int rows, int cols) {
    for (int i = 0; i< rows; i++) {
        for (int j = 0; j < cols; j++) {
            *(result + i * cols + j) = *(matrix1 + i * cols + j) + *(matrix2 + i * cols + j);
        }
    }
}

void printMatrix(int *matrix, int rows, int cols) {
    for (int i = 0; i< rows; i++) {
        for (int j = 0; j < cols; j++) {
printf("%d ", *(matrix + i * cols + j));
        }
printf("\n");
    }
}

int main() {
    int rows, cols;



printf("Enter the number of rows: ");
scanf("%d", &rows);

printf("Enter the number of columns: ");
scanf("%d", &cols);



    if (rows <= 0 || cols <= 0 || rows > MAX_SIZE || cols > MAX_SIZE) {
printf("Invalid matrix size. Exiting...\n");
        return 1;
    }

    int matrix1[MAX_SIZE][MAX_SIZE], matrix2[MAX_SIZE][MAX_SIZE], result[MAX_SIZE][MAX_SIZE];

printf("Enter elements for the first matrix (%dx%d):\n", rows, cols);
    for (int i = 0; i< rows; i++) {
        for (int j = 0; j < cols; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &(*(matrix1 + i * cols + j)));
        }
    }

printf("\nEnter elements for the second matrix (%dx%d):\n", rows, cols);
    for (int i = 0; i< rows; i++) {
        for (int j = 0; j < cols; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &(*(matrix2 + i * cols + j)));
        }
    }

addMatrices((int *)matrix1, (int *)matrix2, (int *)result, rows, cols);

printf("\nOriginal Matrices:\n");
printf("Matrix 1:\n");
printMatrix((int *)matrix1, rows, cols);
printf("Matrix 2:\n");
printMatrix((int *)matrix2, rows, cols);

printf("\nResult Matrix (Sum of Matrix 1 and Matrix 2):\n");
```

```
printMatrix((int *)result, rows, cols);


    return 0;
}
```

Q. 9 Write a C program to multiply two matrix using pointers.

```
#include <stdio.h>

#define MAX_SIZE 10

void multiplyMatrices(int *matrix1, int *matrix2, int *result, int rows1, int cols1, int cols2) {
    for (int i = 0; i< rows1; i++) {
        for (int j = 0; j < cols2; j++) {
            *(result + i * cols2 + j) = 0;

            for (int k = 0; k < cols1; k++) {

                *(result + i * cols2 + j) += *(matrix1 + i * cols1 + k) * *(matrix2 + k * cols2 + j);
            }
        }
    }
}

void printMatrix(int *matrix, int rows, int cols) {
    for (int i = 0; i< rows; i++) {
        for (int j = 0; j < cols; j++) {
printf("%d ", *(matrix + i * cols + j));
```

```
        }
printf("\n");
    }
}

int main() {
    int rows1, cols1, rows2, cols2;

printf("Enter the number of rows for the first matrix: ");
scanf("%d", &rows1);

printf("Enter the number of columns for the first matrix: ");
scanf("%d", &cols1);

printf("\nEnter the number of rows for the second matrix: ");
scanf("%d", &rows2);

printf("Enter the number of columns for the second matrix: ");
scanf("%d", &cols2);

    if (cols1 != rows2) {
printf("Invalid matrix dimensions for multiplication. Exiting...\n");
        return 1;
    }

    if (rows1 <= 0 || cols1 <= 0 || rows2 <= 0 || cols2 <= 0 ||
        rows1 > MAX_SIZE || cols1 > MAX_SIZE || rows2 > MAX_SIZE || cols2 > MAX_SIZE) {
printf("Invalid matrix size. Exiting...\n");
        return 1;
```

```
   }

   int matrix1[MAX_SIZE][MAX_SIZE], matrix2[MAX_SIZE][MAX_SIZE], result[MAX_SIZE][MAX_SIZE];


printf("\nEnter elements for the first matrix (%dx%d):\n", rows1, cols1);
   for (int i = 0; i< rows1; i++) {
       for (int j = 0; j < cols1; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &(*(matrix1 + i * cols1 + j)));
       }
   }

   /
printf("\nEnter elements for the second matrix (%dx%d):\n", rows2, cols2);
   for (int i = 0; i< rows2; i++) {
       for (int j = 0; j < cols2; j++) {
printf("Element at (%d, %d): ", i + 1, j + 1);
scanf("%d", &(*(matrix2 + i * cols2 + j)));
       }
   }

multiplyMatrices((int *)matrix1, (int *)matrix2, (int *)result, rows1, cols1, cols2);

printf("\nOriginal Matrices:\n");
printf("Matrix 1:\n");
printMatrix((int *)matrix1, rows1, cols1);
printf("Matrix 2:\n");
printMatrix((int *)matrix2, rows2, cols2);
```

```
printf("\nResult Matrix (Product of Matrix 1 and Matrix 2):\n");
printMatrix((int *)result, rows1, cols2);


   return 0;
}
```

WORKSHEET WEEK 9

Q. 1 Write a C program to Search string.

```
#include <stdio.h>
#include <string.h>

int main() {
  char s1[] = "Beauty is in the eye of the beholder";
  char s2[] = "the";

  int n = 0;
  int m = 0;
  int times = 0;
  int len = strlen(s2);

  while(s1[n] != '\0') {

     if(s1[n] == s2[m]) {
        while(s1[n] == s2[m]  && s1[n] !='\0') {
          n++;
          m++;
        }

if(m == len&& (s1[n] == ' ' || s1[n] == '\0')) {


          times++;
        }
      } else {
        while(s1[n] != ' ') {
          n++;
          if(s1[n] == '\0')
          break;
        }
      }

      n++;
      m=0;
    }

if(times > 0) {
printf("'%s' appears %d time(s)\n", s2, times);
    } else {
printf("'%s' does not appear in the sentence.\n", s2);
    }
```

```
  return 0;
}
```

Q. 2 Write a C program to Reverse words in string.

```
#include <stdio.h>
#include <string.h>
#define MAX_SIZE 100

int main()
{
   char str[100], reverse[100];
   int len, i, index, wordStart, wordEnd;

printf("Enter any string: ");
   gets(str);

len   = strlen(str);
   index = 0;

wordStart = len - 1;
wordEnd   = len - 1;

while(wordStart> 0)
   {
      if(str[wordStart] == ' ')
      {
i = wordStart + 1;
while(i<= wordEnd)
```

```
            {
                reverse[index] = str[i];

i++;
                index++;
            }
            reverse[index++] = ' ';

wordEnd = wordStart - 1;
        }

wordStart--;
    }

for(i=0; i<=wordEnd; i++)
    {
        reverse[index] = str[i];
        index++;
    }

    reverse[index] = '\0';

printf("Original string \n%s\n\n", str);
printf("Reverse ordered words \n%s", reverse);

    return 0;
}
```

Q. 3 Write a C program to count vowels, consonants, etc.

```
#include <stdio.h>
int main() {

  char line[150];
  int vowels, consonant, digit, space;

  vowels = consonant = digit = space = 0;


printf("Enter a line of string: ");
fgets(line, sizeof(line), stdin);

  for (int i = 0; line[i] != '\0'; ++i) {

    line[i] = tolower(line[i]);

    if (line[i] == 'a' || line[i] == 'e' || line[i] == 'i' ||
        line[i] == 'o' || line[i] == 'u') {
      ++vowels;
    }

    else if ((line[i] >= 'a' && line[i] <= 'z')) {
      ++consonant;
    }

    else if (line[i] >= '0' && line[i] <= '9') {
      ++digit;
    }
    else if (line[i] == ' ') {
      ++space;
    }
  }

printf("Vowels: %d", vowels);
printf("\nConsonants: %d", consonant);
printf("\nDigits: %d", digit);
printf("\nWhite spaces: %d", space);

  return 0;
}
```

Q. 4 Create a program to separate characters in a given string?

```
#include <stdio.h>
#include <stdlib.h>

void main()
{
    char str[100];
    int l= 0;

printf("\n\separate the individual characters from a string :\n");
printf("------------------------------------------------------\n");
printf("Input the string : ");
fgets(str, sizeof str, stdin);
printf("The characters of the string are : \n");
    while(str[l]!='\0')
    {
```

```
printf("%c  ", str[l]);
      l++;
   }
printf("\n");
}
```

Q. 5 Write a program to take two strings from user and concatenate them also add a space between them using strcat() function.

Sample input:

JAI

GLA

Sample output: JAI GLA

```
#include <stdio.h>
#include <string.h>

int main()
{
   char a[100], b[100];

printf("Enter the first string\n");
   gets(a);

printf("Enter the second string\n");
   gets(b);

strcat(a,b);

printf("String obtained on concatenation is %s\n",a);
```

```
    return 0;

}
```

Q. 6 Write a C program to take a string from user and make it toggle its case i.e. lower case to upper case and upper case to lower case.

Sample Input: HElLowOrlD

Sample output: heLlOWoRLd

```
#include <stdio.h>

void toggleChars(char str[])
{
    for (int i = 0; str[i] != '\0'; i++) {
        if (str[i] >= 'A' && str[i] <= 'Z')
            str[i] = str[i] + 'a' - 'A';
        else if (str[i] >= 'a' && str[i] <= 'z')
            str[i] = str[i] + 'A' - 'a';
    }
}

int main()
{
    char str[] = "GeKf@rGeek$";
toggleChars(str);
printf("String after toggle \n");
printf("%s\n", str);
    return 0;
}
```

Q. 7 Write a C program to take two strings as input from user and check they are identical or not without using string functions.

Sample input:

Jai Gla

Jai Gla

Sample output: Identical

```
#include <stdio.h>

#include <string.h>


int main()

{

     char Str1[100], Str2[100];

     int result, i;


printf("\n Please Enter the First String :  ");

gets(Str1);


printf("\n Please Enter the Second String :  ");

gets(Str2);


for(i = 0; Str1[i] == Str2[i] && Str1[i] == '\0'; i++);


if(Str1[i] < Str2[i])

      {

printf("\n str1 is Less than str2");

   }

   else if(Str1[i] > Str2[i])

      {
```

```
printf("\n str2 is Less than str1");
   }
   else
      {
printf("\n str1 is Equal to str2");
   }

     return 0;
}
```

Q. 8 Write a C program to take a list of a student’s names from user by asking number of students and sort them alphabetical order.

Sample Input:

```
 Bhisham
 Jayant
Abhishek
Dhruv
```

Sample Output:

```
Abhishek
Bhisham
Dhruv
Jayant
```

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

int main() {
   int numStudents;
```

```
printf("Enter the number of students: ");
scanf("%d", &numStudents);

   if (numStudents<= 0) {
printf("Invalid number of students. Exiting...\n");
      return 1;
   }
   char **studentNames = (char **)malloc(numStudents * sizeof(char *));

   for (int i = 0; i<numStudents; i++) {
printf("Enter the name of student %d: ", i + 1);

studentNames[i] = (char *)malloc(100 * sizeof(char));
scanf("%s", studentNames[i]);
   }



   for (int i = 0; i<numStudents - 1; i++) {
      for (int j = i + 1; j <numStudents; j++) {
         if (strcmp(studentNames[i], studentNames[j]) > 0) {
            char *temp = studentNames[i];
studentNames[i] = studentNames[j];
studentNames[j] = temp;
         }
      }
   }

printf("\nSorted names in alphabetical order:\n");
   for (int i = 0; i<numStudents; i++) {
```

```
printf("%d. %s\n", i + 1, studentNames[i]);
   }
   for (int i = 0; i<numStudents; i++) {
      free(studentNames[i]);
   }
   free(studentNames);

   return 0;
}
```

<u>WEEK WORKSHEET 10</u>

Q. 1 Write a C program to find length of string using pointers.

```
#include <stdio.h>
int main() {
   char str[100], * ptr;
   int count;
printf("Enter any string: ");
   gets(str);
ptr = str;
   count = 0;
   while ( *ptr != '\0') {
      count++;
ptr++;
   }
printf("The length of the string is: %d", count);
   return 0;
}
```

Q. 2 Write a C program to copy one string to another using pointer.

```
#include<stdio.h>

void copy_string(char*, char*);

main()
{
   char source[100], target[100];
printf("Enter source string\n");
   gets(source);
copy_string(target, source);
printf("Target string is \"%s\"\n", target);
   return 0;
}

void copy_string(char *target, char *source)
{
   while(*source)
   {
      *target = *source;
      source++;
      target++;
   }
   *target = '\0';
}
```

Q. 3 Write a C program to concatenate two strings using pointers.

```
#include <stdio.h>

void concatenate(char *str1, char *str2) {
   while (*str1) {
      str1++;
   }

   while (*str2) {
      *str1 = *str2;
      str1++;
      str2++;
   }
   *str1 = '\0';
}

int main() {
   char string1[100], string2[50];

printf("Enter the first string:\n");
   gets(string1);
printf("Enter the second string:\n");
   gets(string2);

concatenate(string1, string2);

printf("Concatenated string: %s\n", string1);

   return 0;
}
```

Q. 4 Write a C program to compare two strings using pointers.

```
#include <iostream>
using namespace std;

int main()
{
   char string1[50],string2[50],*str1,*str2;
   int i,equal = 0;

printf("Enter The First String: ");
scanf("%s",string1);

printf("Enter The Second String: ");
scanf("%s",string2);

   str1 = string1;
   str2 = string2;

while(*str1 == *str2)
   {
      if ( *str1 == '\0' || *str2 == '\0' )
         break;

      str1++;
      str2++;
   }

if( *str1 == '\0' && *str2 == '\0' )
printf("\n\nBoth Strings Are Equal.");
   else
printf("\n\nBoth Strings Are Not Equal.");
}
```

Q. 5 WAP to find largest among three numbers using pointer

Q. 6 WAP to find largest among three numbers using pointer.

```
#include<stdio.h>

int main()
{
 int a,b,c,*pa, *pb, *pc;

printf("Enter three numbers:\n");
scanf("%d%d%d", &a,&b,&c);



 pa= &a;
 pb= &b;
 pc= &c;
if(*pa > *pb && *pa > *pc)
 {
printf("Largest is: %d", *pa);
 }
 else if(*pb > *pc && *pb > *pc)
 {
printf("Largest is : %d", *pb);
 }
 else
 {
printf("Largest = %d", *pc);
 }
 return 0;
}
```

Q. 7 WAP to find factorial of a number using pointer.

```
 #include<stdio.h>

void findFactorial(int,int *);
int main(){
 int i,factorial,n;

printf("Enter a number: ");
scanf("%d",&n);

findFactorial(n,&factorial);
printf("Factorial of %d is: %d",n,*factorial);

 return 0;
}

void findFactorial(int n,int *factorial){
 int i;

 *factorial =1;

 for(i=1;i<=n;i++)
 *factorial=*factorial*i;
}
```

Q. 8 Write a program to print largest even number present in an array using pointer to an array.

```
#include <stdio.h>

int findLargestEven(int *arr, int size) {
   int largestEven = -1;

   for (int i = 0; i< size; i++) {
       if (arr[i] % 2 == 0 &&arr[i] >largestEven) {
largestEven = arr[i];
       }
   }

   return largestEven;
}

int main() {
   int size;

printf("Enter the size of the array: ");
scanf("%d", &size);

   int arr[size];

printf("Enter %d elements:\n", size);
   for (int i = 0; i< size; i++) {
printf("Element %d: ", i + 1);
scanf("%d", &arr[i]);
```

```
  }

  int *ptr = arr;
  int largestEven = findLargestEven(ptr, size);

  if (largestEven != -1) {
printf("The largest even number in the array is: %d\n", largestEven);
  } else {
printf("No even numbers found in the array.\n");
  }

  return 0;
}
```

Q. 9 WAP to find sum of elements of an array using array of pointer.

```
#include <stdio.h>
#include <malloc.h>

void main()
{
  int i, n, sum = 0;
  int *a;

printf("Enter the size of array A \n");
scanf("%d", &n);

    a = (int *) malloc(n * sizeof(int));

printf("Enter Elements of the List \n");
```

```
   for (i = 0; i< n; i++)
      {
scanf("%d", a + i);
   }



      for (i = 0; i< n; i++)
      {
      sum = sum + *(a + i);
   }

printf("Sum of all elements in array = %d\n", sum);
      return 0;
}
```

Q. 10 WAP to compute simple interest using pointers.

```
#include<stdio.h>
int main() {
   float p, t, r, SI;

   float *x, *y, *z;

printf("Enter the principal (amount), time, and rate::\n");
scanf("%f%f%f", &p, &t, &r);

   x = &p;
   y = &t;
   z = &r;
```

```
    SI = (*x * *y * *z) / 100;

printf("\nSimple Interest = %.2f\n", SI);
    return 0;
}
```

Q. 11 Write a program to print largest even number present in an array using pointer to an array.

```
#include <stdio.h>

int findLargestEven(int *arr, int size) {
    int largestEven = -1;

    for (int i = 0; i< size; i++) {
        if (arr[i] % 2 == 0 &&arr[i] >largestEven) {
largestEven = arr[i];
        }
    }

    return largestEven;
}

int main() {
    int size;

printf("Enter the size of the array: ");
scanf("%d", &size);

    int arr[size];
printf("Enter %d elements:\n", size);
   for (int i = 0; i< size; i++) {

printf("Element %d: ", i + 1);
scanf("%d", &arr[i]);
   }

   int *ptr = arr;

   int largestEven = findLargestEven(ptr, size);



   if (largestEven != -1) {

printf("The largest even number in the array is: %d\n", largestEven);
   } else {

printf("No even numbers found in the array.\n");
   }

   return 0;
}
```

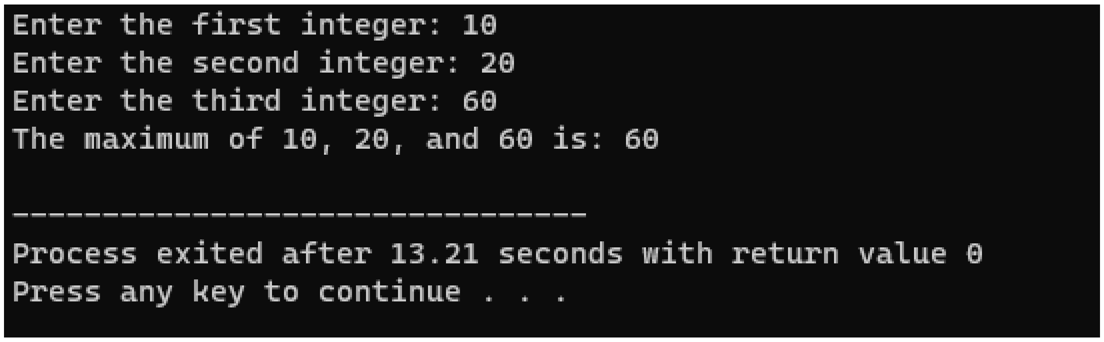
<u>WEEK WORKSHEET 11</u>

Q. 1 Write a C function to return the maximum of three integers.

```
#include <stdio.h>


int findMax(int a, int b, int c) {
   int max = a;
```

```
    if (b > max) {
        max = b;
    }

    if (c > max) {
        max = c;
    }

    return max;
}

int main() {
    int num1, num2, num3;

    printf("Enter the first integer: ");
    scanf("%d", &num1);
    printf("Enter the second integer: ");
    scanf("%d", &num2);
    printf("Enter the third integer: ");
    scanf("%d", &num3);

    int maximum = findMax(num1, num2, num3);

    printf("The maximum of %d, %d, and %d is: %d\n", num1, num2, num3, maximum);

    return 0;
}
```

Output



```
Enter the first integer: 10
Enter the second integer: 20
Enter the third integer: 60
The maximum of 10, 20, and 60 is: 60

--------------------------------
Process exited after 13.21 seconds with return value 0
Press any key to continue . . .
```

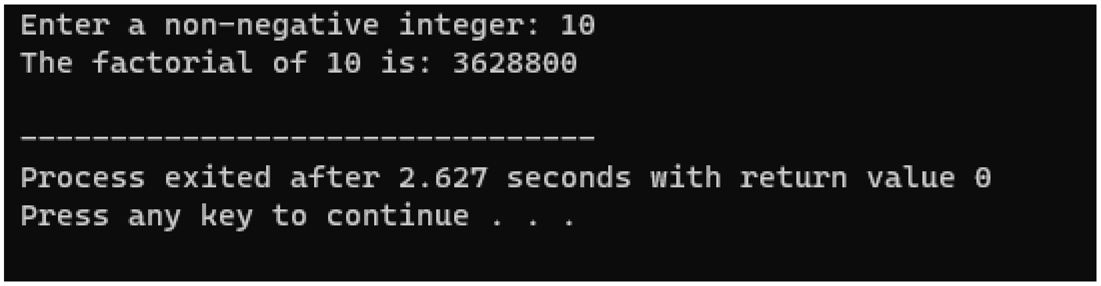
Q. 2 Write a C function to check if a given number is prime or not.

```
#include <stdio.h>


int main() {


 int n, i, flag = 0;

printf("Enter a positive integer: ");

scanf("%d", &n);


 if (n == 0 || n == 1)

  flag = 1;


 for (i = 2; i<= n / 2; ++i) {


  if (n % i == 0) {

   flag = 1;

   break;

  }

 }


 if (flag == 0)
printf("%d is a prime number.", n);
  else
printf("%d is not a prime number.", n);

  return 0;
}
```

Q. 3 Write a C function to compute the factorial of a non-negative integer.

```
#include <stdio.h>
unsigned long long calculateFactorial(int n) {
    if (n == 0 || n == 1) {
        return 1; // 0! and 1! are both 1
    } else {
        return n * calculateFactorial(n - 1);
    }
}

int main() {
    int num;

    printf("Enter a non-negative integer: ");
    scanf("%d", &num);

    if (num < 0) {
        printf("Error: Please enter a non-negative integer.\n");
        return 1;
    }

    unsigned long long result = calculateFactorial(num);
    printf("The factorial of %d is: %llu\n", num, result);


    return 0;
}
```

Output

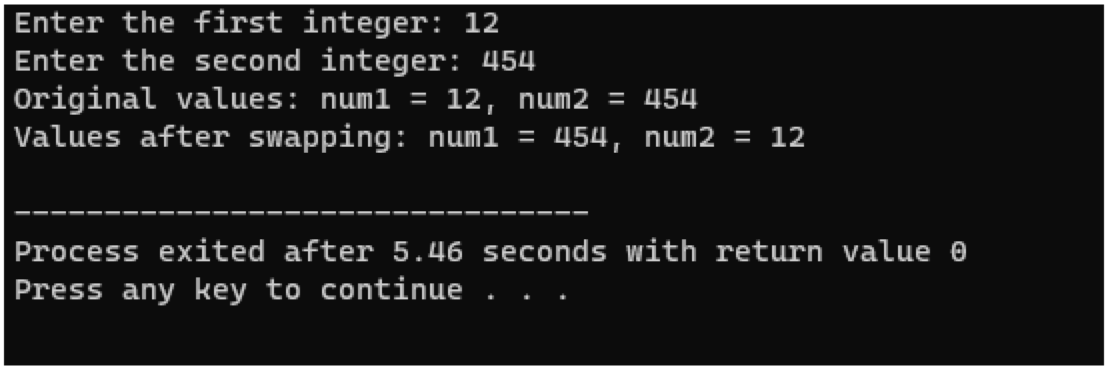


```
Enter a non-negative integer: 10
The factorial of 10 is: 3628800

--------------------------------
Process exited after 2.627 seconds with return value 0
Press any key to continue . . .
```

Q. 4 Write a C function to swap the values of two integers in actual arguments.

```
#include <stdio.h>


void swapIntegers(int *a, int *b) {
    int temp = *a;
    *a = *b;
    *b = temp;
}


int main() {
    int num1, num2;


    printf("Enter the first integer: ");
    scanf("%d", &num1);
    printf("Enter the second integer: ");
    scanf("%d", &num2);
    printf("Original values: num1 = %d, num2 = %d\n", num1, num2);

    swapIntegers(&num1, &num2);

    printf("Values after swapping: num1 = %d, num2 = %d\n", num1, num2);

    return 0;
}
```

Output



```
Enter the first integer: 12
Enter the second integer: 454
Original values: num1 = 12, num2 = 454
Values after swapping: num1 = 454, num2 = 12

--------------------------------
Process exited after 5.46 seconds with return value 0
Press any key to continue . . .
```

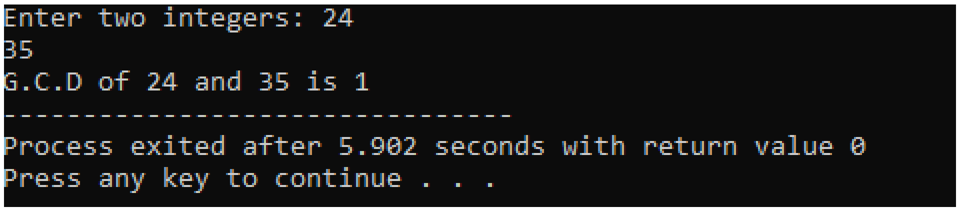
Q. 5 Write a C function to compute the sum and average of an array of integers.

```
#include <stdio.h>

int main(){

    int arr[100], size, sum;
    float avg;

printf("Enter the size of the array: ");
scanf("%d", &size);


printf("Enter the array elements: ");
for(int i = 0; i< size; i++){
scanf("%d", &arr[i]);
  }


  sum = 0;


for(int i = 0; i< size; i++){
     sum = sum + arr[i];
  }


  avg = sum / size;


printf("Sum of array elements is: %d", sum);
printf("\nAvg. of arrays elements is: %.2f", avg);


  return 0;


}
```

Q. 6 Write a C function to find the GCD (Greatest Common Divisor) of two non negative integers using Euclid's algorithm.

```
#include <stdio.h>
int main()
{
  int n1, n2, i, gcd;
printf("Enter two integers: ");

scanf("%d %d", &n1, &n2);


for(i=1; i<= n1 &&i<= n2; ++i)

   {


if(n1%i==0 && n2%i==0)

gcd = i;

   }


printf("G.C.D of %d and %d is %d", n1, n2, gcd);


   return 0;

}
```

Output

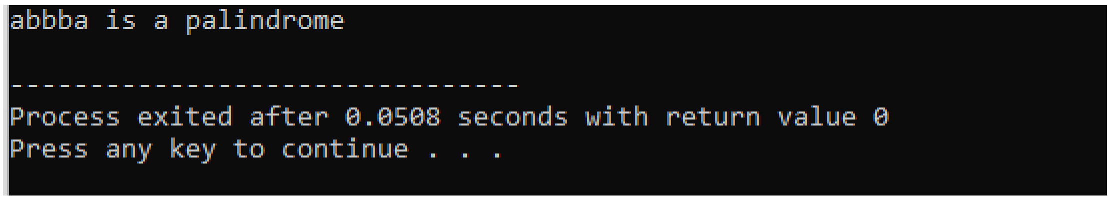


```
Enter two integers: 24
35
G.C.D of 24 and 35 is 1
--------------------------------
Process exited after 5.902 seconds with return value 0
Press any key to continue . . .
```

Q. 7 Write a C function to check if a given string is a valid palindrome, considering only alphanumeric characters and ignoring cases.

```
#include <stdio.h>

#include <string.h>


int main()

{

   char str[] = { "abbba" };
   int l = 0;

   int h = strlen(str) - 1;

   while (h > l) {

       if (str[l++] != str[h--]) {

printf("%s is not a palindrome\n", str);

           return 0;


       }

   }


printf("%s is a palindrome\n", str);


   return 0;

}
```

Output

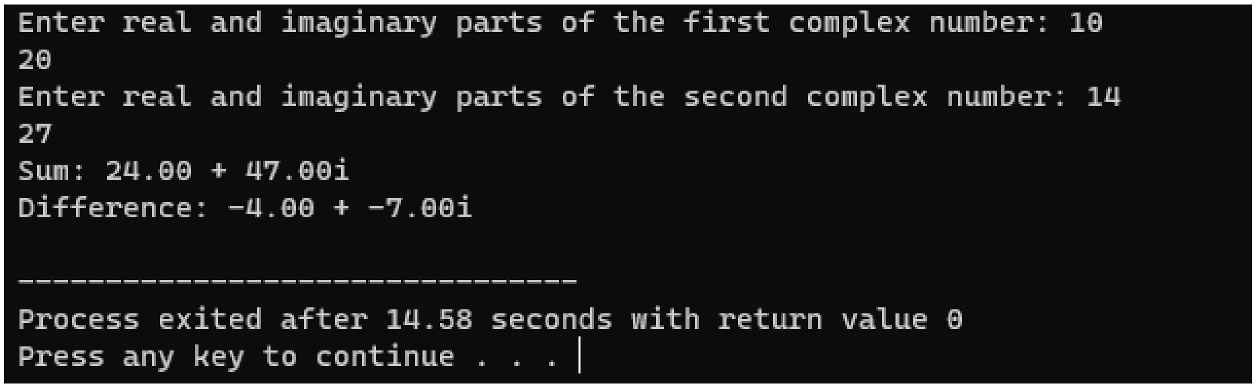


```
abbba is a palindrome

--------------------------------
Process exited after 0.0508 seconds with return value 0
Press any key to continue . . .
```

Q8. Write a C function to calculate the sum and difference of two complex numbers.

```
#include <stdio.h>


typedef struct {

   double real, imag;
} Complex;

void calculateSumAndDifference(Complex num1, Complex num2, Complex *sum, Complex *difference) {
   *sum = (Complex){num1.real + num2.real, num1.imag + num2.imag};
   *difference = (Complex){num1.real - num2.real, num1.imag - num2.imag};
}

int main() {
   Complex c1, c2, sum, difference;

   printf("Enter real and imaginary parts of the first complex number: ");
   scanf("%lf %lf", &c1.real, &c1.imag);

   printf("Enter real and imaginary parts of the second complex number: ");
   scanf("%lf %lf", &c2.real, &c2.imag);

   calculateSumAndDifference(c1, c2, &sum, &difference);

   printf("Sum: %.2lf + %.2lfi\n", sum.real, sum.imag);
   printf("Difference: %.2lf + %.2lfi\n", difference.real, difference.imag);

   return 0;
}
```

Output



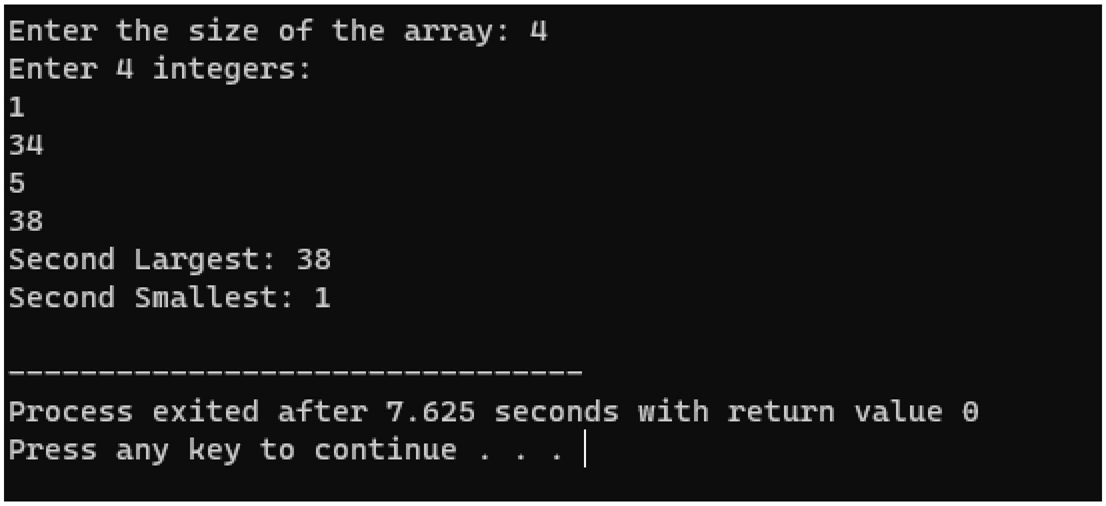
```
Enter real and imaginary parts of the first complex number: 10
20
Enter real and imaginary parts of the second complex number: 14
27
Sum: 24.00 + 47.00i
Difference: -4.00 + -7.00i

--------------------------------
Process exited after 14.58 seconds with return value 0
Press any key to continue . . .
```

Q. 9 Write a C function to find the second largest and second smallest elements in an array of integers.

```
#include <stdio.h>

#include <stdlib.h>


void findSecondLargestAndSmallest(int arr[], int size, int *secondLargest, int *secondSmallest) {

   if (size < 2) {

       printf("Array should have at least two elements.\n");

       return;

   }


   *secondLargest = *secondSmallest = arr[0];


   for (int i = 1; i < size; i++) {

       *secondLargest = (arr[i] > *secondLargest) ? arr[i] : *secondLargest;

       *secondSmallest = (arr[i] < *secondSmallest) ? arr[i] : *secondSmallest;

   }

}


int main() {

   int size;
```

```
    printf("Enter the size of the array: ");
    scanf("%d", &size);

    if (size < 2) {
        printf("Array should have at least two elements.\n");
        return 1;
    }

    int *arr = (int *)malloc(size * sizeof(int));
    if (arr == NULL) {
        printf("Memory allocation failed\n");
        return 1;
    }

    printf("Enter %d integers:\n", size);
    for (int i = 0; i < size; i++) {
        scanf("%d", &arr[i]);
    }

    int secondLargest, secondSmallest;
    findSecondLargestAndSmallest(arr, size, &secondLargest, &secondSmallest);

    printf("Second Largest: %d\n", secondLargest);
    printf("Second Smallest: %d\n", secondSmallest);

    free(arr);

    return 0;
}
```

Output



```
Enter the size of the array: 4
Enter 4 integers:
1
34
5
38
Second Largest: 38
Second Smallest: 1

--------------------------------
Process exited after 7.625 seconds with return value 0
Press any key to continue . . .
```

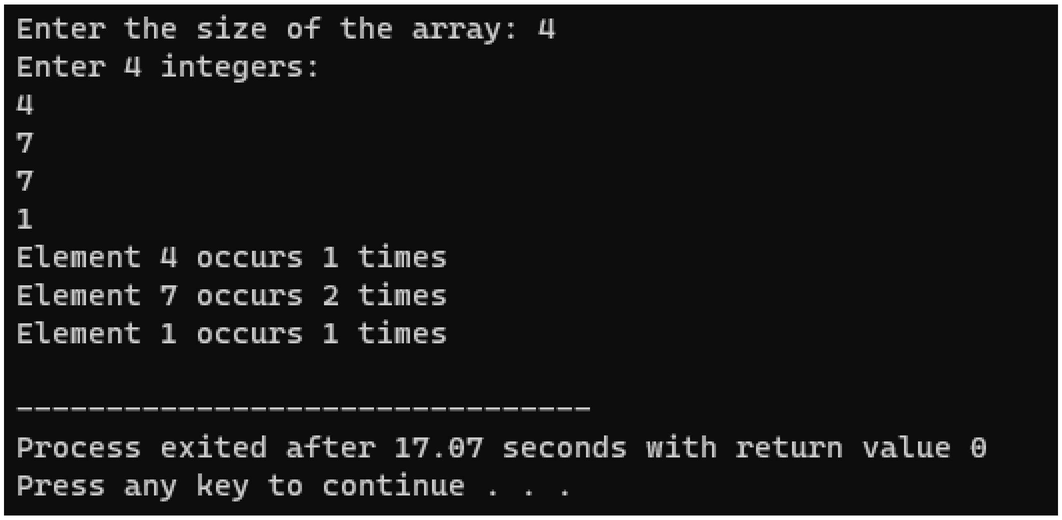
Q. 10 Write a C function to find the number of occurrences of each unique element in an array.

```
#include <stdio.h>

#include <stdlib.h>


void countOccurrences(int arr[], int size) {

   for (int i = 0; i < size; i++) {

      if (arr[i] != -1) {

         int count = 1;

         for (int j = i + 1; j < size; j++) {

            if (arr[j] == arr[i]) {

               count++;

               arr[j] = -1;

            }

         }

         printf("Element %d occurs %d times\n", arr[i], count);

      }

   }
```

```
}

int main() {
   int size;

   printf("Enter the size of the array: ");
   scanf("%d", &size);

   if (size <= 0) {
      printf("Array should have at least one element.\n");
      return 1;
   }

   int *arr = (int *)malloc(size * sizeof(int));
   if (arr == NULL) {
      printf("Memory allocation failed\n");
      return 1;
   }

   printf("Enter %d integers:\n", size);
   for (int i = 0; i < size; i++) {
      scanf("%d", &arr[i]);
   }

   countOccurrences(arr, size);

   free(arr);

   return 0;
```

}

Output



```
Enter the size of the array: 4
Enter 4 integers:
4
7
7
1
Element 4 occurs 1 times
Element 7 occurs 2 times
Element 1 occurs 1 times

--------------------------------
Process exited after 17.07 seconds with return value 0
Press any key to continue . . .
```