Part 3: C++ Syntax and Data Types

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Lecture Notes for MAC 101 (Introduction to Computer Science)

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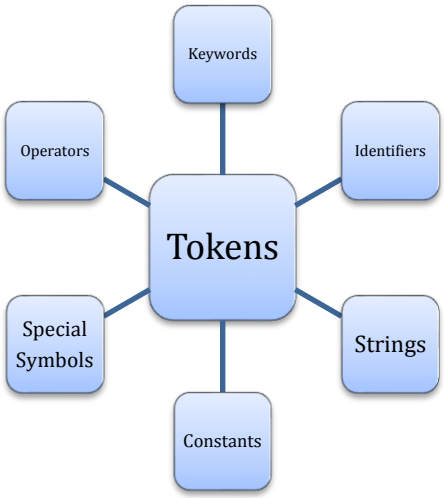
1. C++ Syntax Tokens

Tokens are chunks of a program code each having a special meaning for the compiler.



GuessNumberGame.cpp

```
// example c++ guess game

#include <iostream>
#include <cstdlib>
#include <ctime>
using namespace std;

int main()
{
        srand(time(0)); //seed random number generator
        int number = rand() % 100 + 1; // random number between 1 and 100
        int guess = 0;
        int tries = 0;

        cout << "Guess My Number Game:\n\n";
        do
        {
                cout << "Guess a number between 1 and 100 : ";
                cin >> guess;
                tries++;
                if (guess > number)
                        cout << "Too high!\n\n";
                else if (guess < number)
                        cout << "Too low!\n\n";
                else
                        cout << "\nCorrect! You got it in " << tries << " guesses!\n";
        } while (guess != number);

        cin.ignore();
        cin.get();
        return 0;
}
```

2. Data Types

Any computer program (algorithm) uses some data (information) during execution.

Type	Keyword	Size	Example declaration
Integer	int	At least 16 bits	int i = 23;
Floating-Point	float double	At least 32 bits At least 64 bits	float f = 23.7; double d = 243.6;
Character	char	At least 8 bits	char c = 'g';
String	string	varies	string s = "Hello";

Example of different data types and their maximum capacity

DataTypeExamples.cpp

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

int main()
{
   cout << "Size of char : " << sizeof(char) << endl;
   char c = 'g';
   cout << "Example character type: " << c << endl;

   cout << "Size of int : " << sizeof(int) << endl;
   int i = 12;
   cout << "Example integer type: " << i << endl;

   cout << "Size of float : " << sizeof(float) << endl;
   float f = 22.3;
   cout << "Example floating point type: " << f << endl;

   cout << "Size of double : " << sizeof(double) << endl;
   double d = 125.345;
   cout << "Example double precision type: " << d << endl;

   return 0;
}
```

Output

```
Size of char : 1
Example character type: g
Size of int : 4
Example integer type: 12
Size of float : 4
Example floating point type: 22.3
Size of double : 8
Example double precision type:
125.345
```

An input-output program with integers

InputOutputInteger.cpp

```
// input output example

#include <iostream>
using namespace std;

int main ()
{
  int i;
  cout << "Please enter an integer value: ";
  cin >> i;
  cout << "The value you entered is " << i;
  return 0;
}
```

Output

```
Please enter an integer value: 2
The value you entered is 2
```

Try this: Enter different numeric and non-numeric values of different sizes as inputs for the InputOutputInteger.cpp program. What do you notice?

Question: What is the largest unsigned integer that can be represented with 32 bits?

Question: What is the largest unsigned integer that can be represented with 64 bits?

3. Arithmetic Operations

Basic C++ Arithmetic Binary Operators:

Operation	C++ Operator	Example
Addition	+	H + 3
Subtraction	-	A - B
Multiplication	*	3 * D
Division	/	7 / 5
Modulus	%	10 % 3
Parenthesis	( )	(a + 2) - 5

A program that adds two numbers:

SumTwoNumbers.cpp

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

int main()
{
  int number1 = 0;
  int number2 = 0;
  int sum = 0;

  cout << "Enter first integer: ";
  cin >> number1; // read first integer

  cout << "Enter second integer: ";
  cin >> number2; // read second integer

  sum = number1 + number2; // add the numbers
  cout << "Sum is " << sum << endl;
}
```

Output

```
Enter first integer: 34
Enter second integer: 21
Sum is 55
```

Try this: Write a program that adds 5 consecutive integers.
Input: An integer n
Output: The sum of the five consecutive integers starting with n.

Basic C++ Compound Operators

Expression	Equivalent to
X +=5	X = X + 5
X -=Y	X = X - Y
X *= Y+2	X = X * (Y + 2)
X /= 2	X = X / 2

Increment and Decrement Operators

Expression	Similar to
++X	X = X + 1
X++	X = X + 1
--X	X = X - 1
X--	X = X - 1

Unary Increment Example

IncrementExamples.cpp

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

int main()
{
   int x, y;

   cout << "Unary Prefix Example: " << endl;
   x = 5;
   y = ++x;
   cout << "The value of x is : " << x << endl;
   cout << "The value of y is : " << y << endl << endl;

   cout << "Unary Suffix Example: " << endl;
   x = 5;
   y = x++;
   cout << "The value of x is : " << x << endl;
   cout << "The value of y is : " << y << endl;

   return 0;
}
```

Output

```
Unary Prefix Example:
The value of x is : 6
The value of y is : 6

Unary Suffix Example:
The value of x is : 6
The value of y is : 5
```