Applets, RMI, JDBC
Exam Review

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Announcements

• Quiz today
• Project 2 due tomorrow
• Exam on Thursday

• Web programming
  ➢ CPM and servlets vs JSPs
Division of Labor

Java Classes (Model)  
DataStore

JSP

Java Servlets  
Display results, "light" processing

"heavy lifting", computation

Web App Programming Error

Why do I think this web application is written in Java?
J2SE

• Remember from the first class?

What We Have Done
Applets

- Like servlets, but on the client-side ("application-side")
- Deployed on the web
  - Pulls code down from the server on to your machine
    - Can be slow
  - Can be displayed in an HTML page, embedded in `<applet>` tags
  - Used to provide functions in a web page that require more interactivity or animation than HTML
    - graphical game, complex editing, or interactive data visualization
  - Issues with different web browsers

- Way cool for specific uses
  - Graphics/animation on the web
- Security issues, running someone else’s code on your machine?
  - Run in an “sandbox”
  - Sun’s FAQ: http://java.sun.com/sfaq/
- Example applets online
  - http://www.aharef.info/static/htmlgraph/
  - Do a search for your own!
- Java Web Start - deploy applications
Creating applets

• Create applets by extending
  ➢ java.awt.Applet class or
    • java.swing.JApplet is subclass of java.awt.Applet
  ➢ Subclass of Panel

• Find tutorials online
  ➢ http://java.sun.com/docs/books/tutorial/deployment/applet/

JDBC: Java Database Connectivity

• Database-independent connectivity
  ➢ Connect to database
  ➢ Get information from database
  ➢ Update data in database

• Classes in java.sql.* package

• In Java, two steps
  ➢ Establish a connection with a database
  ➢ Execute queries, statements against database
JDBC: Creating a Connection

- Load the DB driver
  - Classes/library used to connect to the database
    - Specific to the type of database
  - Load the class by name
    - Class.forName("sun.jdbc.odbc.JdbcOdbcDriver");
- Create the connection (see API for all ways)
  - String url = "jdbc:mysql://localhost:3306/masplasDB";
  - Connection con = DriverManager.getConnection(url, loginname, password);
- Need to close connection when done
  - con.close()

JDBC: Executing Queries: Statements

- Statement stmt = con.createStatement();
- executeQuery(String query)
  - Returns a ResultSet
  - Iterate through ResultSet, row-by-row, getting results from each column
  - stmt.executeQuery("SELECT * FROM COFFEES");
- executeUpdate(String query) to update table
  - Returns an integer representing the number of affected rows or 0 for SQL statements that don’t execute anything
JDBC: Prepared Statements

- `prepareStatement(String template)`
  - Compile SQL statement “templates”
- Reuse statement, passing in parameters
  - Java handles formatting of Strings, etc. as parameters
- `updateSales = con.prepareStatement("UPDATE COFFEES SET SALES = ? WHERE COF_NAME LIKE ?");`
  - Set parameters
    - `updateSales.setInt(1, 100);`
    - `updateSales.setString(2, "French Roast");`

JDBC

- API Documentation: `java.sql.*`
  - Statements, Connections, ResultSets, etc. are all `Interfaces`
    - Driver/Library implements interfaces for its database
- Limitations
  - Java doesn’t `compile` the SQL statements
    - Exact syntax depends on DB
    - Compile, run, verify queries outside of Java for your database
    - Then copy and use in Java code
Distributed Programming

- Two primary ways to communicate
  - Message passing (servlets, web services)
  - Remote method calls
    - an object on one computer calls methods of an object on a different computer
    - method call looks like a method call on a local object
    - Remote Method Invocation (RMI)

Java RMI: Remote Method Invocation

- Lookup an object by name
- Object location
- Invoke methods on object “stubs”
- Appears as calling method on local objects
- Naming service
  - Bind object to a name
  - Objects that implement java.rmi.Remote
Why Java RMI?

- Write distributed programs
  - Distributed games
  - Distributed locks to coordinate multiple machines
  - ...
- RMI automates a lot of process
  - Does not require network programming, sockets

Ant

- Java-based build tool
  - Like Java “make” files
  - “without make’s wrinkles”
  - Works cross-platform
- Some IDEs use ant to compile projects
  - NetBeans
Ant

• Configuration files: written in XML
  <project name="DSpace" default="compile">
    ...
    <target name="compile"
      description="Compile the source code">
      <mkdir dir="build/classes"/>
      <javac srcdir="src"
        destdir="build/classes"
        debug="on">
        <include name="**/*.java"/>
        <classpath refid="build.class.path"/>
      </javac>
    </target>
  </project>

• http://ant.apache.org/

Exam Review

• All topics from the semester
  - Know what we did
  - Know how/when to apply/use
• Review quizzes for example questions
  - Probably no fill in the blank questions
    - Know content from those questions
Topics

- Java fundamentals
- OOP
- Javadoc
- Inheritance
- Polymorphism
- Abstract classes
- Interfaces
- Exceptions
- I/O Streams
- Serialization
- Compression
- Cloning
- Collections
- Inner Classes
- GUIs
  - Swing, AWT
  - Components
  - Event Handling
  - Design
- Regular Expressions
- JUnit
- Threads, Synchronization
- Network Programming
- XML
- Web Programming

Using Java

- JDK
- JRE
- Java libraries
- CLASSPATH
Using Java ...

- When to extend a class
- When to implement an interface
- When to use a class

Object-oriented Programming

- Objects and primitives
- Data encapsulation
- Access modifiers
- Mutable/immutable objects
In C++, the following function swaps any two values passed:

```cpp
template<class T>
void swap (T& a, T& b)    {
    T tmp = a;
    a = b;
    b = tmp;
}
```

In Java, the following version of the method has no effect on the two values passed:

```java
public static void swap (Object a, Object b)    {
    Object tmp = a;
    a = b;
    b = tmp;
}
```

Even though all object variables in Java are actually references, explain why the Java version of swap does not work.