Logical Operators and Selection

Introduction to Computers and Programming

Lab Course

TA 林垣志

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Outline

- Operators
    - Relational
    - Logical
- If-else statement
- Switch statement
- Exercise

Relational Operator

- Comparison operators are used to compare values.

| Operator	Name	Example
==	Equal to	x == y
!=	Not equal	x != y
>	Greater than	x > y
<	Less than	x < y
>=	Greater than or equal to	x >= y
<=	Less than or equal to	x <= y

Logical Operator

- Logical operators are used to determine the logic between variables or values.

Operator	Name	Description	Example
&&	Logical and	Returns true if both statements are true	x < 5 && x < 10
||	Logical or	Returns true if one of the statements is true	x < 5 || x < 4
!	Logical not	Reverse the result, returns false if the result is true	!(x < 5 && x < 10)
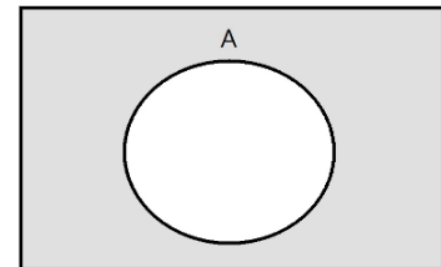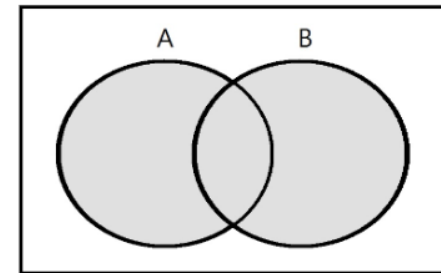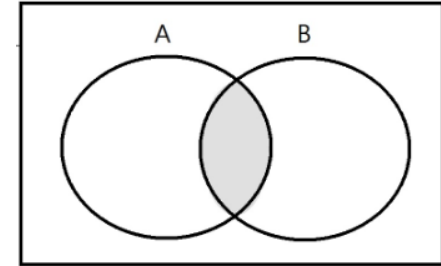
If…Else
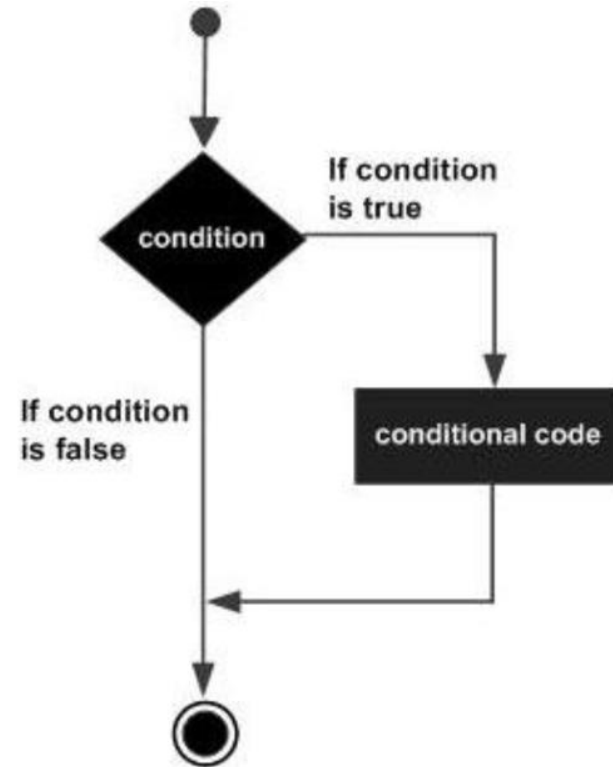
If Statement

- Specify a block of code to be executed if condition is true.

- Syntax:

```
if (test_condition1){
    /* block of code to be executed if condition1 is true */
}
```

- Example:

```
int age = 20;
if (age > 18){
    printf("you're eligible to vote.");
}
```

Else Statement

- Specify a block of code to be executed if condition is false

- Syntax:

```
if (test_condition1){
    /* block of code to be executed if condition1 is true */
}else{
    /* block of code to be executed if condition1 is false*/
}
```

- Example:

```
int age = 17;
if (age >= 18){
    printf("you're eligible to vote.");
}else{
    printf("Sorry, you're not eligible to vote.");
}
```

Else If Statement

- Specify a new condition if condition1 if false.

- Syntax:

```
if (test_condition1){
    /* block of code to be executed if condition1 is true */
}else if (test_condition2){
    /* block of code to be executed if condition1 is false and condition2 is true */
}else{
    /* block of code to be executed if condition1 is false and condition2 is false */
}
```

- Example:

```
int time = 23;
if (time < 10){
    printf("Good morning.");
}else if (time < 20){
    printf("Good day.");
}else{
    printf("Good night Makabaka.");
}
```

Ternary Operator (short hand if-else)

- Often used to replace simple if-else statement.

- Syntax:

```
variable = (test_condition1)? expression_True : expression_False;
```

- Example:

```
int num = (22 % 5 == 2)? 1 : 0;
```

Dangling Else Problem

- Occurs when we use nested if.

- When there are multiple if statements, the else part doesn't get a clear view with which if it should combine.

- Example:

```
if (condition) {
}
if (condition 1) {
}
 if (condition 2) {
}
    else
    {
        }
```

Dangling Else Problem

- Solutions

1. Use braces:

```
if (condition) {
    if (condition 1) {
        if (condition 2) {}
    }
}
 else {
 }
```

2. Use else if:

```
if(condition) {
}
else if(condition-1) {
}
else if(condition-2){
}
else{
}
```

Switch Statement

- Select one of many code blocks to be executed.

Syntax:

```
switch(expression) {
    case x:
        // code block
        break;
    case y:
        // code block
        break;
    default:
        // code block
}
```

Example:

```
int day = 4;

switch (day) {
    case 6:
        printf("Today is Saturday");
        break;
    case 7:
        printf("Today is Sunday");
        break;
    default:
        printf("Looking forward to the Weekend");
}

// Outputs "Looking forward to the Weekend"
```

Exercises

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Exercise 1

- Transform the following if-else statement into switch statement.

```cpp
#include <cstdio>
#include <cstdlib>

int main(){
    int day = 4;

    if (day == 6){
        printf("Today is Saturday!");

    }else if(day == 7){
        printf("Today is Sunday!");

    }else{
        printf("Looking forward to the weekend~");
    }
    // output "Looking forward to the weekend~"
    return 0;
}
```

Exercise 2

- Input an AD year (< 2023), if the year is a leap year.

- The conditions for a leap year are as follows:
  - The input year can be divisible by 400.
  - The input year can be divisible by 4, but not by 100.

Output Ex1:
```
Please input an AD year: 2000
2000 is a leap year
```

Ex2:
```
Please input an AD year: 1964
1964 is a leap year
```

Ex3:
```
Please input an AD year: 2023
2023 is not a leap year
```

Exercise 3

- A quadratic equation be $ax^2 + bx + c = 0$ (need to print like example)
- User input a, b, c
- Determine if the equation has:
  - Two distinct roots
  - Double roots
  - No real root

Output :
```
ax^2 + bx + c
Please input the coefficients: a b c
1 4 4
'1x^2+4x+4' has double roots
```