

Inner Classes

What is an Inner Class?

- A class that is defined within another class
- Benefits:
 - can access private data of the outer class
 - Anonymous inner classes can be defined inline in your code
 - can be hidden from the outer classes within the package
 - useful for adding event listener capabilities
- There are three types of inner classes
 - member - defined within the outer class (either static or non-static)
 - Local - defined within a method
 - Anonymous - defined within a method, has no name and can implement an interface

Notes About Top Level Classes

- All code in Java is implemented within a class
- A Java source file must be named `ClassName.java`
 - The source file may contain many class definitions, but there can only be one public class in a source file
- Top level class definitions can only be defined with `public` and/or default accessor (but sure can be `final` or `abstract`)

Member classes (non-static)

- can access all fields/methods of enclosing class
- may not contain static member (unless declared as final)
- may not contain static initializers

```
public class Book {  
    private String title;  
    private List<Chapter> chapters = new ArrayList<Chapter>();  
  
    class Chapter{  
        public String toString(){  
            int totalChapters = chapters.size(); //from enclosing class  
            return String.format("Chapter '%s' (%d of %d)", title, chapterNumber,  
                                totalChapters);  
        }  
        private String title;  
        private int chapterNumber;  
        ...  
    }  
    ...  
}
```

Member classes (non-static)

- can be instantiated using reference to outer class

```
Book.Chapter chapter1 = new Book().new Chapter("chapter 1",1);
```

```
Book book = new Book();
```

```
Book.Chapter chapter2 = book.new Chapter("chapter 1",1);
```

- within enclosing class inner class can be used as any other class

```
Chapter c = new Chapter("chapter 1",1);
```

Member Classes/Interfaces (static)

- Defined as static member of enclosing class
- can only access static fields/methods of the enclosing class

```
public class Book {  
    private Publisher publisher;  
  
    static class Publisher{  
        String name;  
        String country;  
    }  
    ...  
}
```

- can be constructed without an instance of enclosing class

```
Book.Publisher publisher = new Book.Publisher();
```

Member Classes/Interfaces (static)

- Behaves like a normal static member of enclosing class

```
Book.Publisher publisher = new Book.Publisher();  
publisher.name = "Fred";
```

```
Book book1 = new Book();  
book1.setPublisher(publisher);  
Book book2 = new Book();  
book2.setPublisher(publisher);
```

```
publisher.name = "Jen";
```

```
System.out.println(book1.getPublisher().name); //shows 'Jen'  
System.out.println(book2.getPublisher().name); //shows 'Jen'
```

Local Inner Classes

- Defined within a method
- cannot be declared static
- cannot have an access modifier
- can access enclosing class's methods and fields
- can only access final variables of the enclosing method

```
public void addCover() {  
  
    class CoverPage implements Page {  
        boolean inColor;  
        public String getText() {  
            return "Title: " + title; //property of enclosing class  
        }  
  
        CoverPage(boolean inColor) {  
            this.inColor = inColor;  
        }  
    }  
  
    Page colorCover = new CoverPage(true);  
    Page bwCover = new CoverPage(false);  
    ...  
}
```


Anonymous Classes

- Declared without a name
- allows objects to be created on the fly
- may not define extends or implements
- may not contain constructors

```
public void addCommentPage(final String text) {  
    addPage(new Page() {  
        public String getText() {  
            return "Comment: " + text;  
        }  
    });  
}  
  
public void addPage(Page p) {  
    ...  
}
```

Anonymous Classes

- Anonymous classes can directly implement an interface or extend from a class
- Implementing an interface:

```
interface Page{  
    public String getText();  
}  
  
addPage(new Page() {  
    public String getText() {  
        return "Comment: " + text;  
    }  
});
```

Anonymous Classes

- Extending a class:

```

class Chapter{
    public String toString(){
        int totalChapters = chapters.size(); //from enclosing class
        return String.format("Chapter '%s' (%d of %d)", title, chapterNumber,
            totalChapters);
    }
    private String title;
    private int chapterNumber;

    public Chapter(String title, int chapterNumber){
        this.title = title;
        this.chapterNumber = chapterNumber;
    }
}

public void addIntroChapter(){
    addChapter(new Chapter("Intro", 0){
        public String toString(){
            return String.format("Chapter '%s' ", title);
        }
    });
}

public void addChapter(Chapter c){
    this.chapters.add(c);
}

```

class to be extended

extending the class in method