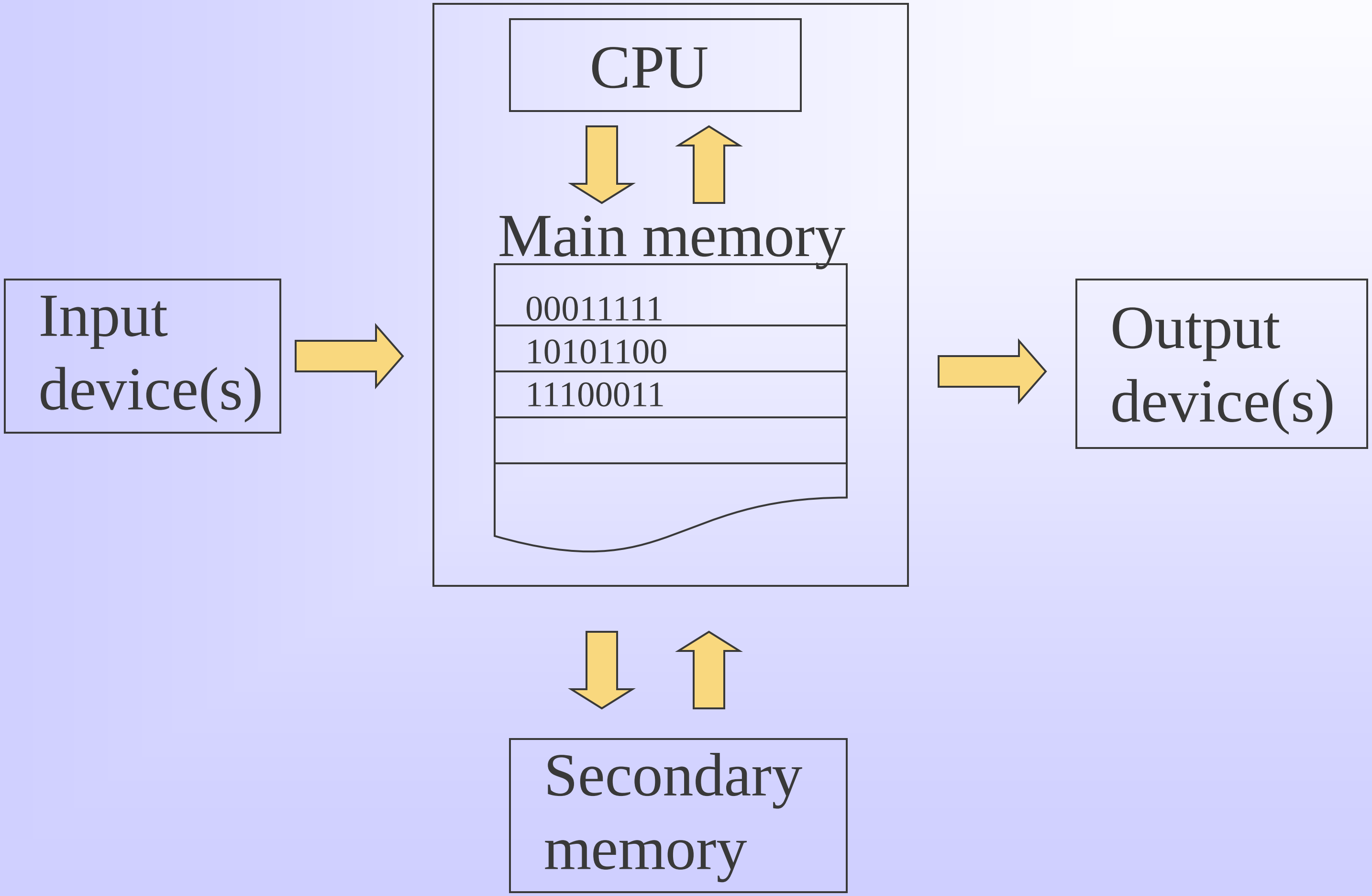
Introduction to Computers and C++ Programming

Chapter 1

Main Components of a Computer



CPU

Main memory

00011111
10101100
11100011

Input device(s)

Output device(s)

Secondary memory

Bytes and Addresses

- Main memory is divided into numbered locations called bytes.
- The number associated with a byte is called its address.
- A group of consecutive bytes is used as the location for a a data item, such as a number or letter. The address of the first byte in the group is used as the address of this larger memory location.

Computer Systems

- Hardware
  - PCs
  - Workstations
  - Mainframes
- Software
  - Operating System
  - Programs

What is a program?

- A program is set of instructions for a computer to follow
- Whenever we give a computer both a program to follow and some data for the program, we are said to be **running** the program on the data, and the computer is said to **execute** the program on the data.

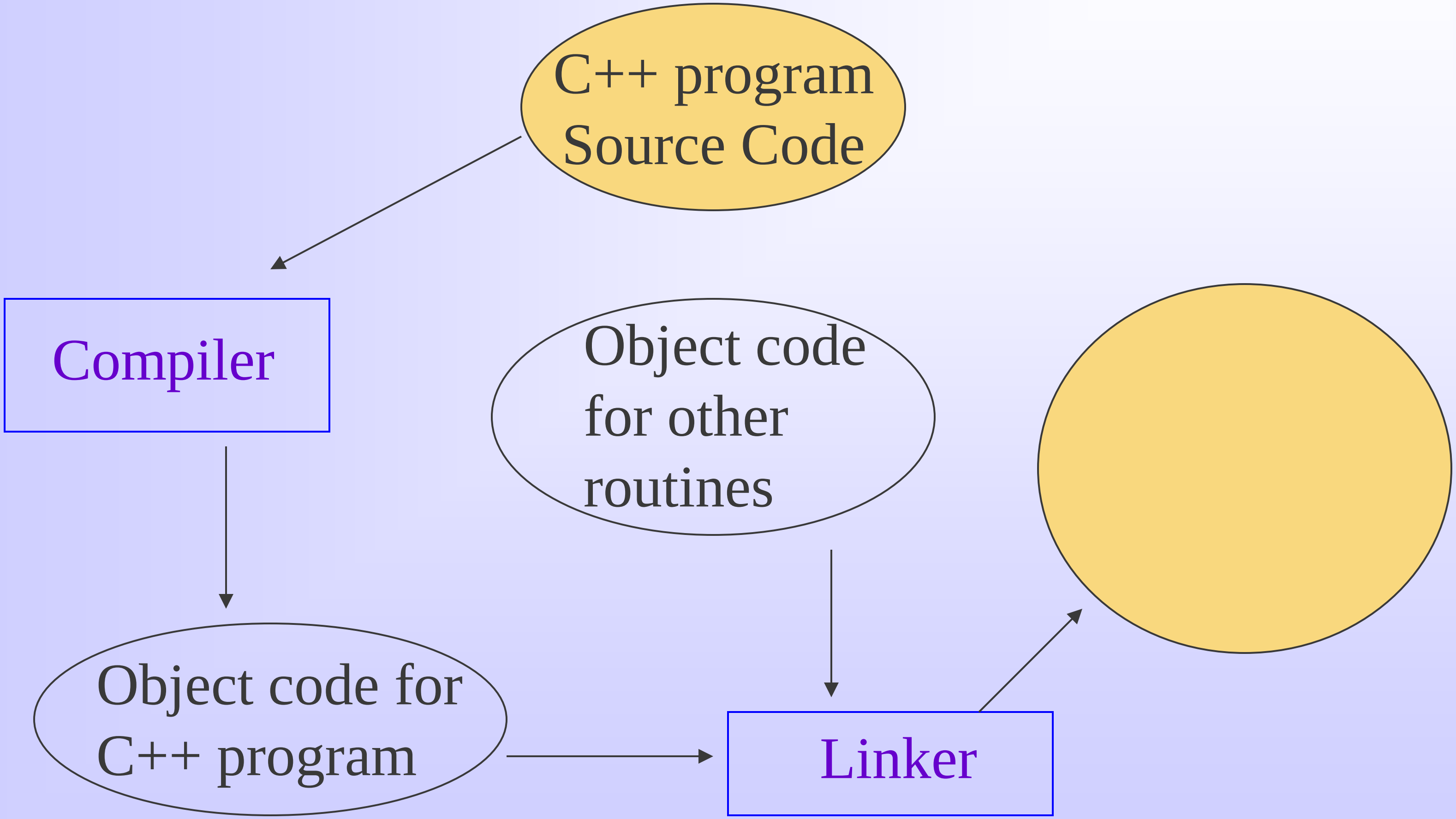
Languages

- High Level Languages
  - C++
  - Java
- Low Level Languages
  - Assembly Language
    - Add X Y Z
  - Machine Language
    - 00011101

Compilers

Programs that translate a high-level language like C++ to a machine-language that the computer can directly understand and execute.

Preparing a C++ program for Running



C++ program
Source Code

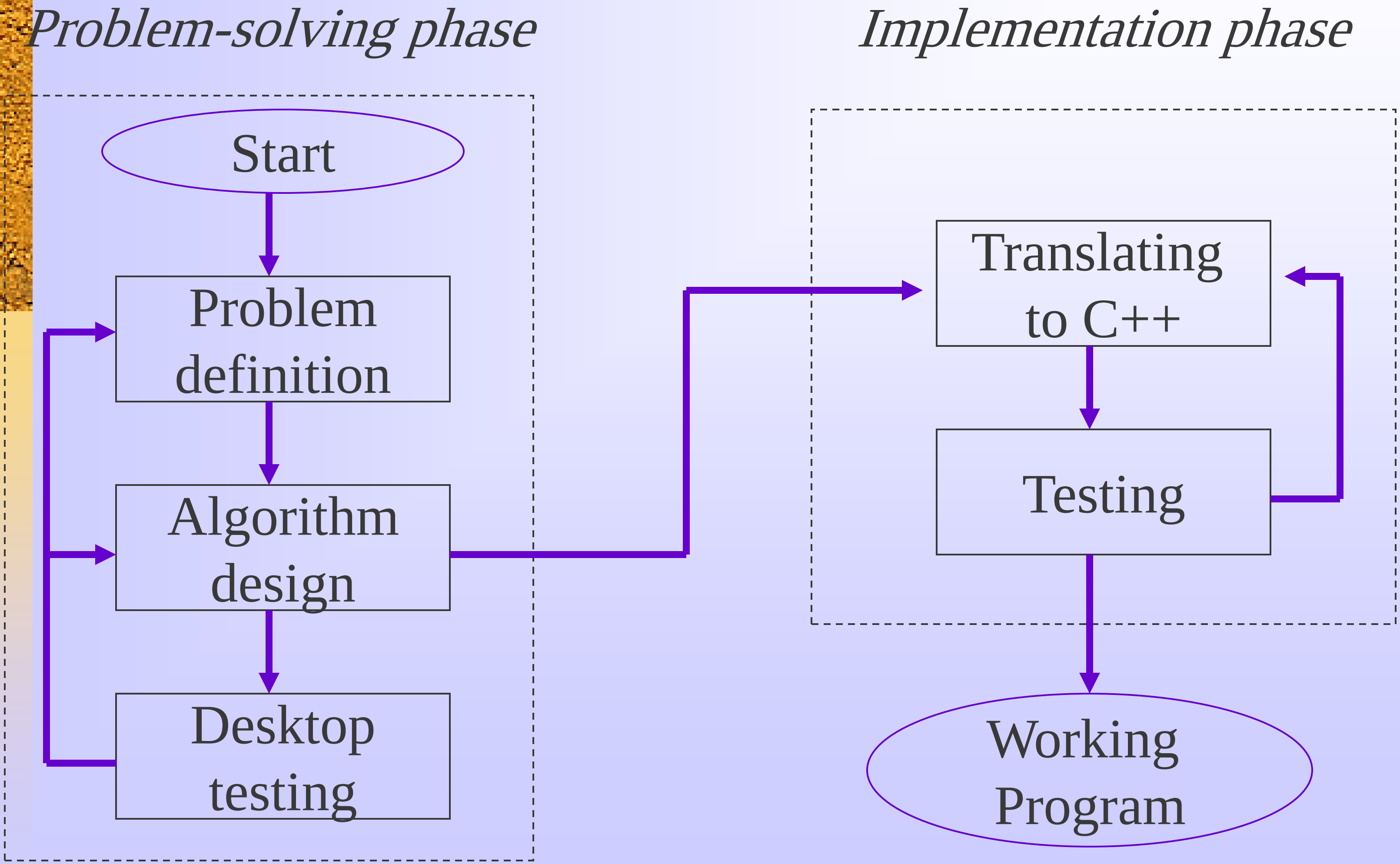
Compiler

Object code
for other
routines

Object code for
C++ program

Linker

Program Design Process



The Software Development Method

1. Specify the problem requirements.
2. Analyze the problem.

   Input:

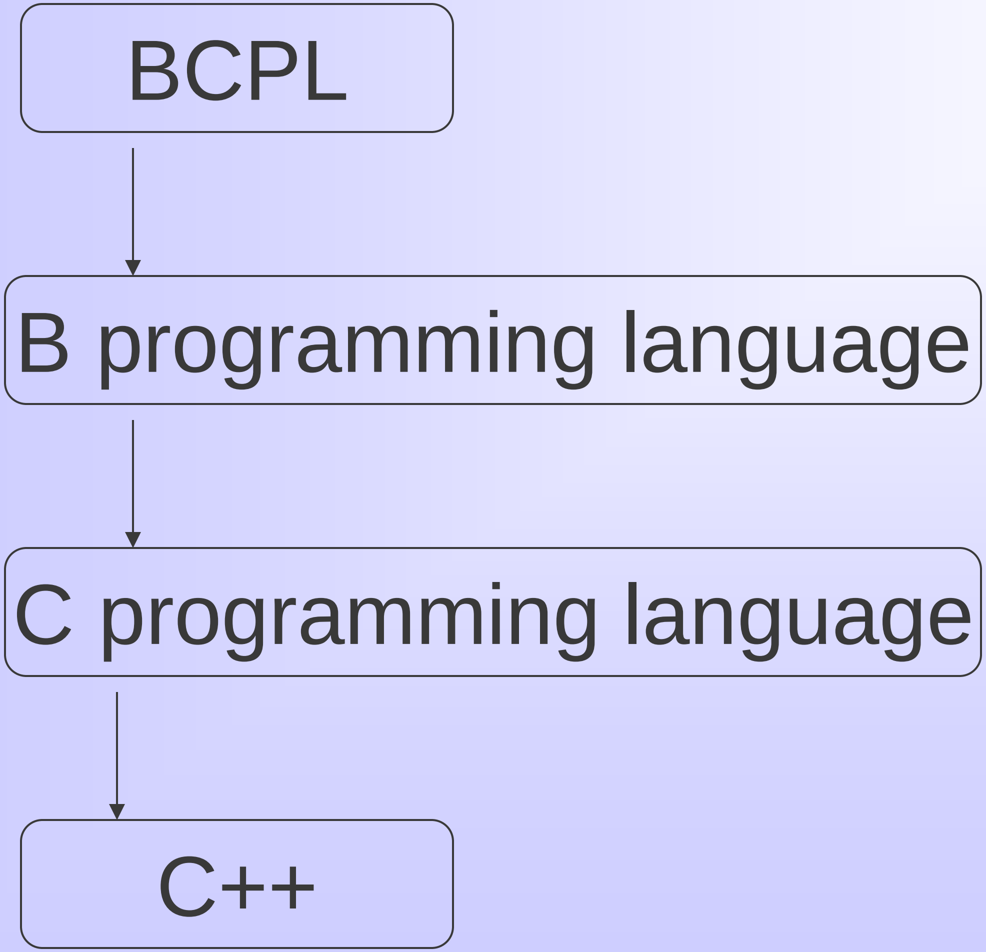
   Output:

   Formulas:
3. Design the algorithm to solve the problem.
4. Implement the algorithm.
5. Test and verify the completed program.
6. Maintain and update the program.

The Software Life Cycle

1. Analysis and specification of the task (problem definition)
2. Design of the software (algorithm design)
3. Implementation (coding)
4. Testing
5. Maintenance and evolution of the system
6. Obsolescense

Introduction to C++



BCPL

B programming language

C programming language

C++

- Dennis Ritchie
- 1970s

- Bjarne Stroustrap
- 1980s

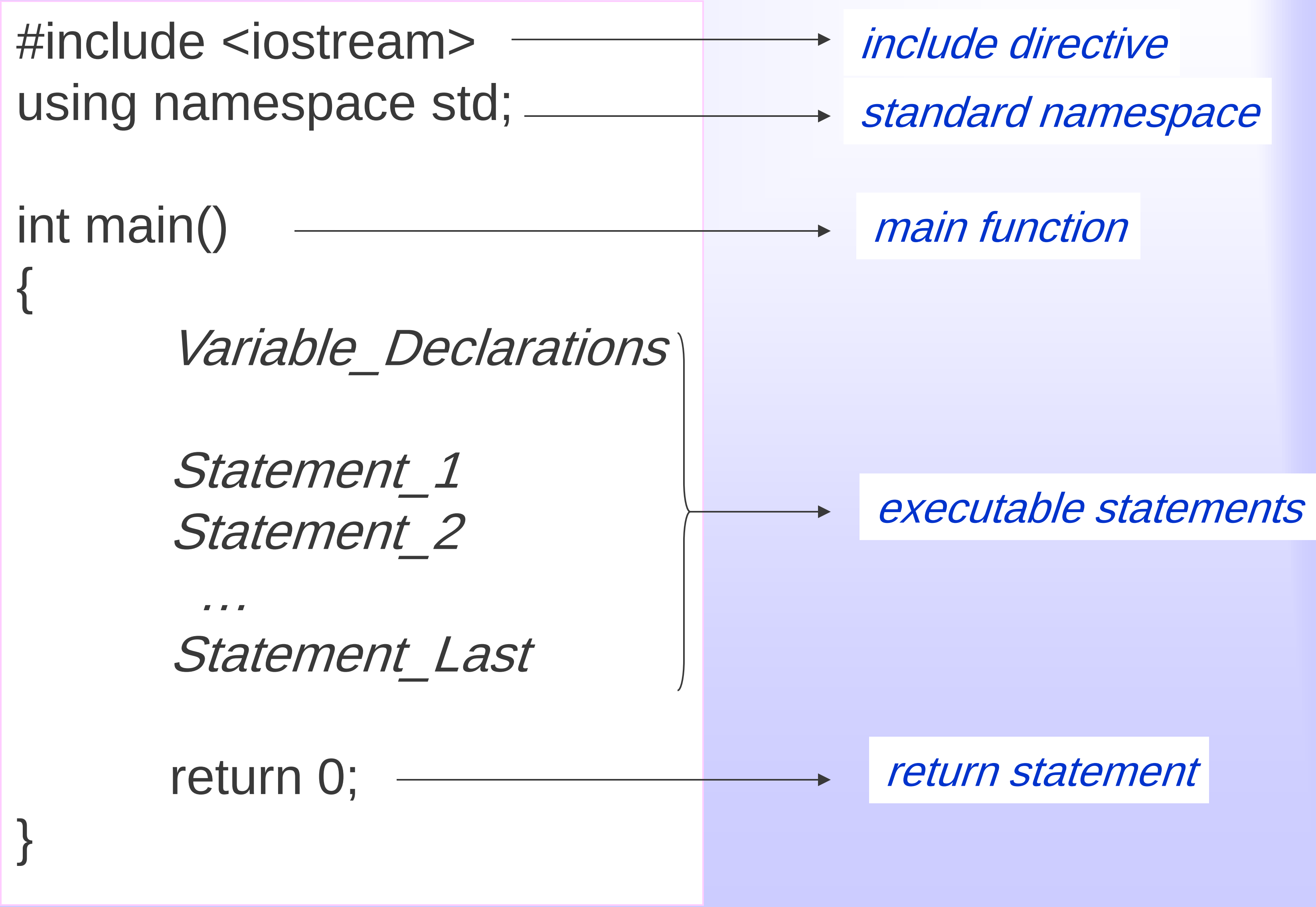
Layout of a C++ Program

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

int main()
{
          Variable_Declarations

          Statement_1
          Statement_2
           ...
          Statement_Last

          return 0;
}
```

Program starts here

Program ends here

Layout of a C++ Program



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

int main()
{
          Variable_Declarations

          Statement_1
          Statement_2
            ...
          Statement_Last

          return 0;
}
```

include directive

standard namespace

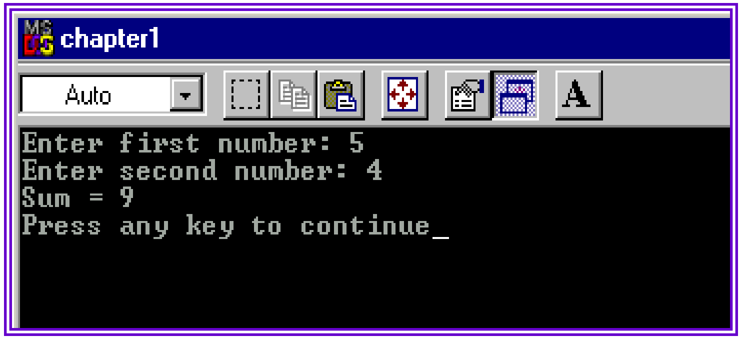
main function

executable statements

return statement

Sample C++ Program

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

int main()
{
     int number1, number2, sum;

     cout << "Enter first number: ";
     cin  >> number1;

     cout << "Enter second number: ";
     cin  >> number2;

     sum = number1 + number2;

     cout  << "Sum = " << sum << “\n”;

     return 0;
}
```



```
Enter first number: 5
Enter second number: 4
Sum = 9
Press any key to continue_
```

Compiling and Running a C++ Program

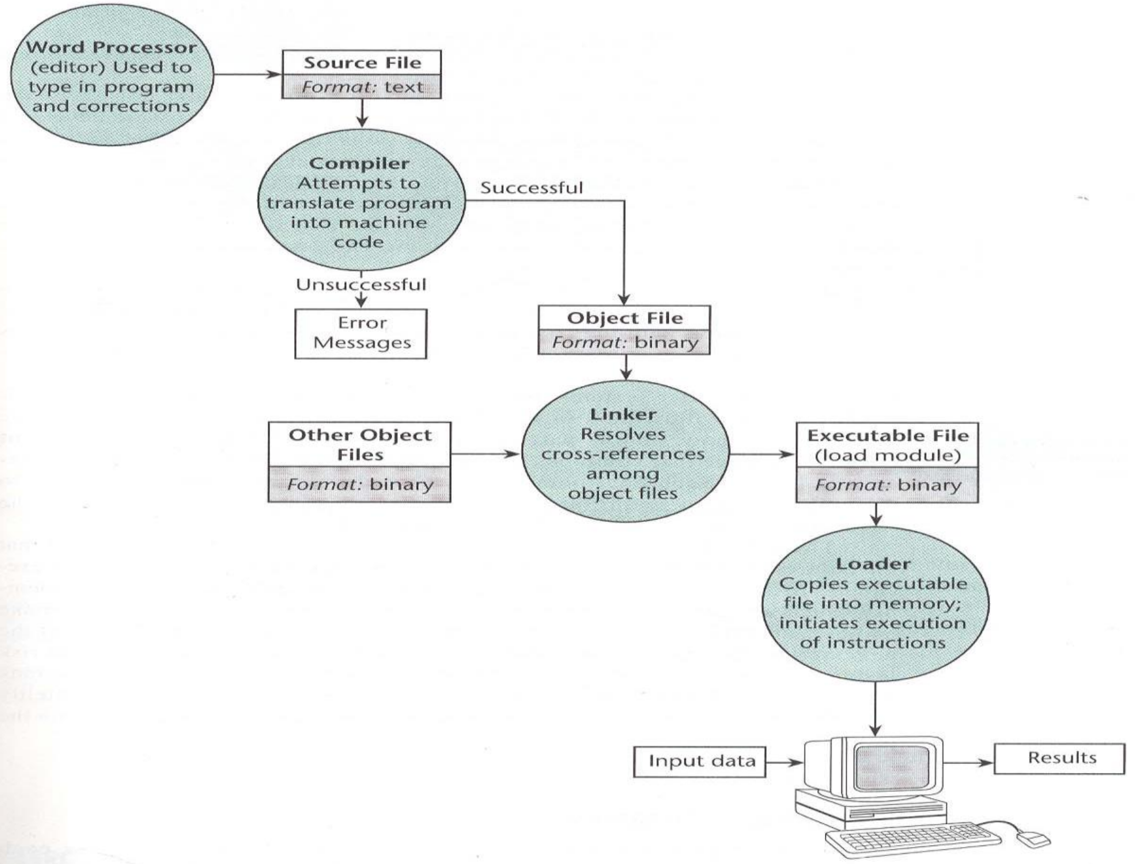

Word Processor
(editor) Used to type in program and corrections
Source File
Format: text
Compiler
Attempts to translate program into machine code
Successful
Unsuccessful
Error Messages
Object File
Format: binary
Other Object Files
Format: binary
Linker
Resolves cross-references among object files
Executable File
(load module)
Format: binary
Loader
Copies executable file into memory; initiates execution of instructions
Input data
Results

Figure 1.11 **Entering, Translating, and Running a High-Level Language Program**

Testing and Debugging

- Bug
  - A mistake/error in the program
- Debugging
  - The process of eliminating bugs in a program

Testing and Debugging

- Types of program errors:
  - Syntax errors
    - Violations of the rules of the programming language
  - Run-time errors
    - Detected by computers when the program is run (numeric calcualtions)
  - Logic errors
    - Mistakes in the underlying algorithm or translating the algorithm into C++ language

Sample C++ Program

Try this:

Write a program that displays the product of two integers

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

int main()
{
        int number1, number2, product;

        cout << "Enter first number: ";
        cin  >> number1;

        cout << "Enter second number: ";
        cin  >> number2;

        product =……………………..?

        cout  << “Product = " << product << “\n”;

        return 0;
}
```