Lecture 1

C++ Basics I

Variable Classes

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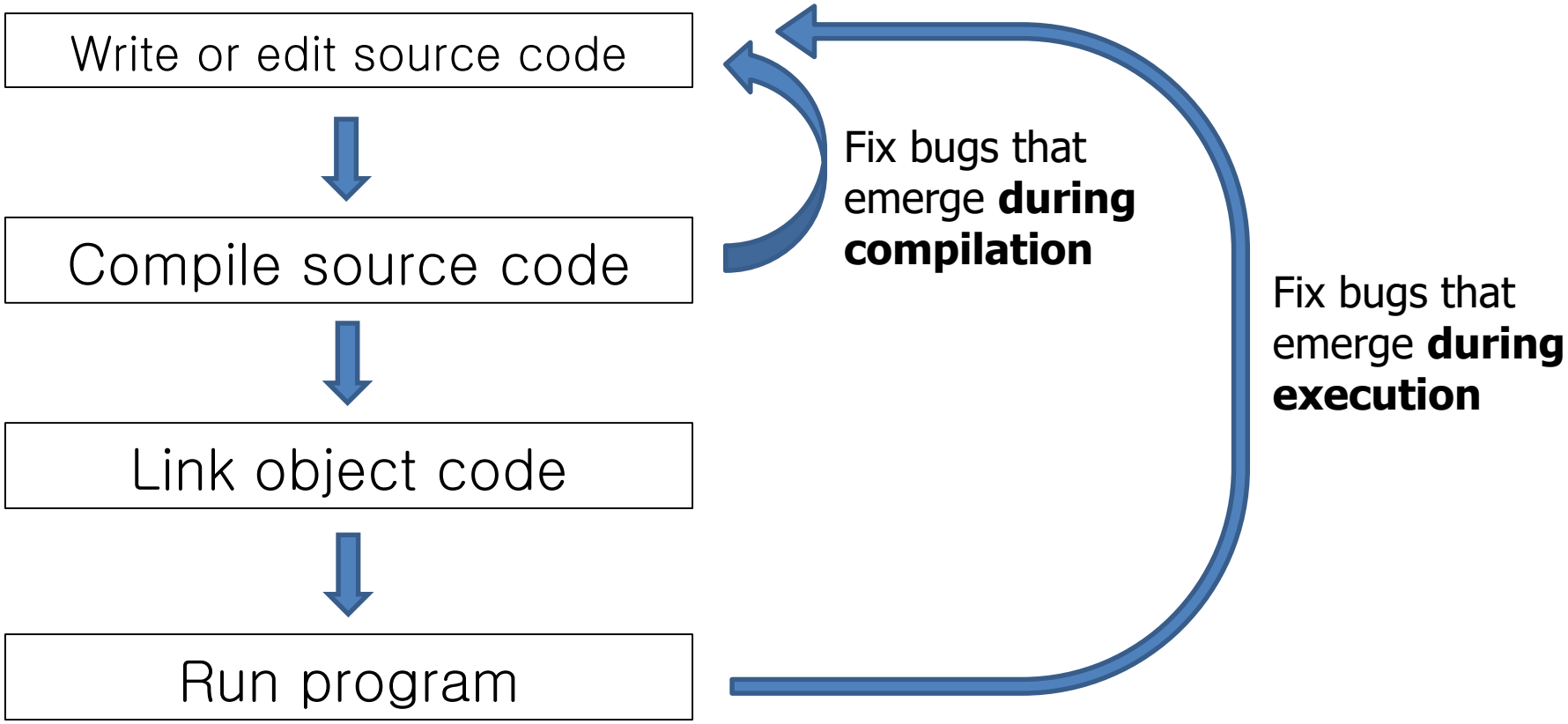
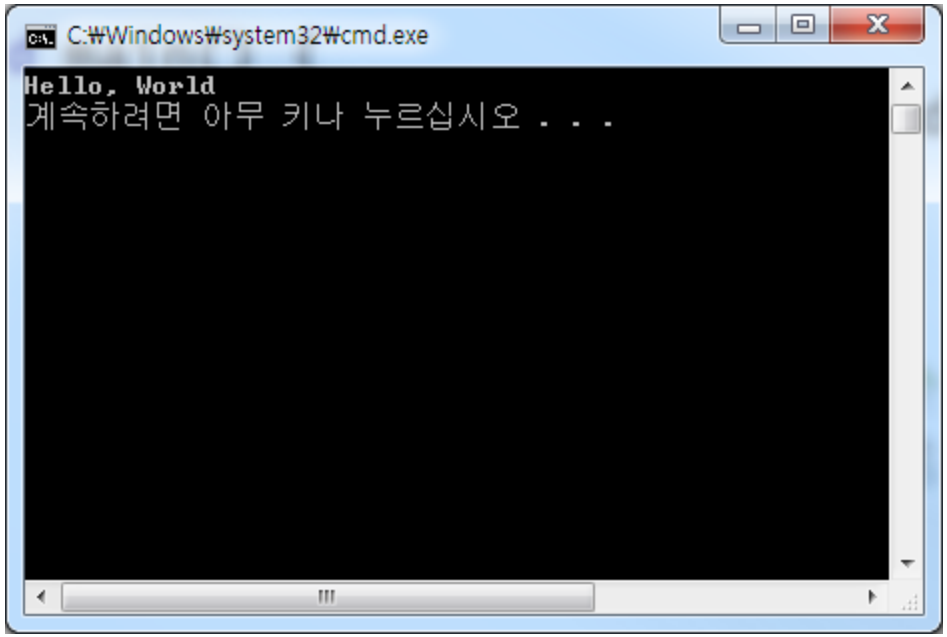
Compile & Execute



A Simple C Program

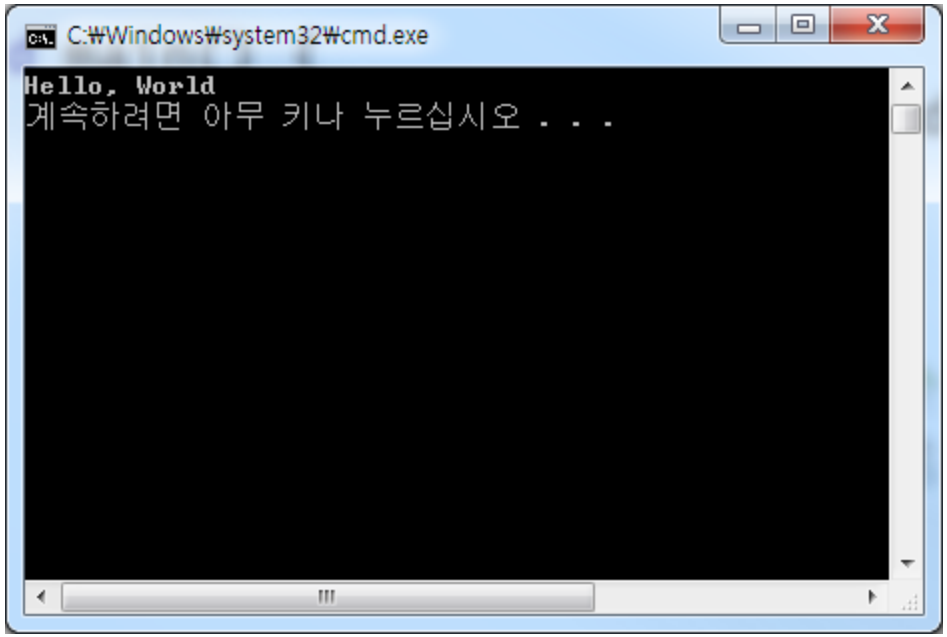
```
#include <stdio.h>

void main() {
   printf("Hello, World\n");
}
```



C++ is an extension of C.

A Simple C++ Program

```
#include <iostream>

void main() {
   // printf("Hello, World\n");
   std::cout << "Hello, World" << std::endl;
}
```



Putting Comments

- **Comments** are ignored by the compiler.
- Comments can help readers understand the code.
  - `//`
  - `/* … */`

```
#include <iostream>

void main() {
   int u = 1, v = 2;
   std::cout << u + v;          // sum of u and v
                                /* sum of u and v */
}
```

Types, Variables

- Primitive built-in types
  - void
  - bool, char, w_char, short, int, long, float, double
  - unsigned char, unsigned int, …

```
#include <iostream>

void main() {
   int height = 11, width = 9, length = 40;
   int result = height * width * length;

   std::cout << "The volume of the box car is ";
   std::cout << result << std::endl;
}
```

Types, Variables

- Enumerations
  - **Enumerations** provide an alternative method for defining/grouping sets of integer type constants.

```
#include <iostream>

void main() {
   enum Forms { shape = 1, sphere, cylinder, polygon };
   std::cout << shape << sphere << cylinder << polygon;
}
```

Types, Variables

- typedef
  - **typedef** allows us to define a synonym for a type

```
#include <iostream>

typedef double wages;       // wages is double
typedef int exam_score;     // exam_score is int
typedef wages salary;       // salary is wages (double)

void main() {
   wages        wage0 = 200, wage1 = 300;
   exam_score   score0 = 90, score1 = 100;

   std::cout << wages0 << score0;
   std::cout << wages1 << score1;
}
```

Types, Variables

- sizeof
  - The **sizeof** operator returns the size (in bytes) of a type or an object.

```
#include <iostream>

typedef double wages;       // wages is double
typedef int exam_score;     // exam_score is int

void main() {
   wages w;
   std::cout << sizeof(int) << sizeof(exam_score);
   std::cout << sizeof(double) << sizeof(wages);
   std::cout << sizeof(w);
}
```

Scope of Variables

- Local and global variables

```
#include <iostream>

int a = 3;

void main() {
    int b = 5;
    {
        int c = 7;
        cout << a << b << c;
    }
    cout << a << b;
    cout << c;          // Compilation Error !
}
```

Global variable

Scope of variable c

Scope of Variables

- extern
  - We can <u>declare</u> a global variable without <u>defining</u> it by using the **extern** keyword.

main.cpp

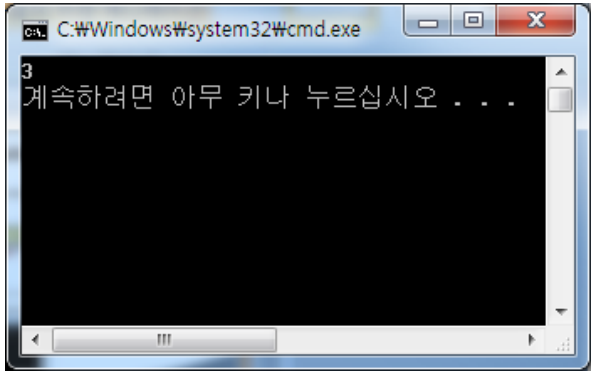
```
#include <iostream>

extern int a;

void main() {
    std::cout << a << std::endl;
}
```

declaration of a

tmp.cpp

```
int a = 3;
```

definition of a



Scope of Variables

- static global variable
  - We can define a global variable as **static** to make its scope local to a file.

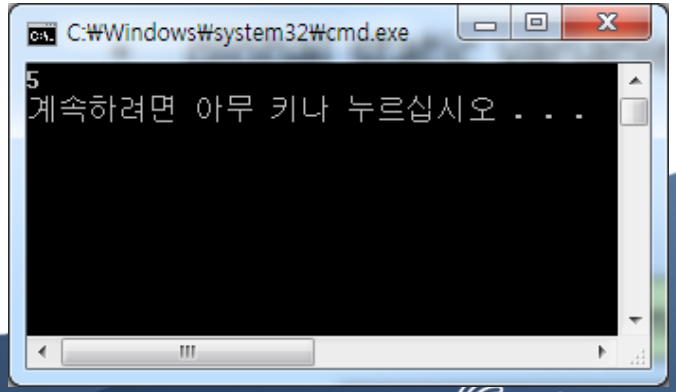
main.cpp

```
#include <iostream>

static int a = 5;

static int f() {}

void main() {
   std::cout << a << std::endl;
}
```

tmp.cpp

```
static int a = 3;
static int f() { }
```

different definitions of variable a

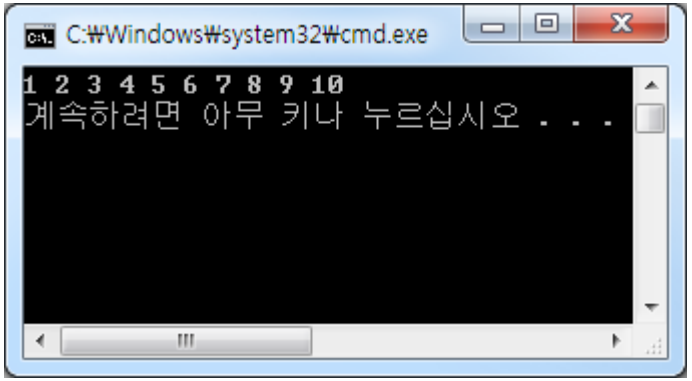


Scope of Variables

- local static variable
  - When the function is called repeatedly, the local static variable (1) retains the previous value and (2) by-passes the initialization.

```
#include <iostream>

void func() {
    static int a = 0;
    a++;
    std::cout << a << " ";
}

void main() {
    for(int i=0;i<10;++i)
        func();
    std::cout << std::endl;
}
```

Local Static Variable



Const Qualifier

- const
  - A **constant** is a special kind of variable whose value cannot be altered in the program.

```
#include <iostream>

void main() {
   int a = 3;
   const int b = 5;   // b is const variable

   a = 7;
   b = 7;             // Compilation Error !
}
```

Basic Expressions

- Arithmetic expressions

  +, -, *, /, %

```
#include <iostream>

void main() {
   std::cout << 6 + 3 << 6 - 3 << 6 * 3 << 6 / 3;
   std::cout << 5 / 3 << 5 % 3 << 5.0 / 3.0;
}
```

Basic Expressions

- Numerical predicates

  ==, !=, >, <, >=, <=

```
#include <iostream>

void main() {
   int i = 50;
   double d = 50.0;

   std::cout << (i == (int)d);
   std::cout << ((double) i != d);
}
```

Basic Statements

- Conditional statement
  - **if … else**, switch

```
#include <iostream>

void main() {
   const int v = 5;

   if(v < 3)        std::cout << “v is less than 3”;
   else if(v < 5)   std::cout << “v is less than 5”;
   else if(v < 7)   std::cout << “v is less than 7”;
   else             std::cout << “v is larger than 7”;
}
```

Basic Statements

- Conditional statement
  - if … else, **switch**

```
#include <iostream>

void main() {
    const int v = 5;

    switch(v) {
        case 3:       std::cout << “v is 3”; break;
        case 5:       std::cout << “v is 5”; break;
        case 7:       std::cout << “v is 7”; break;
        default :     std::cout << “v is not 3 or 5 or 7”
    }
}
```

Basic Expressions

- Conditional operator

  cond ? expr1 : expr2;

```
#include <iostream>

void main() {
   int score;
   std::cin >> score;
   std::cout << “The score is “ << score <<
        (score==1 ? “ point” : “ points”) << “.”
        << std::endl;
}
```

Basic Statements

- Loops
  - **for**, while, do_while

- Problem
  - Do summation from 1 to 10

```
#include <iostream>

void main() {
    int sum = 0;
    for(int i=1;i<=10;++i)
        sum += i;
    std::cout << sum;
}
```

Basic Statements

- Loops
  - for, **while**, do_while

- Problem
  - Do summation from 1 to 10

```
#include <iostream>

void main() {
    int sum = 0, i = 1;
    while(i <= 10) {
        sum += i;
        i++;
    }
    std::cout << sum;
}
```

Basic Statements

- Loops
  - for, while, **do_while**

- Problem
  - Do summation from 1 to 10

```
#include <iostream>

void main() {
    int sum = 0, i = 1;
    do {
        sum += i;
        i++;
    } while(i <= 10);
    std::cout << sum;
}
```

Basic Expressions

- Memory management
  - new, delete

```
#include <iostream>

void main() {
   int * v = new int[10];  // allocate ten consecutive
                           // integer variables

   delete [] v;            // de-allocate the array
}
```

Class

- A **class** consists of the datafields and interface.

```
#include <iostream>

class Box {
public:
   void print() {
      std::cout << height << " " << width << " " << length << std::endl;
   }
   double height, width, length;
};

void main() {
   Box box;
   box.height = 3; box.width = 5; box.length = 7;
   box.print();
}
```