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Course: Data Structures and Algorithms

Instructor: SEAK Leng

Assignment: TP-1

Due Date: March 27, 2025 (12:00 AM)

1. Write a C++ program to ask information from a student such as name, gender, major, age then display the greeting message on screen. Say he/she is eligible to vote the election if the age is at least 18.

   Hi, Mr. ***name!*** your age is ***age*** year old and you learn ***major***! : **for male (M)**

   Hi, Mrs. n***ame!***, you are ***age*** year old and you are majoring in ***major*** : **for female (F)**

   For either Male or Female:

   You can vote. If age is at least 18.

   You can not vote Otherwise.

Source Code

```cpp
#include<iostream>
using namespace std;
int main(){
    string name, major;
    char gender;
    int age;
    cout << "Please give me name, gender,major and age:" << endl;
    cout << "(Example: Rith M SE 18)" << endl;
    cin >> name >> gender >> major >> age;
    if (gender == 'M'){
        if (age < 18 && age >0){
            cout << "Hi, Mr. " << name << "! your age is " << age <<  "year old and you learn "<<major<<"!." << "You can not vote" <<endl;
        } else if (age >= 18 && age < 100){
            cout << "Hi, Mr. " << name << "! your age is " << age <<  "year old and you learn "<<major<<"!." << "You can vote" <<endl;
        }
        else {
            cout << "Please enter a valid age!" << endl;
        }
    }
    else if(gender == 'F'){
        if (age < 18 && age >0){
            cout << "Hi, Ms. " << name << "! your age is " << age <<  "year old and you learn "<<major<<"!." << "You can not vote" <<endl;
        } else if (age >= 18 && age < 100){
            cout << "Hi, Ms. " << name << "! your age is " << age <<  "year old and you learn "<<major<<"!." << "You can vote" <<endl;
        }
        else {
            cout << "Please enter a valid age!" << endl;
        }
    }
    else{
        cout << "Please enter a valid gender (M/F)!" << endl;
    }
        return 0;
}

```

Output:

```
Please give me name, gender,major and age:
(Example: Rith M SE 18)
Daro M AI 30
Hi, Mr. Daro! your age is 30year old and you learn AI!.You can vote
```

2. Write a C++ program to check whether an input character is a vowel or a consonant. Hint: Use ASCII code to test condition.
    - Uppercase letters from: 65 to 90, lowercase letters from 97 to 122
    - Vowel and its ASCII code: a = 97, e = 101, i = 105, o = 111, u = 117

Source Code

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

void check(char c){
    if (int(c)==97 || int(c)==101 || int(c)==105 || int(c)==111 || int(c)==117){
        cout << "The character is a vowel!" << endl;
    }
    else if (int(c)==65 || int(c)==69 || int(c)==73 || int(c)==79 || int(c)==85){
        cout << "The character is a vowel!" << endl;
    }
    else if (int(c)>96 && int(c)<123){
        cout << "The character is a consonant!" << endl;
    }
    else if (int(c)>64 && int(c)<91){
        cout << "The character is a consonant!" << endl;
    }
    else{
        cout << "Please enter a valid character!" << endl;
    }
}

int main(){
    char c;
    cout << "Please give me a character:";
    cin >> c;
    cout << endl;
    check(c);
    return 0;
}

```

Output:

```
Please give me a character:A

The character is a vowel!
```

```
Please give me a character:g

The character is a consonant!
```

3. A program to compute tax salary of a person. The program asks for name, gender and salary of a person and tell him/her how much tax he/she is required to pay. The tax is computed based on the rules below:
   - **For males**
     - Salary more than 1000 USD, pay tax 9.5%
     - Salary 500 – 1000 USD, pay tax 7%
     - Salary 300 – 500 USD, pay tax 5%
     - Salary less than 300, no need to pay tax
   - **For females**
     - Salary more than 1000 USD, pay tax 8%
     - Salary 500 – 1000 USD, pay tax 6.5%
     - Salary 300 – 500 USD, pay tax 3.5%
     - Salary less than 300, no need to pay tax

Source Code:

```cpp
#include<iostream>
using namespace std;
double Tax;

void display(){
    cout << "Tax required to paid is "<< Tax << endl;
}

void maleTax(double salary){
    if (salary > 1000){
        Tax = salary * (9.5/100);
    } else if (salary <= 1000 && salary > 500){
        Tax = salary * (7.0/100);
    } else if(salary <= 500 && salary > 300){
        Tax = salary * (5.0/100);
    }else if(salary <= 300 && salary > 0){
        Tax = 0;
    }
    else{
        cout << "Please enter a valid salary!" << endl;
    }
    display();
}
```

```cpp
void femaleTax(double salary){
    if (salary > 1000){
        Tax = salary * (8.0/100);
    } else if (salary <= 1000 && salary > 500){
        Tax = salary * (6.5/100);
    } else if(salary <= 500 && salary > 300){
        Tax = salary * (3.5/100);
    }else if(salary <= 300 && salary > 0){
        Tax = 0;
    }
    else{
        cout << "Please enter a valid salary!" << endl;
    }
    display();
}

int main(){
    string name;
    char gender;
    double salary;
    cout << "Please give me: name, gender, salary" << endl;
    cout << "(Example: Rith M 1000)" << endl;
    cin >> name >> gender >> salary;
    if (gender == 'M'){
        maleTax(salary);
    } else if (gender == 'F'){
        femaleTax(salary);
    } else {
        cout << "Please enter a valid";
    }
    return 0;
}
```

Output:

```
Please give me: name, gender, salary
(Example: Rith M 1000)
Rith M 1500
Tax required to paid is 142.5
```

```
Please give me: name, gender, salary
(Example: Rith M 1000)
Rith F 580
Tax required to paid is 37.7
```

4. Create a C++ program that can play a game Rock-Paper-Scissor. The game plays between the user against the computer.

Source Code:

```cpp
#include <iostream>
#include <cstdlib>
#include <ctime>
using namespace std;

string getComputerChoice() {
    int choice = rand() % 3;
    if (choice == 0) return "rock";
    else if (choice == 1) return "paper";
    else return "scissors";
}

string getResult(string user, string computer) {
    if (user == computer) {
        return "It's a tie!";
    } else if ((user == "rock" && computer == "scissors") ||
               (user == "paper" && computer == "rock") ||
               (user == "scissors" && computer == "paper")) {
        return "You win!";
    } else {
        return "Computer wins!";
    }
}

int main() {
    srand(time(0));

    string userChoice;
    cout << "Welcome to Rock-Paper-Scissors Game!\n";
    cout << "Enter your choice (rock, paper, scissors): ";
    cin >> userChoice;

    for (auto &c : userChoice) c = tolower(c);

    if (userChoice != "rock" && userChoice != "paper" && userChoice != "scissors") {
        cout << "Invalid choice. Please run the program again.\n";
        return 1;


    string computerChoice = getComputerChoice();
    cout << "Computer chose: " << computerChoice << endl;

    cout << getResult(userChoice, computerChoice) << endl;

    return 0;
}
```

Output:

```
Welcome to Rock-Paper-Scissors Game!
Enter your choice (rock, paper, scissors): rock
Computer chose: paper
Computer wins!
```

5. Write a C++ program to convert a minute to a time format which consists of hour, minute, and second (h:m:s). A user is required to input a minute.
    - Hours = minutes / 60
    - Remainderminutes = minutes % 60
    - Seconds = remainderminutes * 60

Source Code:

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

int main() {
    int minutes;
    cout << "Enter the number of minutes: ";
    cin >> minutes;

    int hours = minutes / 60;
    int remainingMinutes = minutes % 60;
    int seconds = remainingMinutes * 60;

    cout << "Time format (h:m:s) -> ";
    cout << hours << ":" << remainingMinutes << ":" << seconds << endl;

    return 0;
}
```

Output:

```
Enter the number of minutes: 130
Time format (h:m:s) -> 2:10:600
```

6. Write a C++ program to find the summation of numbers from 1 to n except number 10 and 30, where n is a number input by a user and n should be greater than 50.

Source Code:

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

void check(int n){
    int sum;
    for ( int i =1; i<=n;i++){
        sum+= i;
    }
    sum-=40;
    cout << "The sum of the number 1 to  " << n << " is: " << sum << endl;
}

int main (){
    int n;
    while (true){
        cout << "Please give me a number greater than 50:" << endl;
        cin >> n;
        if (n >= 50){
            check(n);
            return false;
        }
    }
    return 0;
}
```

Output:

```
Please give me a number greater than 50:
60
The sum of the number 1 to  60 is: 1803
```

7. Write a C++ program to create a new data structure for storing info of book (book ID, book ISBN, book title, published year, author names and price ($)). Each book could have more than one author. To do:
   - Create an array that can store 5 books' info.
- Create a function to display a book info based on ISBN. This function takes a parameter which is an ISBN of a book.

  void displayBookByISBN(Book books[], int size, string isbn){.... }

- Create a function to display information of all books.

  void displayAllBooks(Book books[], int size) { ... }

Source Code:

```
Enter ISBN of book 1: 1234567890
Enter the title: Data-structure
Enter the author's name: Daro
Enter the price: 123
Enter ISBN of book 2: 1234567891
Enter the title: C++
Enter the author's name: Rith
Enter the price: 120
Enter ISBN of book 3: 1234567892
Enter the title: Java
Enter the author's name: reach
Enter the price: 300
Enter ISBN of book 4: 1234567893
Enter the title: Python
Enter the author's name: Thy
Enter the price: 45
Enter ISBN of book 5: 1234567894
Enter the title: Html
Enter the author's name: Geoch
Enter the price: 80
```

```
Book found!
Book Id: 1
ISBN: 1234567890
Title: Data-structure
Author: Daro
Price: $123
```

```
Book Id: 1
ISBN: 1234567890
Title: Data-structure
Author: Daro
Price: $123

Book 2
Book Id: 2
ISBN: 1234567891
Title: C++
Author: Rith
Price: $120

Book 3
Book Id: 3
ISBN: 1234567892
Title: Java
Author: reach
Price: $300

Book 4
Book Id: 4
ISBN: 1234567893
Title: Python
Author: Thy
Price: $45

Book 5
Book Id: 5
ISBN: 1234567894
Title: Html
Author: Geoch
Price: $80
```

8. Create 5 functions to:
   - i) convert temperature Celsius to Fahrenheit: Fahrenheit = (Celsius * 9.0 / 5.0) + 32
   - ii) convert temperature Fahrenheit to Celsius: Celsius = (Fahrenheit – 32) * 50 / 9.0
   - iii) find root of quadratic equation $ax^2+bx+c=0$.
   - iv) compute BMI of a person's weight and height and tell whether he/she is overweight, underweight and other terms according to BMI list:
     - bmi = weight / (height * height)
     - bmi < 18.5, underweight
     - bmi < 25, normal weight
     - bmi < 30, overweight
     - else, obese
   - v) sum numbers from 1 to n except those numbers that are divisible by 3, n is a parameter of the function.

   Design a menu program to demonstrate these 5 functions with different test cases during the run time of the program.

Source Code:

```cpp
#include <iostream>
#include <cmath>
#include <iomanip>
using namespace std;

void convertTemperatureToFahrenheit(){
    cout << "\t\t***Convert temperature Celsius to Fahrenheit***\n";
    double fahrenheit, celsius;
    cout << "Enter temperature in Celsius: ";
    cin >> celsius;
    fahrenheit = (celsius * 9/5) + 32;
    cout << "Convert temperature from " << celsius << " C to Fahrenheit is " << fahrenheit << " F" << endl;
}

void convertTemperatureToCelsius(){
    cout << "\t\t***Convert temperature Fahrenheit to Celsius***\n";
    double fahrenheit, celsius;
    cout << "Enter temperature in Fahrenheit: ";
    cin >> fahrenheit;
    celsius = (fahrenheit - 32) * 5/9;
    cout << "Convert temperature from " << fahrenheit << " F to Celsius is " << celsius << " C" << endl;
}

void calculateQuadraticEquation(){
    cout << "\t\t***Quadratic Equation ax2+bx+c=0***\n";
    double a, b, c;
    double x, x1, x2;
    cout << "Please enter a: ";
    cin >> a;
    cout << "Please enter b: ";
    cin >> b;
    cout << "Please enter c: ";
    cin >> c;

    double delta = pow(b, 2) - 4 * a * c;

    if(delta == 0){
        x = -b / (2 * a);
        cout << "Result: \n";
        cout << "\tX1 = X2 = " << x << endl;
    } else if(delta > 0){
        x1 = (-b - sqrt(delta)) / (2 * a);
        x2 = (-b + sqrt(delta)) / (2 * a);

        cout << "Result: \n";
        cout << "\tX1 = " << x1 << endl;
        cout << "\tX2 = " << x2 << endl;
    } else {
        cout << "Result: \n";
        cout << "Quadratic equation has no root!" << endl;
    }
}
```

```cpp
void computeBMI(){
    cout << "\t\t***Compute BMI***\n";

    double weight, height, bmi;

    cout << "Please Enter your Weight in (Kilogram): ";
    cin >> weight;
    cout << "Please Enter your Height in meters(m): ";
    cin >> height;

    bmi = weight / pow(height, 2);

    if (bmi < 18.5) {
        cout << "Your BMI is " << fixed << setprecision(2) << bmi << ", which mean you are underweight." << endl;
    } else if (bmi < 25) {
        cout << "Your BMI is " << fixed << setprecision(2) << bmi << ", which mean you have a normal weight." << endl;
    } else if (bmi < 30) {
        cout << "Your BMI is " << fixed << setprecision(2) << bmi << ", which mean you are overweight." << endl;
    } else {
        cout << "Your BMI is " << fixed << setprecision(2) << bmi << ", which mean you are obese." << endl;
    }
}

void summation(int n){
    int sum;
    for(int i = 1; i <= n; i++){
        if(i % 3 == 0){
            continue;
        } else {
            sum += i;
        }
    }
    cout << "Sum from 1 to " << n << " except those that are divisible by 3 is " << sum << endl;
}

int main(){

    int choice;
    do{
        cout << "----------------------------------------" << endl;
        cout << "|              MAIN MENU               |" << endl;
        cout << "----------------------------------------" << endl;
        cout << "| 1. Convert Temperature to Fahrenheit |" << endl;
        cout << "| 2. Convert Temperature to Celsius    |" << endl;
        cout << "| 3. Calculate Quadratic Equation      |" << endl;
        cout << "| 4. Compute BMI                       |" << endl;
        cout << "| 5. Sum (1 to N)                      |" << endl;
        cout << "| 0. Exit                              |" << endl;
        cout << "----------------------------------------" << endl;
        cout << "Choice: ";
        cin >> choice;

        switch(choice){
            case 1:
                convertTemperatureToFahrenheit();
                system("Pause");
                system("cls");
                break;
            case 2:
                convertTemperatureToCelsius();
                system("Pause");
                system("cls");
                break;
            case 3:
                calculateQuadraticEquation();
                system("Pause");
                system("cls");
                break;
            case 4:
                computeBMI();
                system("Pause");
                system("cls");
                break;
            case 5:
                cout << "\t\t***Sum numbers from 1 to n except those numbers that are divisible by 3***\n";
                int n;
                cout << "Please Enter n: ";
                cin >> n;
                summation(n);
                system("Pause");
                system("cls");
                break;
            case 0:
                cout << "Exiting Program...\n";
                system("Pause");
                break;
        }

    }while(choice != 0);

    return 0;
}
```

Output:

```
Choice: 1
                ***Convert temperature Celsius to Fahrenheit***
Enter temperature in Celsius: 30
Convert temperature from 30 C to Fahrenheit is 86 F
```

```
Choice: 2
                ***Convert temperature Fahrenheit to Celsius***
Enter temperature in Fahrenheit: 100
Convert temperature from 100 F to Celsius is 37.7778 C
```

```
Choice: 3
                ***Quadratic Equation ax2+bx+c=0***
Please enter a: 1
Please enter b: -2
Please enter c: 1
Result:
        X1 = X2 = 1
```

```
Choice: 4
                ***Compute BMI***
Please Enter your Weight in (Kilogram): 78
Please Enter your Height in meters(m): 1.85
Your BMI is 22.79, which mean you have a normal weight.
```

```
Choice: 5
            ***Sum numbers from 1 to n except those numbers that are divisible by 3***
Please Enter n: 10
Sum from 1 to 10 except those that are divisible by 3 is 38
```

```
Choice: 0
Exiting Program...
```

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