More About Inheritance

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Instance Variables and Inheritance (1/3)

```
1   class Professor{
2     String title;
3     Professor(){ title = "NTU"; }
4     public String get_title(){ return title; }
5   }
6   class CSIEProfessor extends Professor{
7     String title; //what?
8     CSIEProfessor(){ title = "CSIE"; /*which title?*/}
9     public String get_csie_title(){ return title; /*which
          title?*/}
10  }
11
12  CSIEProfessor HTLin1 = new CSIEProfessor();
13  System.out.println(HTLin1.get_title());       //NTU
14  System.out.println(HTLin1.get_csie_title()); //CSIE
15  Professor HTLin2 = new CSIEProfessor();
16  System.out.println(HTLin2.get_title());       //NTU
17  System.out.println(HTLin2.get_csie_title()); //hahaha
18  Professor HTLin3 = new Professor();
19  System.out.println(HTLin3.get_title());       //NTU
20  System.out.println(HTLin3.get_csie_title()); //hahaha
```

Instance Variables and Inheritance (2/3)

What TYPE-of-reference wants to access its title?

```
1  class Professor{
2    String title; /* Professor (this) */
3    Professor(){ title = "NTU"; } /* Professor (this) */
4    public String get_title(){ return title; }
5    /* Professor (this) */
6  }
7  class CSIEProfessor extends Professor{
8    String title; /* CSIEProfessor (this) */
9    CSIEProfessor(){ title = "CSIE";} /* CSIEProfessor (this) */
10   public String get_csie_title(){ return title; }
11   /* CSIEProfessor (this) */
12   public String get_super_title(){ return super.title; }
13   /* Professor (super) */
14   public String get_super_title_2(){
15     return ((Professor)this).title;
16   }
17   /* Professor (this as Professor) */
18 }
```

Instance Variables and Inheritance (3/3)

What TYPE-of-reference wants to access its title?

```
1  CSIEProfessor HTLin1 = new CSIEProfessor();
2  System.out.println(HTLin1.title); /* CSIEProfessor (HTLin1) */
3  Professor HTLin2 = new CSIEProfessor();
4  System.out.println(HTLin2.title); /* Professor (HTLin2) */
5  Professor HTLin3 = new Professor();
6  System.out.println(HTLin3.title); /* Professor (HTLin3) */
7  CSIEProfessor HTLin4 = new CSIEProfessor();
8  System.out.println(((Professor)HTLin4).title);
9  /* Professor (HTLin4 as Professor) */
```

- compile-time (static) binding: compiler easily decide intention by declared type
- instance variables: static binding, new variable w/ same name "hides" old one (when using new type)

Class Variables and Inheritance (1/1)

```
1  class Professor{
2    static int count;
3    Professor(){ count++; } //i.e., Professor.count++;
4  }
5  class CSIEProfessor extends Professor{
6    static int count;
7    CSIEProfessor(){
8      super(); count++; //i.e., CSIEProfessor.count++;
9    }
10 }
11 System.out.println(CSIEProfessor.count); //clear intention
12 System.out.println(Professor.count); //clear intention
13 //intention determined by reference TYPE
14 CSIEProfessor HTLin1 = new CSIEProfessor();
15 System.out.println(HTLin1.count); //CSIEProfessor.count
16 Professor HTLin2 = new CSIEProfessor();
17 System.out.println(HTLin2.count); //Professor.count
18 Professor HTLin3 = null;
19 System.out.println(HTLin3.count); //Professor.count
```

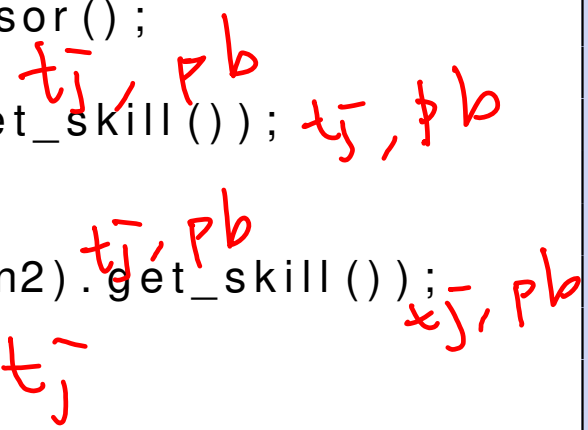
- class variables: static binding (as said before)

Class Methods and Inheritance (0/0)

- class methods: exactly the same as class variables
  intention determined by directly using class names, or by reference TYPE

Instance Methods and Inheritance (1/2)

```
1  class Professor{
2    String skill = "tell jokes";
3    public String get_skill(){ return skill; }
4  }
5  class JaiJaiProfessor extends Professor{
6    public String get_skill(){ return skill + ", play on BBS"; }
7  }
8
9  JaiJaiProfessor HTLin1 = new JaiJaiProfessor();
10 System.out.println(HTLin1.get_skill());
11 System.out.println(((Professor)HTLin1).get_skill());
12 Professor HTLin2 = new JaiJaiProfessor();
13 System.out.println(HTLin2.get_skill());
14 System.out.println(((JaiJaiProfessor)HTLin2).get_skill());
15 Professor HTLin3 = new Professor();
16 System.out.println(HTLin3.get_skill());
17 System.out.println(
18   ((JaiJaiProfessor)HTLin3).get_skill()
19 );//ohohoh, why do you want to be JaiJai?
```



Instance Methods and Inheritance (2/2)

```
1  class Professor{
2    private String skill = "tell␣jokes";
3    public String get_skill(){ return skill; }
4    public String get_skill_ohohoh(){ return skill; }
5  }
6  class JaiJaiProfessor extends Professor{
7    public String get_skill_hahaha(){ return skill + ",␣play␣on␣
         BBS"; }
8    public String get_skill_ohohoh(){
9      return get_skill_ohohoh() + ",␣play␣on␣BBS";
10   }
11   public String get_skill(){
12     return super.get_skill() + ",␣play␣on␣BBS";
13   }
14 }
```

- the hahaha version: won't work because skill is private
- the ohohoh version: stack overflow (a.k.a. run out of paper)

Key Point: Type versus Content

- static (compile-time) binding: determined by type
  - instance variables
  - class variables
  - class methods

  —inherited class “hides” things from base class

  —hidden stuff can be revealed by casting
- dynamic (run-time) binding: determined by content
  - all (non-private) instance methods in Java
  - “virtual” instance methods in C++

  —inherited class “overrides” things from base class

  —overridden stuff cannot be revealed by casting