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1. Structure of a C++ Program

```
#include <iostream>  // Header for input/output

using namespace std;
```

```
int main() {
    cout << "Hello, World!" << endl;  // Print to console
    return 0;
}
```

---

2. Basic Syntax and Data Types

Variables and Data Types

```
int age = 25;               // Integer
float height = 5.9;         // Floating point
double pi = 3.14159;        // Double precision float
char grade = 'A';           // Character
bool isStudent = true;      // Boolean (true/false)
string name = "Alice";      // String (requires <string> header)
```

Constants

```
const double GRAVITY = 9.8;  // Unchangeable variable
```

---

3. Input/Output (I/O)

```
#include <iostream>

int main() {
    string name;
    cout << "Enter your name: ";
    cin >> name;                           // Input
    cout << "Hello, " << name << endl;    // Output
    return 0;
}
```

---

4. Operators

```
int a = 10, b = 3;

int sum = a + b;       // Addition
int diff = a - b;      // Subtraction
int prod = a * b;      // Multiplication
float div = a / (float)b; // Division (type casting)
int mod = a % b;       // Modulus

a++;  // Increment
b--;  // Decrement
```

---

5. Conditional Statements

```
int age = 20;

if (age >= 18) {
    cout << "Adult" << endl;
} else {
    cout << "Minor" << endl;
}
```

Else If Example

```
int score = 85;

if (score >= 90) {
    cout << "Grade A" << endl;
} else if (score >= 75) {
    cout << "Grade B" << endl;
} else {
```

```
    cout << "Grade C" << endl;
}
```

---

6. Loops

For Loop

```
for (int i = 1; i <= 5; i++) {
    cout << i << endl;
}
```

While Loop

```
int count = 1;

while (count <= 5) {
    cout << count << endl;
    count++;
}
```

Do-While Loop

```
int n = 1;

do {
    cout << n << endl;
    n++;
} while (n <= 5);
```

---

7. Functions

```
#include <iostream>

int add(int a, int b) {
    return a + b;
}

int main() {
    cout << "Sum: " << add(10, 5) << endl;
    return 0;
}
```

Function with Default Parameters

```
int power(int base, int exponent = 2) {
    return pow(base, exponent);
}
```

---

8. Arrays

```
int numbers[5] = {1, 2, 3, 4, 5};

for (int i = 0; i < 5; i++) {
    cout << numbers[i] << endl;
}
```

---

9. Strings

```
#include <string>

string greet = "Hello";
```

```
greet += ", World!";
cout << greet << endl;
```

---

10. Pointers

```
int value = 42;
int* ptr = &value;  // Pointer to value

cout << "Address: " << ptr << endl;  // Print address
cout << "Value: " << *ptr << endl;   // Dereference pointer
```

---

11. Classes and Objects

```
class Dog {
public:
    string name;
    void bark() {
        cout << name << " says Woof!" << endl;
    }
};

int main() {
    Dog myDog;
    myDog.name = "Buddy";
    myDog.bark();
    return 0;
}
```

---

12. Constructors

```
class Car {
public:
```

```
    string brand;

    // Constructor
    Car(string b) {
        brand = b;
    }
};

int main() {
    Car car1("Toyota");
    cout << "Brand: " << car1.brand << endl;
    return 0;
}
```

---

13. Inheritance

```
class Animal {
public:
    void eat() {
        cout << "This animal eats food." << endl;
    }
};

class Cat : public Animal {
public:
    void meow() {
        cout << "Cat says Meow!" << endl;
    }
};

int main() {
    Cat kitty;
    kitty.eat();
    kitty.meow();
    return 0;
}
```

---

14. Exception Handling

```
try {
    int x = 10 / 0;
} catch (...) {
    cout << "Error: Division by zero" << endl;
}
```

---

15. File I/O

Writing to a File

```
#include <fstream>

ofstream file("example.txt");
file << "Hello, File!";
file.close();
```

Reading from a File

```
#include <fstream>

ifstream file("example.txt");
string line;
while (getline(file, line)) {
    cout << line << endl;
}
file.close();
```

---

16. Useful STL (Standard Template Library) Containers

Vectors (Dynamic Arrays)

```
#include <vector>

vector<int> nums = {1, 2, 3};
nums.push_back(4);

for (int n : nums) {
    cout << n << endl;
}
```

Maps (Key-Value Pairs)

```
#include <map>

map<string, int> scores;
scores["Alice"] = 90;
scores["Bob"] = 85;

for (auto it : scores) {
    cout << it.first << ": " << it.second << endl;
}
```

This cheat sheet covers the basics of C++ to get you started.