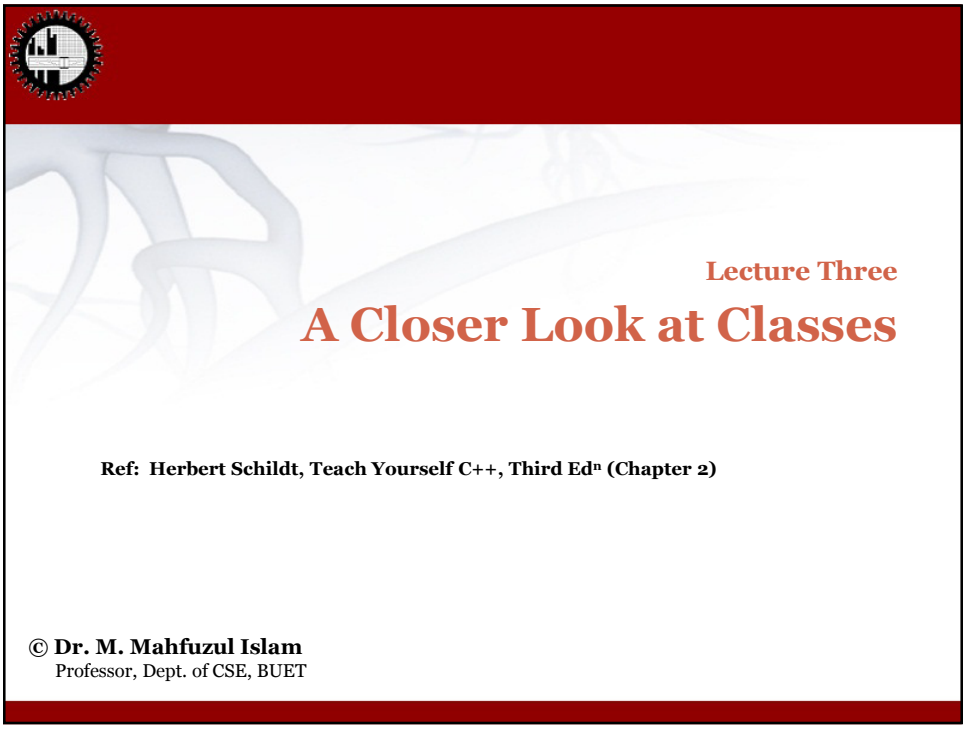

Lecture Three

A Closer Look at Classes

Ref: Herbert Schildt, Teach Yourself C++, Third Edn (Chapter 2)

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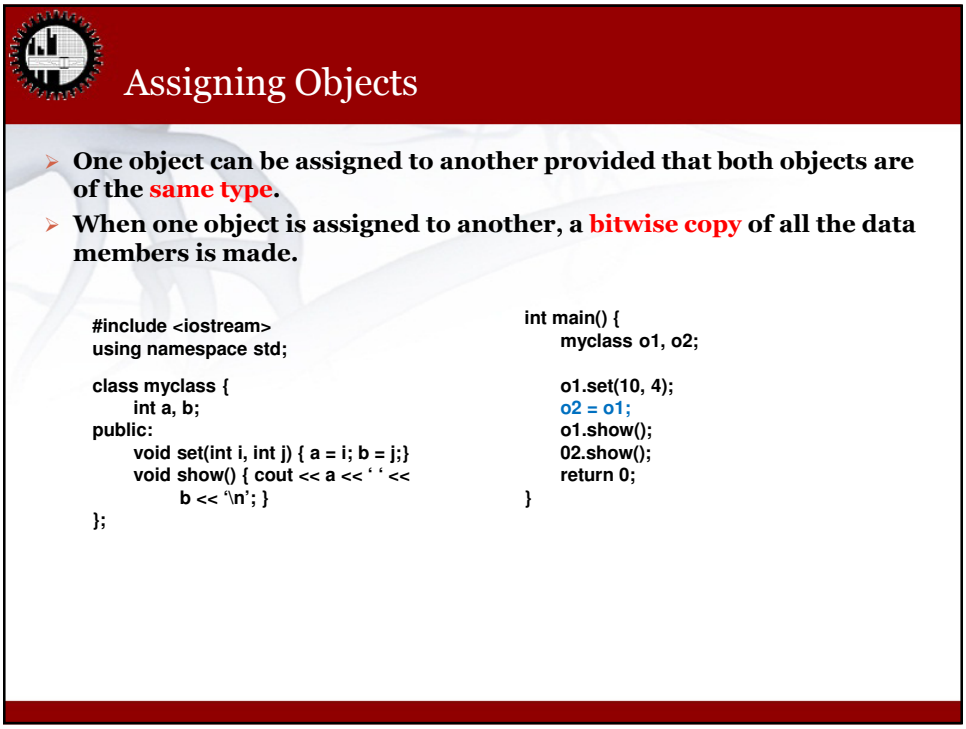

Assigning Objects

- One object can be assigned to another provided that both objects are of the same type.
- When one object is assigned to another, a bitwise copy of all the data members is made.

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

class myclass {
      int a, b;
public:
      void set(int i, int j) { a = i; b = j;}
      void show() { cout << a << ' ' <<
            b << '\n'; }
};
```

```
int main() {
      myclass o1, o2;

      o1.set(10, 4);
      o2 = o1;
      o1.show();
      02.show();
      return 0;
}
```

Assigning Objects

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

#define SIZE 10

class stack {
        char stck[SIZE];
        int tos;
public:
        stack() {tos = 0};
        void push(char ch);
        char pop();
};

void stack::push(char ch){
        if (tos == SIZE){
                cout << "Stack is full\n";
                return;
        }
        stck[tos++] = ch;
}
```

```
char stack::pop(){
        if (tos == 0){
                cout << "Stack is empty\n";
                return;
        }
        return stck[--tos];
}

int main(){
        stack s1, s2;

        s1.push('a');
        s1.push('b');

        s2 = s1;
        cout << s1.pop() << ' ' << s1.pop()<<"\n";
        cout << s2.pop() << ' ' << s2.pop()<<"\n";
        return 0;
}
```

The outputs are identical.

Assigning Objects: **Error Possibility**

- Must exercise some care when assigning one object to another

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

class strtype {
   char  *p;
   int   len;
public:
   strtype(char *ptr);
   ~strtype();
   void show();
};

strtype::strtype(char *ptr){
    len = strlen(ptr);
    p = (char *) malloc(len+1);
    if (!p) {
        cout << "Allocation error\n";
        exit(1);
    }
    strcpy(p, ptr);
}
```

```
strtype::~strtype(){
   cout << "freeing  p.....\n";
   free(p);
}

void strtype::show(){
   cout <<  p << " – length: " << len;
   cout << '\n';
}

int main(){
   strtype  s1("This is a test."), s2("I like C++");

   s1.show();
   s2.show();

   s2 = s1;
   s1.show();
   s2.show();
   return 0;
}
```

What is the

When the objects are destroyed, the memory pointed to by s1's p is freed twice and the memory pointed to by s2's p is not freed at all.

Passing Objects to Functions

- **Parameter passing, by default, is called by value.**
- **New object does not call constructor, but destructor is called**

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

class samp {
      int i;
public:
     samp(int n);
    ~samp();
     void set_i(int n) {i= n;}
     int get_i() { return i}
};

samp::samp(int n){
     i = n;
     count << "Constructing…\n";
}

samp::~samp(){
    count << "Destructing...\n";
}
```

```
void sqr_it(samp o) {
    o.set_i(o.get_i() * o.get_i());
    cout << "Copy: value of a:" << o.get_i() << '\n';
}

int main() {
    samp a(10);

    sqr_it(a);
    cout << "Main: value of a:" << a.get_i() << '\n';
    return 0;
}
```

OUTPUT:
Constructing….
Copy: value of a: 100
Destructing….
Main: value of a: 10
Destructing….

Passing Objects to Functions: Problem

- If the object used as the arguments allocates dynamic memory and free the memory then the destructor function is called and the original object is damaged.

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

class dyna {
      int *p;
public:
     dyna(int i);
    ~dyna() {free(p); cout << "Freeing...\n";}
     int get () { return *p}
};

dyna::dyna(int i){
     p = (int *) malloc( sizeof(int) );
    if (!p) {
        cout << "Allocation problem\n";
        exit(1);
    }
   *p = i;
}
```

```
void neg (dyna ob) {
      return -ob.get();
}

int main() {
      dyna o(-10);

      cout << o.get() << '\n';
      cout << neg(o) << '\n';
      cout << o.get() << '\n';
      return 0;
}
```

OUTPUT:
-10
Freeing… // when o is passed to neg(), copy is
          //created and destroyed in neg()
10
NULL pointer assignment // o.get()
NULL pointer assignment // free(p) in destructor
Freeing…../when o is destroyed

Passing Objects to Functions: Solutions

Solutions:

- **To pass the address of the object, not the object itself.**
- **A special type of constructor called "copy constructor" is used (Chap 5).**

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

class samp {
      int i;
public:
     samp(int n) { i = n;}
     void set_i(int n) {i= n;}
     int get_i() { return i}
};

samp::~samp(){
    count << "Destructing...\n";
}
```

```
void sqr_it(samp *o) {
   o.set_i(o.get_i() * o.get_i());
   cout << "Copy: value of i:" << o.get_i() << '\n';
}

int main() {
    samp a(10);

    sqr_it(&a);
    cout << "Main: value of i:" << a.get_i() << '\n';
    return 0;
}
```

OUTPUT:

copy: value of i: 100
main: value of i: 100

Returning Objects from Functions

- **When an object is returned by a function, a temporary object is created which holds the return value. This object is return by the function.**
- **After the value has been returned, this object is destroyed.**
- **The destruction of this temporary object may cause unexpected side effects.**

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

class samp {
      char *s;
public:
      samp() { s = '\0'; }
     ~samp() { if (s) free(s); count << "Freeing
                                        S\n";}
      void show() {cout << s << '\n';}
      void set (char *str);
};

void samp::set(char *str){
      s = (char *) malloc(strlen(str)+1);
      if(!s) { cout << "Allocation error\n";
          exit(1);}
      strcpy(s, str);
}
```

```
samp input() {
      char s[80];
      samp str;

      cout <<"Enter a string: ";
      cin >> s;
      str.set(s);
      return str;
}


int main() {
      samp ob;

      ob = input();
      ob.show();
      return 0;
}
```

Friend Function

- **A friend function is not a member of a class but still has access to its private elements.**
- **Three uses of friend functions**

  (1) to do operator overloading;
  (2) creation of certain types of I/O functions; and
  (3) one function to have access to the private members of two or more different classes.
- **A friend function is a regular non-member function**

Friend Function

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

class truck;

class car {
      int passengers;
      int speed;
public:
     car(int p, int s) { passengers = p; speed = s; }
     friend int sp_greater(car c, truck t);
};

class truck {
     int weight;
     int speed;
public:
     car(int w, int s) { weight = w; speed = s; }
     friend int sp_greater(car c, truck t);
};

int  sp_greater (car c, truck t) {
     return c.speed – t.speed;
}
```

```
int main() {
     int t;
     car c(6, 55);
     truck t(2000, 72);

     t = sp_greater(c, t);
     if (t > 0) cout << ”Faster.\n”;
     else if (t==0) cout << “Equal.\n”;
          else count << “slower.\n”;

     return 0;
}
```

Forward declaration:
class truck;

Friend Function

➢**A friend function can be a member of one class and a friend of another.**

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

class truck;

class car {
      int passengers;
      int speed;
public:
      car(int p, int s) { passengers = p; speed = s; }
      int sp_greater(truck t);
};

class truck {
      int weight;
      int speed;
public:
     car(int w, int s) { weight = w; speed = s; }
     friend int car::sp_greater(truck t);
};
```

```
int  car::sp_greater (truck t) {
      return speed – t.speed;
}

int main() {
      int t;
      car c(6, 55);
      truck t(2000, 72);

      t  = c. sp_greater(t);
      if (t > 0) cout << ”Faster.\n”;
      else if (t==0) cout << “Equal.\n”;
            else count << “slower.\n”;

       return 0;
}
```

➢ t = c.sp_greater(t);

can be written by the scope resolution operator (::) as

t =c.car::sp_greater(t);

but this is unnecessary.