面向对象程序的分析与设计
Object-Oriented Analysis and Design

Lecture 14
Java Review

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Contents

- Review on Java

Review on Java

Classes

- Is this legal in the file name "Test.java"?

```
Import java.io.*;
public class Test{
  public static void main (…){
  }
}
class Lab1 {
  ……
}
```

Classes

- Is this legal in the file name "Test.java"?

```
Import java.io.*;
public class Test{
  public static void main (…){
  }
}
public class Lab1 {
  ……
}
```

References & Objects

- How many objects and how many references have been created?

```
Worker wk1,wk2;
Adult ad1, ad2;
Wk1 = new Worker();
Wk2=wk1;
Ad1= new Adult ();
Ad2= wk1;
```

Abstract Classes

This is an abstract class

```
public abstract class myClass {
    abstract void print ();
    int calculate (int x, int y) {
            return x+y;
    }
}
```

Abstract Classes

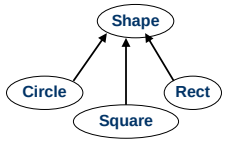
Is this an abstract class

```
public abstract class myClass {
    int calculate (int x, int y) {
            return x+y;
    }
}
```

Casting

Shape c = new Circle();
double r = c.getRadius();

- What would happen? Why?



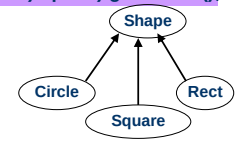
How do we use this Shape as a Circle?

Shape c = new Circle();
double r = ((Circle)c).getRadius();

forces c to act as a circle

- Is this ok?
- How about this one?

Shape square = new Shape ();
double r = ((Circle)square).getRadius();



Narrowing Conversions and Casting

String s = new String("bye");
String t;
Object obj;

obj = s;
t = obj; // NO NO NO !!!

// you must CAST

t = (String) obj;

Review

Which order is correct for the access modifiers?

- A. public, default, protected, private
- B. private, default, protected, public
- C. default, private, protected, public
- D. protected, private, default, public

Review

Which statement is wrong?

- int myarray [3]={1,2,3};
- int myarray []=new int []{1,2,3};
- int [] myarray ={1,2,3};
- int myarray []=new int [3];

Review

What is the common pattern of class definitions

- A. Methods and instance variables are both private.
- B. Methods are private, and instance variables are public.
- C. Methods are public, and instance variables are private.
- D. Methods and instance variables are both public.

Review

The Java statement Object element = new Object(); creates a:

- new class
- new object
- new reference variable
- new container to hold objects

Review

Can two different classes contain methods with the same name?

A. No.

B. Yes, but only if the two classes have the same name.

C. Yes, but only if the main program does not create objects of both kinds.

D. Yes, this is always allowed.

Review

The constructor of a subclass can call the constructor of the superclass by using the _____ reference.

- extends
- new
- super
- import

Review

Inheritance should only be used when a(n) _____ relationship exists between the superclass and the subclass.

- is-a
- has-a
- has-many
- similar-to

Review

Dynamic binding is also known as _____.

- early binding
- late binding
- package binding
- inheritance binding

- Future City

Review

_____ is the ability of a variable name to represent, during program execution, instances of different but related classes that descend from a common superclass.

- Inheritance
- Containment
- Polymorphism
- Encapsulation

Review

If the field modifier _____ is specified in a method definition, the method cannot be overridden by a subclass.

- public
- protected
- final
- abstract

Review

If a method definition in a superclass has the field modifier _____, a subclass is required to override the method.

- static
- protected
- Final
- abstract

Review

Methods declared as _____ use static binding.

- protected
- final
- public
- abstract

Review

- A method that has the same name but a different set of parameters as an existing method is said to _____ the original method.
  - bind
  - cancel
  - Override
  - overload

Review

- Which of the following is true about an abstract class?
  - it can be instantiated
  - it can contain zero or more abstract methods
  - it cannot be inherited by other classes
  - it cannot contain data fields

- Future IT

Talk about Research

What Research Is?

- Is Research information gathering?
- Is Research the transportation of facts?

What Research Is

- Research is:

" …the systematic process of collecting and analyzing information (data) in order to increase our understanding of the phenomenon about which we are concerned or interested."

Research Characteristics

1. Originates with a question or problem.
2. Requires clear articulation of a goal.
3. Follows a specific plan or procedure.
4. Often divides main problem into subproblems.
5. Guided by specific problem, question, or hypothesis.
6. Accepts certain critical assumptions.
7. Requires collection and interpretation of data.
8. Cyclical in nature.

Definition of Software Engineering Research

Discover, improve and evaluate…

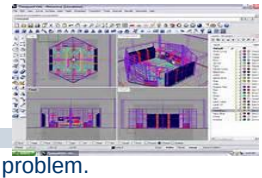
- methods, and
- tools

… to help practitioners develop large scale software.

Software Engineering Research entails both

- discovery of new/enhanced methods and tools
- evaluation of methods and tools

Research Projects



- Research begins with a problem.
  - This problem need not be Earth-shaking.
  - (MSc, vs. Ph.D. topic)
- Identifying this problem can actually be the hardest part of research. (Why?)
- In general, good research projects should:
  - Address an important question.
  - Advance knowledge.

Research Project Pitfalls

- The following kinds of projects usually don't make for good research:
  - Self-enlightenment.
  - Comparing data sets.
  - Correlating data sets.
  - Problems with yes / no answers.

High-Quality Research (1 of 2)

- Good research requires:
  - The scope and limitations of the work to be clearly defined.
  - The process to be clearly explained so that it can be reproduced and verified by other researchers.
  - A thoroughly planned design that is as objective as possible.

High-Quality Research (2 of 2)

- Good research requires:
  - Highly ethical standards be applied.
  - All limitations be documented.
  - Data be adequately analyzed and explained.
  - All findings be presented unambiguously and all conclusions be justified by sufficient evidence.

Sources of Research Problems

- ????

Sources of Research Problems

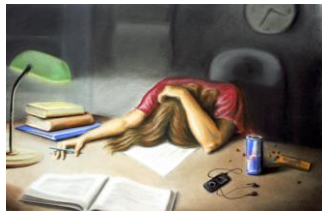
- Observation.
- Literature reviews (future work of research papers).
- Professional conferences (Group discussion).
- Experts.

Examples of Joined Research

- Does program transformation help increase the productivity of software maintenance? How?
- How does interface design affect software architecture?
- How can we best reverse engineer the architecture of a system to improve human understanding?
- What is the impact of object orientation on program transformation?

Processes & Methodologies

- Research Process.
- Common Methodologies.



Research Process

- Research is an extremely cyclic process.
  - Later stages might necessitate a review of earlier work.
- This isn't a weakness of the process but is part of the built-in error correction machinery.
- Because of the cyclic nature of research, it can be difficult to determine where to start and when to stop.

Step 1: A Question Is Raised

- A question occurs to or is posed to the researcher for which that researcher has no answer.
  - This doesn't mean that someone else doesn't already have an answer.
- The question needs to be converted to an appropriate problem statement like that documented in a research proposal.

Step 2: Suggest Hypotheses

- The researcher generates intermediate hypotheses to describe a solution to the problem.
  - This is at best a temporary solution since there is as yet no evidence to support either the acceptance or rejection of these hypotheses.

Step 3: Literature Review

- The available literature is reviewed to determine if there is already a solution to the problem.
  - Existing solutions do not always explain new observations.
  - The existing solution might require some revision or even be discarded.

Step 4: Literature Evaluation

- It's possible that the literature review has yielded a solution to the proposed problem.
  - This means that you haven't really done research.
  - A solution might be turned out tomorrow
- On the other hand, if the literature review turns up nothing, then additional research activities are justified.

Step 5: Acquire Data

- The researcher now begins to gather data relating to the research problem.
  - The means of data acquisition will often change based on the type of the research problem.
  - This might entail only data gathering, but it could also require the creation of new measurement instruments.

Step 6: Data Analysis

- The data that were gathered in the previous step are analyzed as a first step in ascertaining their meaning.
- As before, the analysis of the data does not constitute research.
  - This is basic number crunching.

Step 7: Data Interpretation

- The researcher interprets the newly analyzed data and suggests a conclusion.
  - This can be difficult.
  - Keep in mind that data analysis that suggests a correlation between two variables can't automatically be interpreted as suggesting causality between those variables.

Step 8: Hypothesis Support

- The data will either support the hypotheses or they won't.
  - This may lead the researcher to cycle back to an earlier step in the process and begin again with a new hypothesis.
  - This is one of the self-correcting mechanisms associated with the scientific method.

Common Methodologies

- Methodologies are high-level approaches to conducting research.
  - The individual steps within the methodology might vary based on the research being performed.
- The commonly used research methodology (quantitative vs qualitative):
  - Case Study
  - Experiment
  - Survey

Keep In Mind That

- No study is perfect
- "All data is dirty is some way or another; research is what you do with that dirty data" (Manuel)
- Measurement involves making choices

Conclusion

- There are a lot of topics in software engineering research
- Software engineering is shifting from qualitative and empirical understanding to **precise and quantitative** models.
  - The experimentation is desirable for software engineering whenever possible.
- Those methods might be applicable to other fields in Computer Science

THANK YOU!

It is nice to be with you!

You are welcome to contact me at scxu@hotmail.com