SAXONY EGYPT UNIVERSITY
FOR APPLIED SCIENCE AND TECHNOLOGY

ECT 121
Computer Programming I

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Lecture Three

Selection Structure (if and Switch statement)

If Statement

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- **Syntex**

```
if ( Condition )
        Statement;
```

- **Note :** Statement can be a single statement, a null statement, or a block.

Single statement

```
.....;
```

Block

```
{
.....;
.....;
.....;
}
```

Example

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```cpp
#include <iostream>  // Include the library for input/output operations

using namespace std; // Use the standard namespace

int main() {
    int x, pcounter = 0; // Declare integer variables

    cout << "Enter a number: "; // Prompt user for input
    cin >> x; // Read the input number

    if (x > 0)
        cout << "Positive number" << endl; // Single-line if statement

    if (x > 0) {  // Multi-line if statement
        cout << "Positive number" << endl;
        pcounter++;  // Increment counter
    }

    cout << "Counter value: " << pcounter << endl; // Display the counter value

    return 0; // Indicate successful execution
}
```

Output

```
Enter a number: 5
Positive number
Positive number
Counter value: 1
```

Output

```
Enter a number: -3
Counter value:  0
```

If-else Statement

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- **Syntex**

```
if ( Condition )
        Statement1;
else
        Statement2;
```

- **Note :** Statement1 and Statement2 each can be a single statement, a null statement, or a block.

Example (1)

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```cpp
#include <iostream>  // Include the input-output library

using namespace std; // Use the standard namespace

int main() {
    int x; // Declare variable

    cout << "Enter a number: "; // Prompt user for input
    cin >> x; // Read user input

    if (x > 0)
        cout << "Positive number" << endl; // Print if x is positive
    else
        cout << "Negative number" << endl; // Print if x is negative or zero

    return 0; // Indicate successful execution
}
```

Output

```
Enter a number: 5
Positive number
```

Output

```
Enter a number: -3
Negative number
```

Example (2)

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Write a C++ program that takes an integer input x representing a student's score. The program should:

- Check if the score is 50 or greater and print "Pass", otherwise print "Fail".

```cpp
#include <iostream>  // Include the input-output library

using namespace std; // Use the standard namespace

int main() {
    int x;           // Declare variable for user input
    int pcounter = 0, fcounter = 0; // Counters for pass and fail cases

    cout << "Enter the score: "; // Prompt user for input
    cin >> x; // Read user input

    if (x >= 50) {
        cout << "Pass" << endl;
        pcounter++; // Increment pass counter
    } else {
        cout << "Fail" << endl;
        fcounter++; // Increment fail counter
    }

    // Display the counters
    cout << "Pass count: " << pcounter << endl;
    cout << "Fail count: " << fcounter << endl;

    return 0; // Indicate successful execution
}
```

Output

```
Enter the score: 75
Pass
Pass count: 1
Fail count: 0
```

Output

```
Enter the score: 40
Fail
Pass count: 0
Fail count: 1
```

Example (4)

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Trace the following code fragments and show the output.

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

int main() {
    int p = 7, z = 8, m = 9;

    if (p > 0)
        z += m++;  // Post-increment: z = 8 + 9 = 17, then m becomes 10

    if (z > 5)
        p += ++m;  // Pre-increment: m becomes 11, then p = 7 + 11 = 18

    cout << z << endl;  // Output: 17
    cout << p;          // Output: 18

    return 0;
}
```

Trace

p	z	m
~~7~~	~~8~~	~~9~~
18	17	~~10~~
		11

Output

17

18

Example (3)

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Trace the following code fragments and show the output.

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

int main() {
    int p = 7, z = 8, m = 9;

    if (p > 0)
        z += m++;  // Post-increment: z = 8 + 9 = 17, then m becomes 10
    else if (z > 5)
        p += ++m;  // This will not execute since 'if (p > 0)' is true

    cout << z << endl;  // Output: 17
    cout << p;          // Output: 7

    return 0;
}
```

Trace

p	z	m
7	~~8~~	~~9~~
	17	10

Output

17

7

Nested if

```
if ( Expression1 )
        Statement1;
else
if ( Expression2 )
        Statement2;
        .
        .
else
if ( ExpressionN )
        StatementN;
else
        Statement N+1;
```

- only one of these statements will be executed

Example (1)

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

int main() {
    int temp;
    cout << "Enter temperature: ";
    cin >> temp;

    if (temp <= 0)
        cout << "very cold";
    else if (temp <= 10)
        cout << "cold";
    else if (temp <= 20)
        cout << "warm";
    else if (temp <= 25)
        cout << "hot";
    else
        cout << "very hot";

    return 0;
}
```

Output

```
Enter temperature: -5
very cold
```

Output

```
Enter temperature: 5
cold
```

Output

```
Enter temperature: 15
warm
```

Output

```
Enter temperature: 23
hot
```

Example (2)

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- **Write a program that calculates the total salary of an employee. The total salary is calculated as follows:**

- Total salary = (basic salary + bonus – working tax)

➢ If the basic salary is below 3000.00 L.E., then:

  - The bonus is 250.00 L.E.
  - The working tax is 1.00% of the basic salary.

➢ Otherwise, if the basic salary is 3000.00 L.E. or more, then:

  - The bonus is 300.00 L.E.
  - The working tax is 2.00% of the basic salary.

Example (2) Cont.

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```cpp
#include <iostream>

using namespace std;

int main() {
    double basic_salary, bonus, tax, total_salary;

    // Input the basic salary
    cout << "Enter the basic salary: ";
    cin >> basic_salary;

    // Determine bonus and tax based on basic salary
    if (basic_salary < 3000.00) {
        bonus = 250.00;
        tax = basic_salary * 0.01;  // 1% tax
    } else {
        bonus = 300.00;
        tax = basic_salary * 0.02;  // 2% tax
    }

    // Calculate total salary
    total_salary = (basic_salary + bonus - tax);

    // Display result
    cout << "Total salary: " << total_salary << " L.E." << endl;

    return 0;
}
```

Output

```
Enter the basic salary: 2500
Total salary: 2725.00
```

Calculation:

- Bonus = `250.00`
- Tax = `2500 * 0.01 = 25.00`
- Total Salary = `2500 + 250 - 25 = 2725.00`

Output

```
Enter the basic salary: 3500
Total salary: 3730.00
```

Calculation:

- Bonus = `300.00`
- Tax = `3500 * 0.02 = 70.00`
- Total Salary = `3500 + 300 - 70 = 3730.00`

Example (3)

Trace the following code fragments and show the output.

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

int main() {
    int x;

    // Test case 1: x = 50
    x = 50;
    cout << "Testing for x = " << x << endl;
    if (x >= 60) {
        if (x <= 100)
            cout << "Accept\n";
        else
            cout << "Reject\n";
    }
    cout << "done\n";

    cout << "\n"; // Separator for readability

    // Test case 2: x = 70
    x = 70;
    cout << "Testing for x = " << x << endl;
    if (x >= 60) {
        if (x <= 100)
            cout << "Accept\n";
        else
            cout << "Reject\n";
    }
    cout << "done\n";

    return 0;
}
```

Trace

x
~~50~~
70

Output

```
Testing for x = 50
done

Testing for x = 70
Accept
done
```

Example (4)

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Trace the following code fragments and show the output.

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

int main() {
    int a = 5, x = 10, y = 25, z = 30;

    if (x != y) { // 10 != 25 → true
        if (!(x < y) && (y < z)) { // !(10 < 25) && (25 < 30)
            // !(true) && true → false && true → false
            a += x++ + --y; // This block does not execute
        } else {
            a += ++x + y--; // a = 5 + (11) + (25)
        }
    }

    cout << x << endl; // 11
    cout << y << endl; // 24
    cout << a;         // 41

    return 0;
}
```

Trace

a	x	y	z
~~5~~	~~10~~	~~25~~	30
41	11	24	

Output

```
x = 11, y = 24, a = 41
```

Example (4)

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Trace the following code fragments and show the output.

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

int main() {
    int x = 15, y = 20, z = 25;

    if (x < y) { // 15 < 20 → true
        if (x < z) { // 15 < 25 → true
            x++;      // x = 16
            z = x + ++y; // z = 16 + 21 = 37
        } else {
            x++;      // (Not executed)
            z = x - ++y; // (Not executed)
        }
    }

    cout << (x + y) / z++; // (16 + 21) / 37 → 37 / 37 = 1
    return 0;
}
```

Trace

x	y	z
~~15~~	~~20~~	~~25~~
16	21	~~37~~
		38

Output

1

Example (5)

Trace the following code fragments and show the output.

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

int main() {
    int x = 5, y = 6, z = 3;

    if (x > y) { // 5 > 6 → false
        if (x > z) {
            z = x++ - ++y;
        }
    } else {
        z = ++x - y++; // z = 6 - 6 = 0
    }

    cout << (x + y) / z++; // (6 + 7) / 0 → Division by zero error
    return 0;
}
```

Trace

x	y	z
~~5~~	~~6~~	3
6	7	0

Output

```
ERROR: Division by Zero
```

Switch Statement

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- Used to select one of several alternatives.
- Based on a single Value (int, char only).
- Strings and floating-point values cannot be used in switch (only integral types).
- Break is used to exit the switch statement and continue with the rest of the program.

Switch Statement

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```
switch ( variable )
{
   case value 1 : statement(s);  break ;
   case value 2 : statement(s);   break  ;
   ..........................................
   case value n : statement(s);   break  ;
   default : cout<<"Wrong Input";
} // end of the switch statement
```

Example (1)

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

int main() {
    int num = 2;

    switch (num) {
        case 1:
            cout << "Number is 1" << endl;
            break;
        case 2:
            cout << "Number is 2" << endl;
            break;
        case 3:
            cout << "Number is 3" << endl;
            break;
        default:
            cout << "Number is not 1, 2, or 3" << endl;
    }

    return 0;
}
```

Output

```
Number is 2
```

Example (2)

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

int main() {
    int choice;
    cout << "Enter a number (1-3): ";
    cin >> choice;

    switch (choice) {
        case 1:
            cout << "You selected option 1" << endl;
            break;
        case 2:
            cout << "You selected option 2" << endl;
            break;
        case 3:
            cout << "You selected option 3" << endl;
            break;
        default:
            cout << "Invalid selection!" << endl;
    }

    return 0;
}
```

Output

```
Enter a number (1-3): 2

You selected option 2
```

Example (3)

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

int main() {
    int num = 2;

    switch (num) {
        case 1:
            cout << "Number is 1" << endl;
        case 2:
            cout << "Number is 2" << endl;
        case 3:
            cout << "Number is 3" << endl;
        default:
            cout << "Default case executed" << endl;
    }

    return 0;
}
```

Output

```
Number is 2
Number is 3
Default case executed
```

Example (4)

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

int main() {
    char grade;
    cout << "Enter your grade (A, B, C, D, F): ";
    cin >> grade;

    switch (grade) {
        case 'A':
            cout << "Excellent!" << endl;
            break;
    case 'B':
        cout << "Good job!" << endl;
        break;
    case 'C':
        cout << "You passed." << endl;
        break;
    case 'D':
        cout << "You should work harder." << endl;
        break;
    case 'F':
        cout << "You failed." << endl;
        break;
         default:
            cout << "Invalid grade." << endl;
    }

    return 0;
}
```

Output

```
Enter your grade (A, B, C, D, F): B

Good job!
```

Example (5)

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

int main() {
    int day;
    cout << "Enter a number (1-5) for a weekday: ";
    cin >> day;

    switch (day) {
        case 1:
            cout << "Monday" << endl;
            break;
        case 2:
            cout << "Tuesday" << endl;
            break;
        case 3:
            cout << "Wednesday" << endl;
            break;
        case 4:
            cout << "Thursday" << endl;
            break;
        case 5:
            cout << "Friday" << endl;
            break;
        default:
            cout << "Invalid input! Please enter a number between 1 and 5." << endl;
    }

    return 0;
}
```

Output

```
Enter a number (1-5) for a weekday: 7

Invalid input! Please enter a number between 1 and 5.
```

Nested Switch statement

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

int main() {
    int category = 1, item = 2;

    switch (category) {
        case 1:
            cout << "Category 1 selected" << endl;
            switch (item) {
                case 1:
                    cout << "Item 1 selected" << endl;
                    break;
                case 2:
                    cout << "Item 2 selected" << endl;
                    break;
                default:
                    cout << "Invalid item" << endl;
            }
            break;
        default:
            cout << "Invalid category" << endl;
    }

    return 0;
}
```

Output

```
Category 1 selected

Item 2 selected
```

Example (7)

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

enum Day { MON, TUE, WED, THU, FRI, SAT, SUN };

int main() {
    Day today = WED;

    switch (today) {
        case MON:
            cout << "It's Monday!" << endl;
            break;
        case WED:
            cout << "It's Wednesday!" << endl;
            break;
        case FRI:
            cout << "It's Friday!" << endl;
            break;
        default:
            cout << "It's another day." << endl;
    }

    return 0;
}
```

Output

```
It's Wednesday!
```

Example (8)

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

int main() {
    int score;
    cout << "Enter your score: ";
    cin >> score;

    switch (score) {
        case 90 ... 100:
            cout << "Grade: A" << endl;
            break;
        case 80 ... 89:
            cout << "Grade: B" << endl;
            break;
        case 70 ... 79:
            cout << "Grade: C" << endl;
            break;
        default:
            cout << "Grade: F" << endl;
    }

    return 0;
}
```

Output

```
Enter your score:  85

Grade: B
```

Example (9)

Write a program to ask the user for the brightness of a light bulb (in Watts), and print out the expected lifetime:

Brightness	Lifetime in hours
25	2500
40, 60	1000
75, 100	750
otherwise	0

Example (9) cont.

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

int main() {
    int watt;

    // Asking the user for input
    cout << "Enter the brightness of the light bulb (in Watts): ";
    cin >> watt;

    // Using switch-case to determine lifetime
    switch (watt) {
        case 25:
            cout << "Expected lifetime: 2500 hours" << endl;
            break;
        case 40:
        case 60:
            cout << "Expected lifetime: 1000 hours" << endl;
            break;
        case 75:
        case 100:
            cout << "Expected lifetime: 750 hours" << endl;
            break;
        default:
            cout << "Expected lifetime: 0 hours" << endl;

    }


    return 0;
}
```

Input:

```
Enter the brightness of the light bulb (in Watts): 25
```

Output

```
Expected lifetime: 2500 hours
```

Input:

```
Enter the brightness of the light bulb (in Watts): 60
```

Output

```
Expected lifetime: 1000 hours
```

Input:

```
Enter the brightness of the light bulb (in Watts): 90
```

Output

```
Expected lifetime: 0 hours
```

Example (10)

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Write a program to act as a calculator. The program will asks the user to input two real numbers and an arithmetic operation (' + ', ' - ', ' * ', ' / ') and then print the result.

Example (10) cont.

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

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

    // Asking for user input
    cout << "Enter first number: ";
    cin >> num1;
    cout << "Enter an operation (+, -, *, /): ";
    cin >> operation;
    cout << "Enter second number: ";
    cin >> num2;

    // Performing the operation using switch-case
    switch (operation) {
        case '+':
            result = num1 + num2;
            cout << "Result: " << result << endl;
            break;
     case '-':
        result = num1 - num2;
        cout << "Result: " << result << endl;
        break;
     case '*':
        result = num1 * num2;
        cout << "Result: " << result << endl;
        break;
     case '/':
        if (num2 != 0) {
            result = num1 / num2;
            cout << "Result: " << result << endl;
        } else {
            cout << "Error: Division by zero is not allowed!" << endl;
        }
        break;
     default:
        cout << "Error: Invalid operation!" << endl;
  }

  return 0;
}
```

Input:

```
Enter first number: 10
Enter an operation (+, -, *, /): *
Enter second number: 5
```

Output

```
Result: 50
```

Input:

```
Enter first number: 15
Enter an operation (+, -, *, /): /
Enter second number: 0
```

Output

```
Error: Division by zero is not allowed!
```

Example (11)

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Rewrite the following "if statement" into "switch statement":

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

int main() {
    int m, n;
    cout << "Enter values for m and n: ";
    cin >> m >> n;

    if (m == 1) {
        if (n > 0 && n < 100)
            cout << "level one";
    }
    else if (m == 2 || m == 3) {
        cout << "level two";
    }
    else if (m == 4) {
        cout << "final level";
    }
    else {
        cout << "error";
    }

    return 0;
}
```

Answer:

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

int main() {
    int m, n;
    cout << "Enter values for m and n: ";
    cin >> m >> n;

  switch (m) {
      case 1:
          if (n > 0 && n < 100)
              cout << "level one";
          break;
      case 2:
      case 3:
          cout << "level two";
          break;
      case 4:
          cout << "final level";
          break;
      default:
          cout << "error";
  }

  return 0;
}
```

Example (2)

SAXONY EGYPT UNIVERSITY FOR APPLIED SCIENCE AND TECHNOLOGY

Rewrite the following "if statement" into "switch statement":

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

int main() {
    int m;
    cout << "Enter a value for m: ";
    cin >> m;

    if (m == 0)
        cout << "Zero";
    else if (m == 1 || m == 3)
        cout << "Odd";
    else if (m == 2 || m == 4)
        cout << "Even";
    else
        cout << "Out of Range";

    return 0;
}
```

Answer:

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

int main() {
    int m;
    cout << "Enter a value for m: ";
    cin >> m;

    switch (m) {
        case 0:
            cout << "Zero";
            break;
        case 1:
        case 3:
            cout << "Odd";
            break;
        case 2:
        case 4:
            cout << "Even";
            break;
        default:
            cout << "Out of Range";
    }

    return 0;
}
```

Assignment (1)

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Write a C program that calculates bills for the Electricity Company. There are 3 types of customers:
Residential (code R), Commercial (code C) and Industrial (code I).

1. For a code R customer, the bill is $10 plus $0.05 for each kilowatt used.
2. For a code C customer, the bill is $1000 for the first 2000 kilowatt, and $0.005 for each additional kilowatt used.
3. For a code I customer, the bill is $1000 if he used less than 4000 kilowatt, $2000 if he used between 4000 and 10000 kilowatt, or $3000 if he used more than 10000 kilowatt.

The inputs of the program should be the type of customer (R C or I) and the kilowatts used. The output should be the amount of money the customer has to pay.

Assignment (2)

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Trace the following code fragments and show the output.

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

int main() {
    int c = 1, x = 5, y = 6, z;
    switch(c)
    {
        case 1: z = x++ / --y;
        case 2: z += ++x / y;
        case 3: z *= x % y--; break;
        case 4: z /= ++x % y; break;
        default: cout << "out of range";
    }
    cout << z;
    return 0;
}
```

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THANK YOU