Week 1 & 2 Detailed Lecture Notes

Lecture 1

Introduction to the Course

This course is designed to teach problem-solving techniques and programming using C++. We will learn how to design and analyze problems, break them down into smaller parts, and write efficient programs.

Problem-Solving Methodology

Problem-solving in programming involves the following steps:

1. **Understanding the Problem** - Read and analyze the given problem.
2. **Planning a Solution** - Think about how to solve the problem.
3. **Designing an Algorithm** - Write step-by-step instructions.
4. **Writing the Code** - Convert the algorithm into a programming language.
5. **Testing and Debugging** - Run the program and fix errors if any.
6. **Optimization** - Improve efficiency if required.

Design, Analyze, and Decompose a Problem

- **Design**: Planning how to solve the problem.
- **Analyze**: Checking the feasibility of the solution.
- **Decompose**: Breaking the problem into smaller, manageable parts.

Example: Suppose we need to make a cup of tea. The steps can be broken into:

1. Boil water.
2. Add tea leaves.
3. Add sugar and milk.
4. Stir and serve.

This is an example of decomposing a problem into smaller tasks.

Algorithms, Pseudocode, and Flowcharts

Algorithm

An algorithm is a step-by-step procedure to solve a problem. Example: Algorithm for adding two numbers:

1. Start
2. Input two numbers
3. Add the numbers
4. Display the sum
5. Stop

Pseudocode

Pseudocode is a way of writing an algorithm using simple, human-readable statements.

```
BEGIN
    INPUT num1, num2
    sum = num1 + num2
    PRINT sum
END
```

Flowchart

A flowchart is a graphical representation of an algorithm using different symbols.

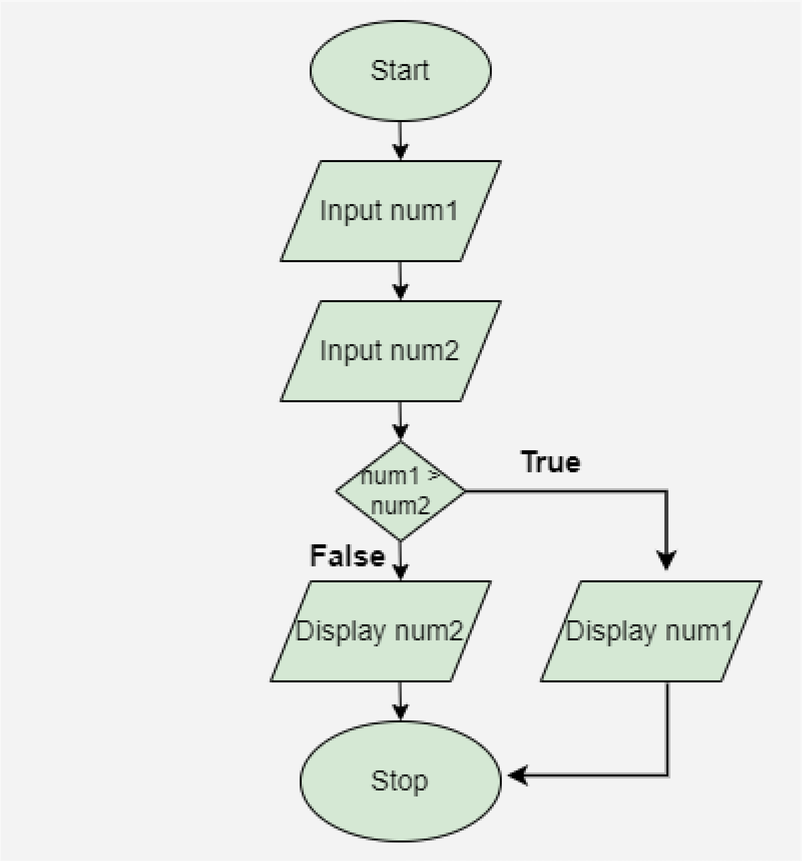
Example flowchart for adding two numbers:

```
[Start]
   |
   V
(Input two numbers)
   |
   V
(Add the numbers)
   |
   V
(Display sum)
   |
   V
[Stop]
```

Rules For Creating a Flowchart

A flowchart is a graphical representation of an algorithm. It should follow some rules while creating a flowchart

- Rule 1: Flowchart opening statement must be ‘start’ keyword.
- Rule 2: Flowchart ending statement must be ‘end’ keyword.
- Rule 3: All symbols in the flowchart must be connected with an arrow line.
- Rule 4: Each decision point should have two or more distinct outcomes.
- Rule 5: Flow should generally move from top to bottom or left to right.
    - For more info check the link https://www.geeksforgeeks.org/an-introduction-to-flowcharts/



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Lecture 2

History of C++ Language

- Developed by **Bjarne Stroustrup** in 1979.
- Based on C language but with additional features like **Object-Oriented Programming (OOP).**
- Widely used for **system programming, game development, and real-time applications.**

Translators

A translator converts high-level code into machine code. The types of translators are:

1. **Compiler**: Converts the entire code at once (e.g., C++ compiler).
2. **Interpreter**: Translates and executes the code line by line (e.g., Python interpreter).
3. **Assembler**: Converts assembly language into machine code.

Basic Program Structure in C++

Every C++ program consists of:

1. **Header Files** (e.g., `#include <iostream>`)
2. **Main Function** (`int main() { }`)
3. **Statements** (instructions inside `{ }`)
4. **Return Statement** (`return 0;`)

Example:

```
#include <iostream>
using namespace std;
int main() {
    cout << "Hello, World!";
    return 0;
}
```

Directives, Comments, Output

- **Directives**: Commands that begin with `#` (e.g., `#include <iostream>`).
- **Comments**: Used for explanation (`// single-line comment`, `/* multi-line comment */`).
- **Output using cout**:

```
cout << "Welcome to C++";
```

Escape Sequences

Escape sequences are special characters used in output.

- `\n` - New line
- `\t` - Tab space
- `\"` - Double quote
- `\\` - Backslash

Example:

```
cout << "Hello\nWorld";  // Outputs: Hello (new line) World
```

setw, endl Manipulator

- **setw**: Sets the width of output.
- **endl**: Moves output to the next line.

Example:

```
#include <iostream>
#include <iomanip>
using namespace std;
int main() {
    cout << setw(10) << "Hello" << endl;
    cout << "World";
    return 0;
}
```

Week 2 Lecture Notes

Lecture 3

Declaration of a Variable and Memory Concepts

- A **variable** is a named location in memory used to store data.
- Before using a variable, it must be **declared**.
- Syntax:
- `data_type variable_name;`
- Example:
- `int age;`
- `float temperature;`

Integer and Floating-Point Variables

- **Integer (`int`)**: Stores whole numbers (e.g., `10, -5`).
- **Floating-point (`float`, `double`)**: Stores decimal numbers (e.g., `3.14, -2.5`).

Initialization of Variables

Assigning a value at the time of declaration.

```
int num = 10;
float pi = 3.14;
```

Taking Input from User using `cin`

The `cin` object is used to take input from the user. Example:

```
#include <iostream>
using namespace std;
int main() {
    int age;
    cout << "Enter your age: ";
    cin >> age;
    cout << "You entered: " << age;
    return 0;
}
```

Lecture 4

Arithmetic Operators

C++ provides the following arithmetic operators:

- `+` Addition
- `-` Subtraction
- `*` Multiplication
- `/` Division

Arithmetic Expressions

Expressions that perform arithmetic operations. Example:

```
int a = 10, b = 5;
int sum = a + b; // sum = 15
int difference = a - b; // difference = 5
int product = a * b; // product = 50
int quotient = a / b; // quotient = 2
```

Note: When dividing integers, the result is also an integer. Example:

```
int result = 7 / 2;  // result = 3 (not 3.5)
```

For a floating-point result, use `float` or `double`:

```
float result = 7.0 / 2;  // result = 3.5
```