Lab # 3: I/O Programming

EC-102 – Computer Systems and Programming

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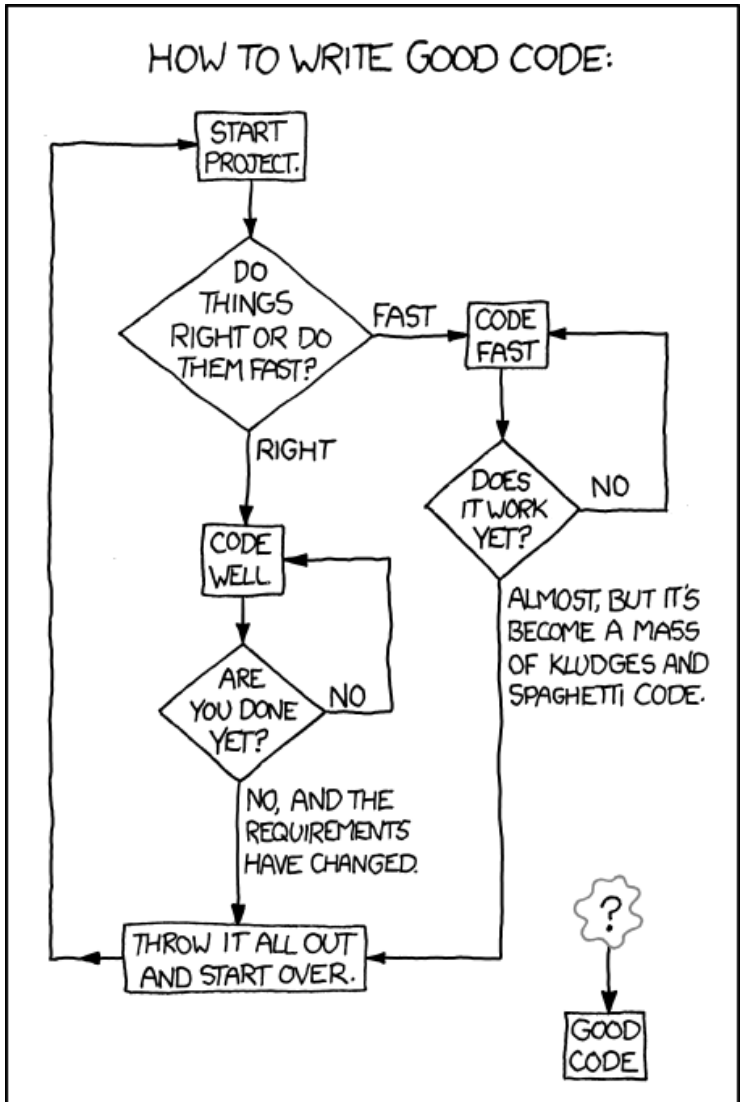
Outline



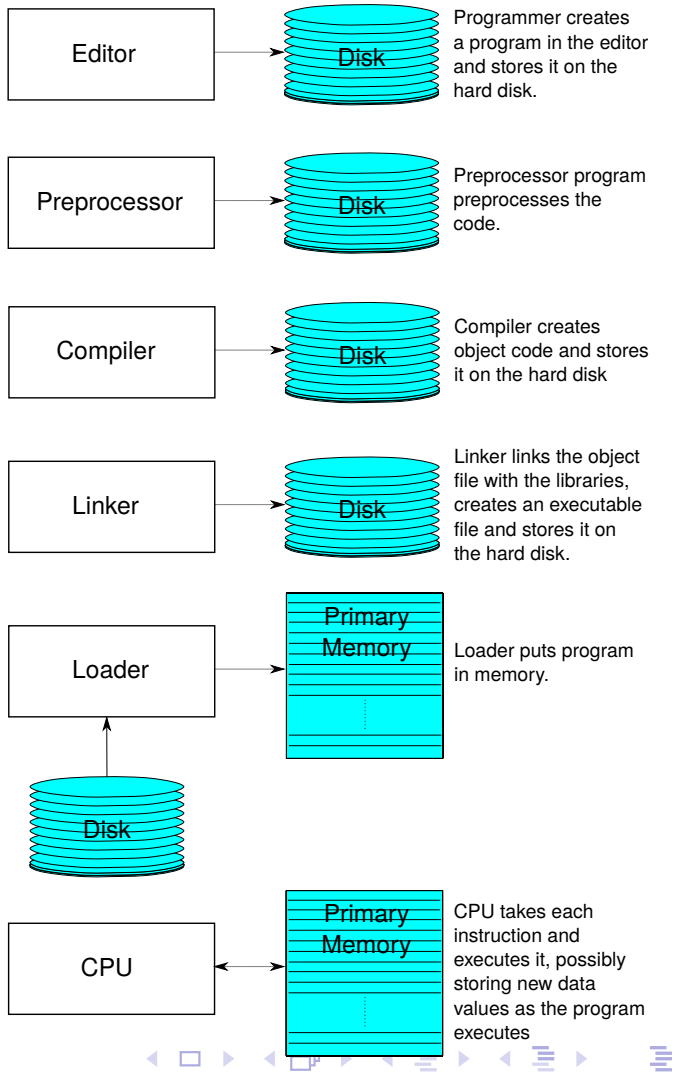
Quiz

1. Write short description of the following: (Marks:2 for each part)
   - Algorithm
   - Machine Language
   - Assembler
   - Advantages of Debugging?
2. Advantages of C++ in detail (Marks:5)
3. Applications of Programming (Marks:2)

Basics of a Typical C++ Environment

Phases of C++ Programs

- Edit
- Preprocess
- Compile
- Link
- Load
- Execute



First Program in C++

```
1 // my first program in C++
2 #include <iostream>
3 using namespace std;
4 int main()
5 {
6     cout << "My First Program!
    " << endl;
7     return 0;
8 }
```

Line-by-line Explanation

1. Single line comment. In C++, there are two types of comments.
   - Single line – //...
   - Multi line – /*...*/
2. Preprocessor directive to include input/output stream header file.
3. A namespace where features of the C++ standard library such as `cout` or `endl` are declared.

First Program in C++

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6     cout << "My First Program!
    " << endl;
7     return 0;
8 }
```

Line-by-line Explanation

4. Function `main` appears at least once in every C++ program.
5. Left brace begins function body.
6. cout belongs to namespace std and is used for console output, << is known as a stream insertion operator. `endl` also belongs to namespace std and is used to insert a newline

Arithmetic Operators

C++ operation	C++ arithmetic operator
Addition	+
Subtraction	-
Multiplication	*
Division	/
Modulus	%

Fundamental C++ Data Types

The C++ language offers several fundamental data types. These include

- `int` (-2,147,483,648 *to* 2,147,483,647) takes up **4 bytes**
- `short` (-32,768 *to* 32,767) takes up **2 bytes**
- `float` (3.4×10^{-38} *to* 3.4×10^{38}) takes up **4 bytes**
- `double` (1.7×10^{-308} *to* 1.7×10^{308}) takes up **8 bytes**
- `char` (-128 *to* 127) takes up **1 byte**

Fundamental C++ Data Types

- The strong data type system of C++ helps make sure that the data variables are used consistently and correctly.
- Type checking makes it easy for the compiler to spot errors during compilation and thus prevent such issues during execution of the program.
- Before a variable is used in C++, it must be declared and defined as follows,
  `int myage;`
- This line declares and defines a variable named `myage` as an integer.

Fundamental C++ Data Types

- A declaration introduces the name `myage` to the compiler and attaches a specific meaning to it.
- A definition like this also instructs the compiler to allocate some memory for the variable.

Fundamental C++ Data Types

When the compiler reads `myage` definition,

- It sets aside enough memory storage for an integer and uses the name `myage` to refer to it.
- It reserves the name `myage` so that it cannot be used by any other variable.
- It ensures that whenever this variable is used, it is used in a way that is consistent with the way an integer should be used.

Keywords in C++

- Predefined reserved identifiers which have a special significance within the language.
- They are case-sensitive and cannot be used as identifiers in your program.
- They will be highlighted with a specific color by Visual Studio's editor as you write your code.
- If the keywords you type in do not appear highlighted, then they have been entered incorrectly.

Keywords in C++

Here's a list of all the reserved keywords in standard C++.

alignas	continue	friend	register	true
alignof	decltype	goto	reinterpret_cast	try
asm	default	if	return	typedef
auto	delete	inline	short	typeid
bool	do	int	signed	typename
break	double	long	sizeof	union
case	dynamic_cast	mutable	static	unsigned
catch	else	namespace	static_assert	using
char	enum	new	static_cast	virtual
char16_t	explicit	noexcept	struct	void
char32_t	export	nullptr	switch	volatile
class	extern	operator	template	wchar_t
const	false	private	this	while
constexpr	float	protected	thread_local	
const_cast	for	public	throw	

Stream I/O

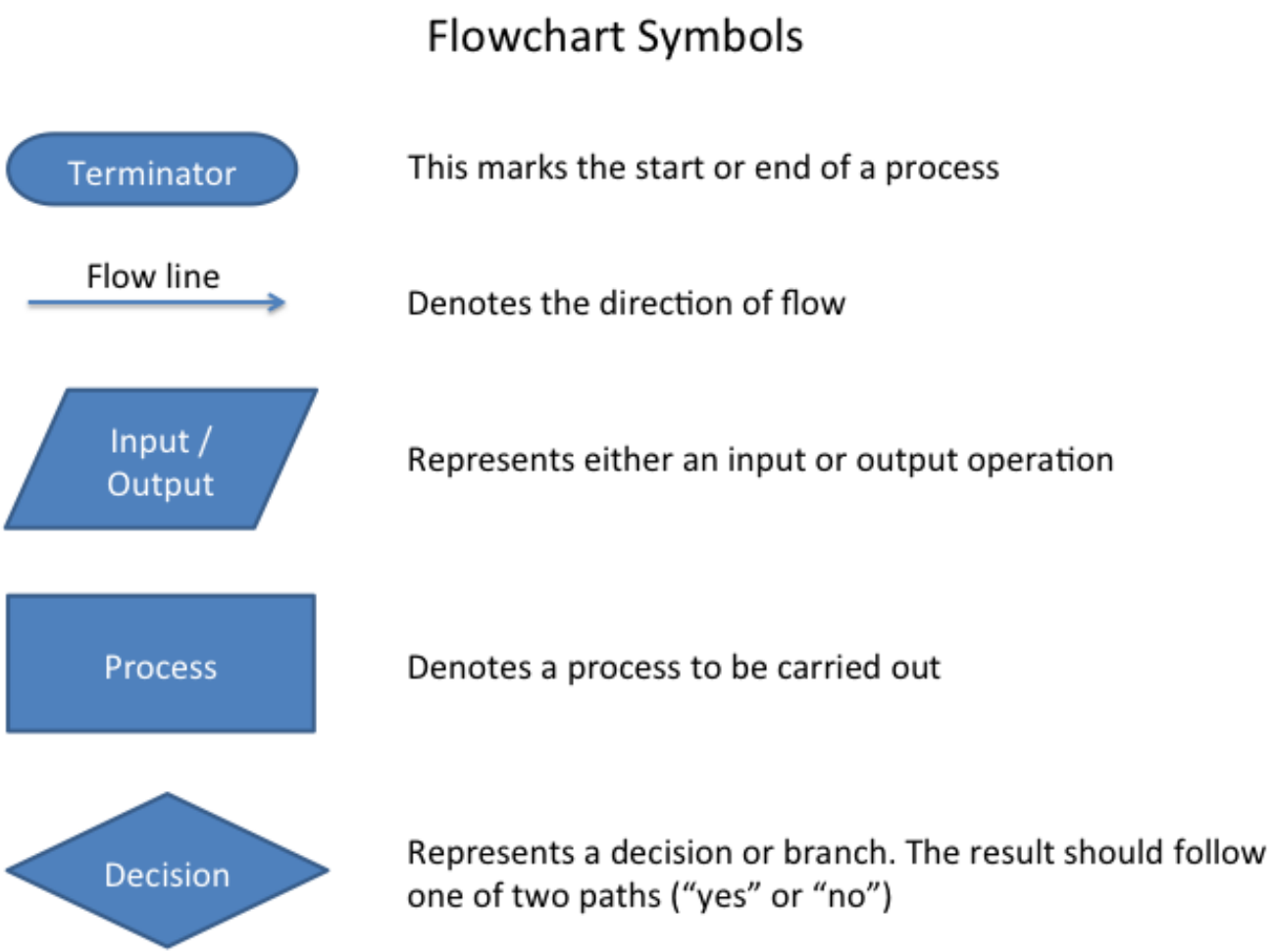
- C++ input/output revolves around the notion of a data stream, where we can insert data into an output stream or extract data from an input stream.
- The standard output stream to the screen is referred to as `cout`.
- The standard input stream from the keyboard is referred to as `cin`.

Assignment Statements

- The statement which assigns some value to a variable is called an assignment statement.
- The $=$ operator is used to assign a value to a variable.
- In an assignment statement such as `myage = 25;`, the variable `myage` has been assigned a value of 25.

What is Flowchart?

Graphical representation of Code.

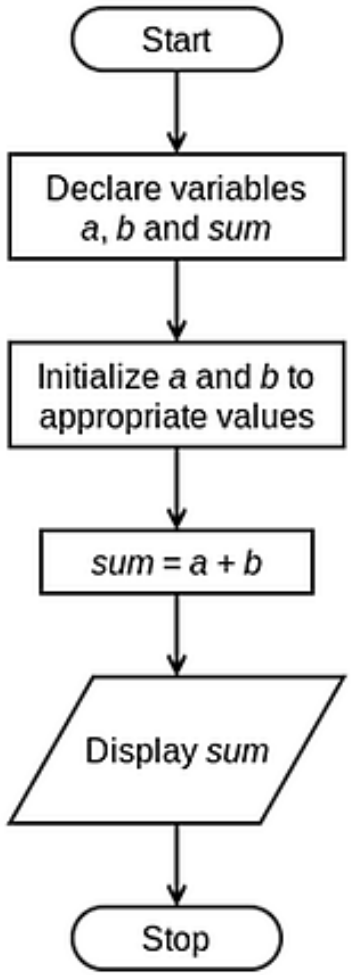


Example 1

Algorithm

1. Start
2. Declare variables `a`, `b` and `sum`
3. Initialize `a` and `b` to appropriate values
4. Add `a` and `b` and assign the result to `sum`
5. Display `sum`
6. Stop

Flowchart

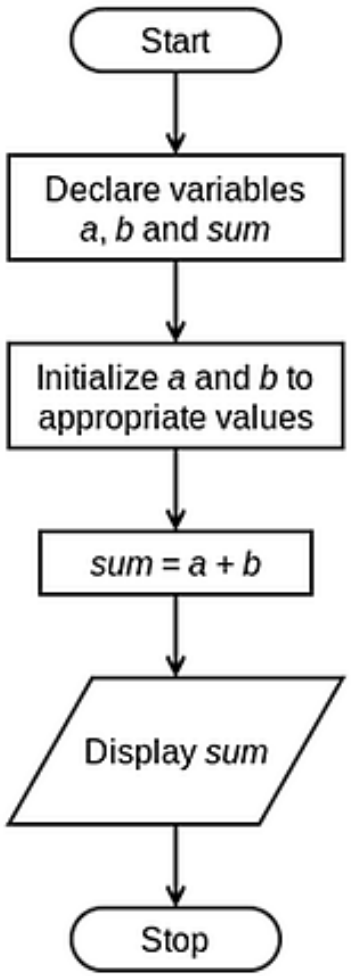


Example 1

Code

```
1  // this program displays the
       sum of two numbers
2  #include <iostream>
3  using namespace std;
4  int main()
5  {
6      int a, b, sum;
7      a = 20;
8      b = 30;
9
10     sum = a + b;
11
12     cout << sum << endl;
13     return 0;
14 }
```

Flowchart

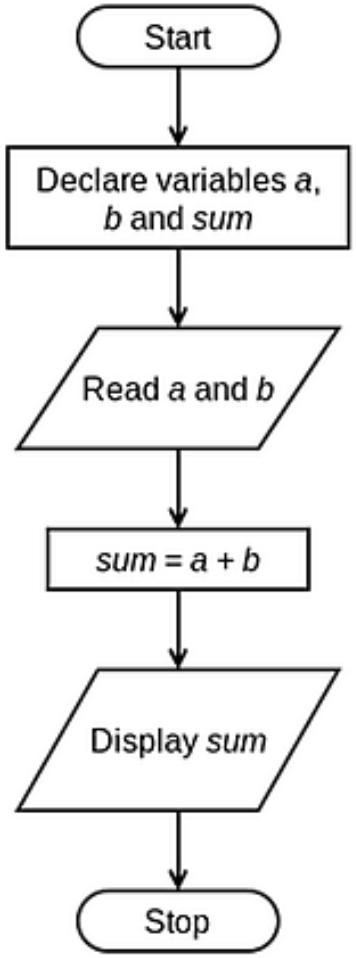


Example 2

Algorithm

1. Start
2. Declare variables `a`, `b` and `sum`
3. Read values of `a` and `b`
4. Add `a` and `b` and assign the result to `sum`
5. Display `sum`
6. Stop

Flowchart



Example 2

Code

```
1  // this program displays the sum of
       two numbers entered by the user
2  #include <iostream>
3  using namespace std;
4  int main()
5  {
6      int a, b, sum;
7      cout << "Enter first number: ";
8      cin >> a;
9      cout << "Enter second number: ";
10     cin >> b;
11
12     sum = a + b;
13
14     cout << "The sum of two numbers
       is: ";
15     cout << sum << endl;
16
```

Flowchart