



EAST DELTA UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Final Assignment

Course Name: Structured Programming Language

Course Code: 113

Date of Submission: 08/09/2024

Submitted To Sohrab Hossain	Submitted By Upal Barua ID: 242001922E
---------------------------------------	---

Signature

1. Write a C program to Determine the roots of the quadratic equation $ax^2 + bx + c = 0$ using the well known quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ using if-else, ladder if-else, and nested if-else. Allow for the possibility that one of the constants has a value of zero, and that the quantity $b^2 - 4ac$ is less than or equal to zero.

Using if-else:

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

int main() {
    double a, b, c, discriminant, root1, root2;
    printf("Enter a, b, and c: ");
    scanf("%lf %lf %lf", &a, &b, &c);

    if (a == 0) {
        if (b != 0) {
            root1 = -c / b;
            printf("Root: %.2lf\n", root1);
        } else {
            printf("Invalid equation.\n");
        }
    } else {
        discriminant = b * b - 4 * a * c;
        if (discriminant > 0) {
            root1 = (-b + sqrt(discriminant)) / (2 * a);
            root2 = (-b - sqrt(discriminant)) / (2 * a);

            printf("Roots are real and different: %.2lf and %.2lf\n", root1, root2);
        } else if (discriminant == 0) {
            root1 = root2 = -b / (2 * a);

            printf("Roots are real and the same: %.2lf\n", root1);
        } else {
            printf("Roots are complex.\n");
        }
    }
}
```

Using ladder if-else:

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

int main() {
    double a, b, c, discriminant, root1, root2;
    printf("Enter a, b, and c: ");
    scanf("%lf %lf %lf", &a, &b, &c);
```

```

if (a == 0 && b != 0) {
    root1 = -c / b;
    printf("Root: %.2lf\n", root1);
} else if (a == 0 && b == 0) {
    printf("Invalid equation.\n");
} else if ((discriminant = b * b - 4 * a * c) > 0) {
    root1 = (-b + sqrt(discriminant)) / (2 * a);
    root2 = (-b - sqrt(discriminant)) / (2 * a);
    printf("Roots are real and different: %.2lf and %.2lf\n", root1, root2);
} else if (discriminant == 0) {
    root1 = root2 = -b / (2 * a);
    printf("Roots are real and the same: %.2lf\n", root1);
} else {
    printf("Roots are complex.\n");
}
}

```

Using nested if-else:

```

#include <math.h>
#include <stdio.h>

```

```

int main() {
    double a, b, c, discriminant, root1, root2;
    printf("Enter a, b, and c: ");
    scanf("%lf %lf %lf", &a, &b, &c);

    if (a != 0) {
        discriminant = b * b - 4 * a * c;
        if (discriminant > 0) {
            root1 = (-b + sqrt(discriminant)) / (2 * a);
            root2 = (-b - sqrt(discriminant)) / (2 * a);
            printf("Roots are real and different: %.2lf and %.2lf\n", root1, root2);
        } else if (discriminant == 0) {
            root1 = root2 = -b / (2 * a);
            printf("Roots are real and the same: %.2lf\n", root1);
        } else {
            printf("Roots are complex.\n");
        }
    } else {
        if (b != 0) {
            root1 = -c / b;
            printf("This is a linear equation. Root: %.2lf\n", root1);
        } else {
            printf("Invalid equation.\n");
        }
    }
}

```

```
}
```

2. Write a program to determine whether a year entered by the user is a leap year or not using if-else, ladder if-else, and nested if-else. Remember, a leap year is exactly divisible by 4 except for century years (years ending with 00). The century year is a leap year only if it is perfectly divisible by 400.

Using if-else:

```
#include <stdio.h>

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

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

Using ladder if-else:

```
#include <stdio.h>

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

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

    return 0;
}
```

Using nested if-else:

```
#include <stdio.h>

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

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

3. Write a program to sum 20 to 10 (only even numbers) using for, while, and do-while loop.

Using if-else:

```
#include <stdio.h>

int main() {
    int sum = 0;

    for (int i = 20; i >= 10; i--) {
        if (i % 2 == 0) {
            sum += i;
        }
    }

    printf("Sum of even numbers from 20 to 10: %d\n", sum);
}
```

Using ladder if-else:

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

```
int main() {
```

```

int sum = 0;
int i = 20;

while (i >= 10) {
    if (i % 2 == 0) {
        sum += i;
    }

    i--;
}

printf("Sum of even numbers from 20 to 10: %d\n", sum);
}

```

Using nested if-else:

```

#include <stdio.h>

int main() {
    int sum = 0;
    int i = 20;

    do {
        if (i % 2 == 0) {
            sum += i;
        }
        i--;
    } while (i >= 10);

    printf("Sum of even numbers from 20 to 10: %d\n", sum);
}

```

4. Write a C program to check whether a character is uppercase or lowercase alphabet.

```

#include <stdio.h>

int main() {
    char ch;

    printf("Enter a character: ");
    scanf("%c", &ch);

    if (ch >= 'A' && ch <= 'Z') {
        printf("Uppercase alphabet.\n");
    } else if (ch >= 'a' && ch <= 'z') {
        printf("Lowercase alphabet.\n");
    }
}

```

```
}
```

5. There are 8 ounces in a cup. Write a program that converts ounces to cups.

```
#include <stdio.h>

int main() {
    double ounces, cups;

    printf("Enter the number of ounces: ");
    scanf("%lf", &ounces);

    cups = ounces / 8.0;

    printf("%.2lf ounces = %.2lf cups.\n", ounces, cups);
}
```

6. Write a program that computes the square footage of a house given the dimensions of each room. Have the program ask the user how many rooms in the house and then request the dimensions of each room. Display the resulting total square footage.

```
#include <stdio.h>

int main() {
    int numRooms;
    double length, width, roomArea, totalArea = 0.0;

    printf("Number of rooms in the house: ");
    scanf("%d", &numRooms);

    for (int i = 1; i <= numRooms; i++) {
        printf("Length and width of room %d (in feet): ", i);
        scanf("%lf %lf", &length, &width);

        roomArea = length * width;

        totalArea += roomArea;
    }

    printf("The total area of the house is: %.2lf square feet.\n", totalArea);
}
```

7. Write a program that prints the numbers 1 to 100 using 5 columns. Have each number separated from the next by a tab.

```
#include <stdio.h>

int main() {
    for (int i = 1; i <= 100; i++) {
        printf("%d\t", i);

        if (i % 5 == 0) {
            printf("\n");
        }
    }
}
```

8. Take a character input from the user and check if it is a digit or not.

```
#include <stdio.h>

int main() {
    char ch;

    printf("Enter a character: ");
    scanf("%c", &ch);

    if (ch >= '0' && ch <= '9') {
        printf("Is a digit.\n");
    } else {
        printf("Is not a digit.\n");
    }
}
```

9. Write a program in C that takes minutes as input and displays the total number of hours and minutes.

```
#include <stdio.h>

int main() {
    int totalMinutes;
    int hours, minutes;

    printf("Number of minutes: ");
    scanf("%d", &totalMinutes);

    hours = totalMinutes / 60;
```

```

minutes = totalMinutes % 60;

// Display the result
printf("%d minutes = %d hours and %d minutes.\n", totalMinutes, hours, minutes);
}

```

10. Write an appropriate control structure that will examine the value of a floating-point variable called temp and print one of the following messages, depending on the value assigned to temp.

- (a) ICE, if the value of temp is less than 0.
- (b) WATER, if the value of temp lies between 0 and 100.
- (c) STEAM, if the value of temp exceeds 100.

```

#include <stdio.h>

int main() {
    float temp;

    printf("Enter the temperature: ");
    scanf("%f", &temp);

    if (temp < 0) {
        printf("ICE\n");
    } else if (temp >= 0 && temp <= 100) {
        printf("WATER\n");
    } else {
        printf("STEAM\n");
    }
}

```

11. Write a loop that will calculate the sum of every third integer, beginning with i=2 (icy calculate the sum 2 + 5 + 8 + 11 + -) for all values that are less than 100. Write the loop three different ways.

- (a) Using a while statement.
- (b) Using a do - while statement.
- (c) Using a for statement.

Using while statement:

```

#include <stdio.h>

```

```
int main() {
    int i = 2, sum = 0;

    while (i < 100) {
        sum += i;
        i += 3;
    }

    printf("Sum using while: %d\n", sum);
    return 0;
}
```

Using do-while statement:

```
#include <stdio.h>

int main() {
    int i = 2, sum = 0;

    do {
        sum += i;
        i += 3;
    } while (i < 100);

    printf("Sum using do-while: %d\n", sum);
    return 0;
}
```

Using for statement:

```
#include <stdio.h>

int main() {
    int sum = 0;

    for (int i = 2; i < 100; i += 3) {
        sum += i;
    }

    printf("Sum using for: %d\n", sum);
    return 0;
}
```

12. Write a C program to input marks of five subjects Physics, Chemistry, Biology, Mathematics and Computer. Calculate percentage and grade according to following:

Percentage \geq 93% : Grade A

Percentage \geq 85% : Grade B

Percentage \geq 80% : Grade C

Percentage \geq 75% : Grade D

Percentage \geq 60% : Grade E

Percentage $<$ 60% : Grade F

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

```
int main() {
    float physics, chemistry, biology, mathematics, computer, total, percentage;
    char grade;

    printf("Enter marks in Physics: ");
    scanf("%f", &physics);

    printf("Enter marks in Chemistry: ");
    scanf("%f", &chemistry);

    printf("Enter marks in Biology: ");
    scanf("%f", &biology);

    printf("Enter marks in Mathematics: ");
    scanf("%f", &mathematics);

    printf("Enter marks in Computer: ");
    scanf("%f", &computer);

    total = physics + chemistry + biology + mathematics + computer;

    percentage = (total / 500) * 100;

    if (percentage  $\geq$  95) {
        grade = 'A';
    } else if (percentage  $\geq$ 
```

13. Write a C program to input basic salary of an employee and calculate its Gross salary according to following:

Basic Salary \leq 10000 : House Rent = 20%, DA = 80%

Basic Salary \leq 20000 : House Rent = 25%, DA = 90%

Basic Salary $>$ 20000 : House Rent = 30%, DA = 95%

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

```
int main() {  
    float basicSalary, houseRent, da, grossSalary;  
  
    printf("Enter the basic salary of the employee: ");  
    scanf("%f", &basicSalary);  
  
    if (basicSalary <= 10000) {  
        houseRent = 0.20 * basicSalary;  
        da = 0.80 * basicSalary;  
    } else if (basicSalary <= 20000) {  
        houseRent = 0.25 * basicSalary;  
        da = 0.90 * basicSalary;  
    } else {  
        houseRent = 0.30 * basic
```

14. Write a C program to input electricity unit charges and calculate total electricity bill according to the given condition:

For first 50 units taka. 0.50/unit

For next 100 units taka. 0.75/unit

For next 100 units taka. 1.20/unit

For unit above 250 taka. 1.50/unit

An additional surcharge of 20% is added to the bill.

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

```
int main() {  
    float unit, totalBill, surcharge;  
  
    printf("Enter electricity units consumed: ");  
    scanf("%f", &unit);
```

```

if (unit <= 50) {
    totalBill = unit * 0.50;
} else if (unit <= 150) {
    totalBill = (50 * 0.50) + ((unit - 50) * 0.75);
} else if (unit <= 250) {
    totalBill = (50 * 0.50) + (100 * 0.75) + ((unit - 150) * 1.20);
} else {
    totalBill = (50 * 0.50) + (100 * 0.75) + (100 * 1.20) + ((unit - 250) * 1.50);
}

surcharge = totalBill * 0.20;
totalBill += surcharge;

printf("Total Electricity Bill = %.2f Taka\n", totalBill);

return 0;
}

```

15. Write a program to calculate surface area $A = 2\pi rh + 2r^2$, lateral area $AL = 2\pi rh$, and base area $AB = \pi r^2$.

```

#include <stdio.h>
#include <math.h>

int main() {
    float radius, height, surfaceArea, lateralArea, baseArea;
    const float pi = 3.1416;

    printf("Enter the radius of the cylinder: ");
    scanf("%f", &radius);

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

    lateralArea = 2 * pi * radius * height;
    baseArea = pi * radius * radius;
    surfaceArea = lateralArea + 2 * baseArea;

    printf("Lateral Area (AL) = %.2f\n", lateralArea);
    printf("Base Area (AB) = %.2f\n", baseArea);
    printf("Surface Area (A) = %.2f\n", surfaceArea);
}

```

16. Develop a simple calculator that can perform basic operations like addition, subtraction, multiplication, and division. The program should allow the user to input two numbers and the operation they wish to perform, then display the result.

```
#include <stdio.h>

int main() {
    char operation;
    float num1, num2, result;

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

    printf("Enter second number: ");
    scanf("%f", &num2);

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

    if (operation == '+') {
        result = num1 + num2;
        printf("Result: %.2f\n", result);
    } else if (operation == '-') {
        result = num1 - num2;
        printf("Result: %.2f\n", result);
    } else if (operation == '*') {
        result = num1 * num2;
        printf("Result: %.2f\n", result);
    } else if (operation == '/') {
        if (num2 != 0) {
            result = num1 / num2;
            printf("Result: %.2f\n", result);
        } else {
            printf("Error: Division by zero is not allowed.\n");
        }
    } else {
        printf("Invalid operation.\n");
    }
}
```

17. Develop a “Guess the Number” game where the computer randomly selects a number between 1 and 100, and the user has to guess it. After each guess, the program tells the user whether their guess was too high, too low, or correct.

```

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

int main() {
    int randomNumber, guess;

    srand(time(0));
    randomNumber = rand() % 100 + 1;

    printf("I have selected a number between 1 and 100.\n");

    do {
        printf("Enter your guess: ");
        scanf("%d", &guess);

        if (guess > randomNumber) {
            printf("Too high! Try again.\n");
        } else if (guess < randomNumber) {
            printf("Too low! Try again.\n");
        } else {
            printf("Congratulations! You guessed the number.\n");
        }
    } while (guess != randomNumber);
}

```

18. Write a program that prints the ASCII values of all characters. You might limit the output to printable characters only, from 32 to 126.

```

#include <stdio.h>

int main() {
    for (int i = 32; i <= 126; i++) {
        printf("Character: %c, ASCII Value: %d\n", i, i);
    }
}

```

19. Implement a program that swaps the values of two variables. The program should demonstrate swapping with and without using a temporary variable.

```

#include <stdio.h>

int main() {

```

```
int a, b;

printf("Enter two integers: ");
scanf("%d %d", &a, &b);

int temp = a;
a = b;
b = temp;

printf("After swapping with temp: a = %d, b = %d\n", a, b);

a = a + b;
b = a - b;
a = a - b;

printf("After swapping without temp: a = %d, b = %d\n", a, b);
}
```

20. Create a program that calculates someone's age based on the current year and the year of birth entered by the user.

```
#include <stdio.h>

int main() {
    int currentYear, birthYear, age;

    printf("Enter the current year: ");
    scanf("%d", &currentYear);

    printf("Enter your birth year: ");
    scanf("%d", &birthYear);

    age = currentYear - birthYear;

    printf("Your age is: %d\n", age);
}
```

Discussion

Working with various C programs has deepened my understanding of core programming concepts. C is a versatile language, useful for a wide range of tasks from simple calculations to more complex logic. Through this process, I've gained hands-on experience with essential control structures like if-else statements and loops, which help in making decisions and repeating actions based on conditions. For instance, I used these structures in programs like calculating electricity bills and creating a simple calculator.

I also learned about functions and how to manage variables, which taught me the value of organizing code for reusability. Creating a "Guess the Number" game introduced me to random number generation and using feedback loops based on user input.

Understanding ASCII values helped me see how characters are stored in memory, and the swapping program showed me different ways to handle variables.

In summary, these exercises highlighted C's strengths in both high-level logic and low-level operations, such as managing memory and interacting with hardware. This makes C a foundational language in programming that supports a range of technological applications.