
ECE PULSE
THE HEARTBEAT OF INNOVATION
Put your Analog, Digital, and Software Skills to the test!
ONEsite
NVIDIA
accenture
Schlumberger
QUALCOMM
INFOBRIGHT
Open Source Data Warehousing
MathWorks
Join us for the 2013 ECE Pulse Competitions on Saturday, February 9th. There are a variety of competitions in all skill levels with prizes ranging From Gift Cards to GPUs!
To Register and Learn more, visit http://pulse.ece.illinois.edu

Announcements

MP3 available, due 2/22, 11:59p. EC: 2/12, 11:59p.

MP 3.1 will be on Exam 1.

Exam 1: 2/19, 7-10p, in rooms tba. 75min exam, given 3hr.

TODAY: inheritance-fin

templates

Abstract Base Classes:

```
class flower {
public:
    flower();
    virtual void drawBlossom() = 0;
    virtual void drawStem() = 0;
    virtual void drawFoliage() = 0;
    …
};
```

```
class daisy:public flower {
public:
    virtual void drawBlossom();
    virtual void drawStem();
    virtual void drawFoliage();
    …
private:
    int blossom; // number of petals
    int stem; // length of stem
    int foliage // leaves per inch
};
```

```
void daisy::drawBlossom() {
// whatever
}
void daisy::drawStem() {
// whatever
}
void daisy::drawFoliage() {
// whatever
}
```

```
flower f;
daisy d;
flower * fptr;
```

Concluding remarks on inheritance:

Polymorphism: objects of different types can employ methods of the same name and parameterization.

```
animal ** farm;

farm = new animal*[5];
farm[0] = new dog;
farm[1] = new pig;
farm[2] = new horse;
farm[3] = new cow;
farm[4] = new duck;

for (int i=0; i<5;i++)
    farm[i]->speak();
```

Inheritance provides DYNAMIC polymorphism—type dependent functions can be selected at run-time. Wikipedia: Polymorphism in OOP

Next topic: “templates” are C++ implementation of static polymorphism, where type dependent functions are chosen at compile-time.

What do you notice about this code?

```
void swapInt(int x, int y){
   int temp;
   temp = x;
   x = y;
   y = temp;
}
```

```
void swapChar(char x, char y){
   char temp;
   temp = x;
   x = y;
   y = temp;
}
```

```
int main(){
   int a = 1; int b = 2;
   char c = 'n'; char d = 'm';
   swapInt(a,b);
   swapChar(c,d);
   cout << a << " " << b << endl;
   cout << c << " " << d << endl;
}
```

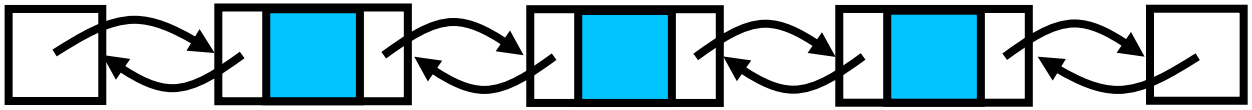
Function templates:

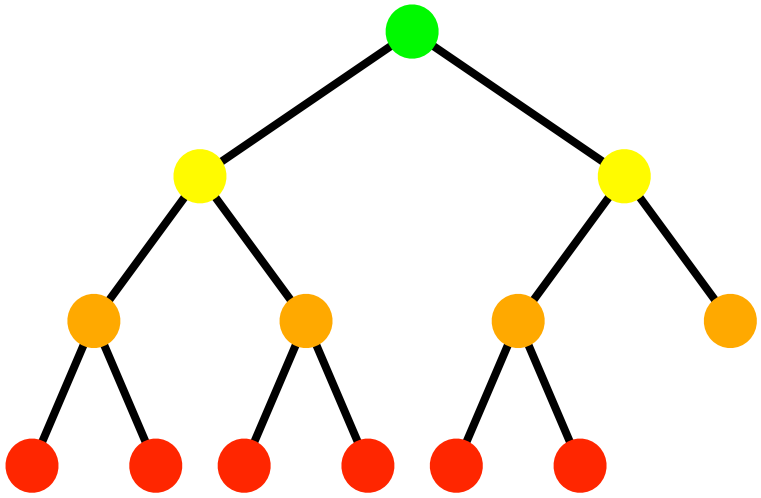
```
template <class T>
void swapUs(T & x, T & y){
   T temp;
   temp = x;
   x = y;
   y = temp;
}
```

```
int main(){
   int a = 1; int b = 2;
   char c = 'n'; char d = 'm';
   swapUs       (a,b);
   swapUs       (c,d);
   cout << a << " " << b << endl;
   cout << c << " " << d << endl;
}
```

Classes can be given templates too:

0	1	2	3	4	5	6	7





Class templates:

```
template <class T>
class mypair {
private:
   T a, b;
public:
   mypair (T first, T second);
   T getmax ();
};
```

```
template <class T>
T mypair<T>::getmax () {
   T retmax;
   retmax = (a>b? a : b);
   return retmax;
}

template <class T>
mypair<T>::mypair(T first,T second)
{
   a = first;
   b = second;
}
```

```
int main () {
   mypair<int> myobject(100, 75);
   cout << myobject.getmax();
   return 0;
}
```

Class templates:

```
template <class T>
class mypair {
private:
   T a, b;
public:
   mypair(T first, T second);
   T getmax();
};
```

```
template <class T>
T mypair<T>::getmax() {
   T retmax;
   retmax = (a>b? a : b);
   return retmax;
}

template <class T>
mypair<T>::mypair(T first, T second){
   a = first;
   b = second;
}
```

Challenge1: write the function signature for the copy constructor (if we needed one) for this class.

_____ _____ :: _____(_____)

Challenge2: How do you declare a dynamic array of `mypair`s of integers?

Challenge3: How do you allocate memory if you want that array to have 8 elements?

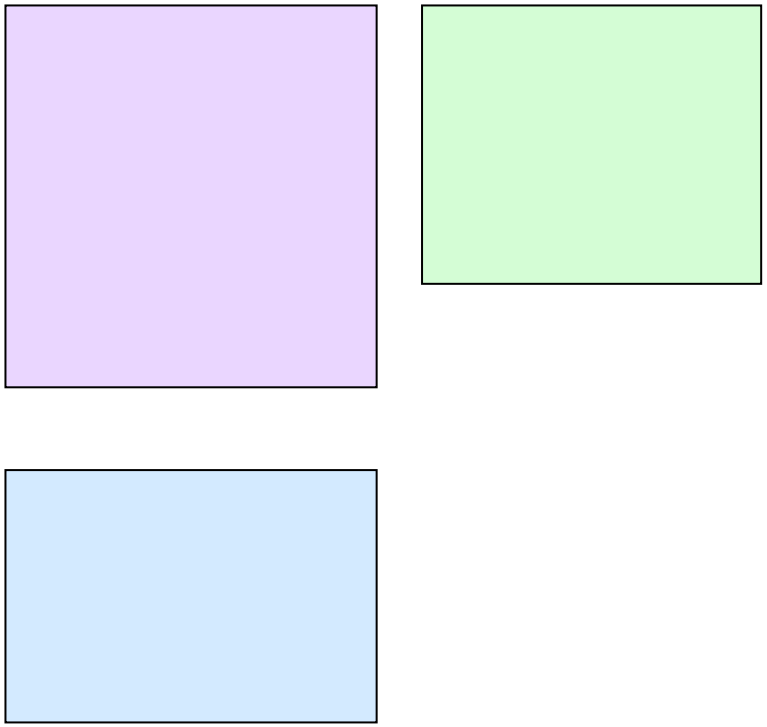
A note on templates:

```
template <class T, class U>
T addEm(T a, U b) {
   return a + b;
}

int main() {
   addEm<int,int>(3,4);
   addEm<double,int>(3.2,4);
   addEm<int,double>(4,3.2);
   addEm<string,int>("hi",4);
   addEm<int,string>(4,"hi");
}
```

Template compilation:

Old:



New: