Java and C# in Depth
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Exercise Session – Week 10
Overview

Today, pitfalls and surprises w.r.t. persistence

- JDBC
- LINQ
- Serialization (Java and C#)
- OODBMS db4o
Quiz 1: scrolling a ResultSet (JDBC)

How do you assess the following code snippet that iterates through a ResultSet?

```java
ResultSet rs = stmt.executeQuery("SELECT ...");
while(rs.next())
{
    String firstColumnInfo = rs.getString(0);
    String secondColumnInfo = rs.getString(1);
    System.out.println("Fetched info:" + firstColumnInfo + ";" + "secondColumnInfo");
}
...
```
Quiz 1: Solution

An exception is thrown: rows in a ResultSet start from 1

... 

ResultSet rs = stmt.executeQuery("SELECT…");
while(rs.next())
{
    String firstColumnInfo = rs.getString(0);
    String secondColumnInfo = rs.getString(1);
    System.out.println("Fetched info:" + firstColumnInfo + ";" +
                       "secondColumnInfo");
}

...
Quiz 2: What’s the problem here? (JDBC)

```java
public String getPassword(String name) throws ApplicationException{
    try {
        con = //get connection here;
        stmt = con.createStatement();
        rs = stmt.executeQuery("Query here");
        while (rs.next()) { password=rs.getString(1); }
        rs.close(); stmt.close(); con.close();
    } catch (SQLException ex) {
        throw new ApplicationException("Couldn't run query [" + sql + "]", ex);
    }
    return password;
}
```
public String getPassword(String name) throws ApplicationException {
    try {
        //as before, but “con” not local anymore
        rs.close(); stmt.close();
    } catch (SQLException ex) {
        //as before…
    }

    finally {
        try {
            if (con != null) { con.close(); }
        } catch (SQLException ex) {
            throw new ApplicationException("Failed to close connection", ex);
        }
    }

    return password;
}
Quiz 3: What is printed? (LINQ)

List<int> numbers = new List<int>() { 1, 2 };  
IEnumerable<int> sequence =  
    (from n in numbers select n * 10);  
foreach (int n in sequence) Console.Write(n + "|");  
10|20|  
numbers.Add (3);  
foreach (int n in sequence) Console.Write(n + "|");  
10|20|30|  
LINQ queries are evaluated lazily!  
You can "freeze" the result of a query by calling:  
IEnumerable<int> sequence = (from n in numbers select n * 10).ToList();
Quiz 4: What is printed? (LINQ)

```csharp
IEnumerable<char> query = "Not what you might expect!";
foreach (char vowel in "aeiou")
    query = (from c in query where c != vowel select c);
foreach (char c in query) Console.Write(c);

"Not what you might expect!"
```

When the query is executed `vowel` has value `u` (we delete `u` multiple times, 1 in this case)

```csharp
foreach (char vowel in "aeiou") {
    char temp = vowel;
    query = (from c in query where c != temp select c);
}
foreach (char c in query) Console.Write(c);

"Nt wht y mght xpct!"
```
Quiz 5: Serialization (Java)

class Student implements Serializable {
    private String name;
    private int birthYear;
    transient private int age = 19;
    ...
}

Student student = new Student ("B. Meyer", 1950);
ObjectOutputStream out = new ObjectOutputStream(...);
out.writeObject(student);
out.close();

...

ObjectInputStream in = new ObjectInputStream(...); // the same file
student = (Student) in.readObject();
in.close();
System.out.println(student);

Initializers (as well as constructors) are omitted during deserialization
Quiz 5: How to make it work?

class Student implements Serializable {
    private String name;
    private int birthYear;
    transient private int age;
    ...

    // The following method is not necessary in this example
    private void writeObject(ObjectOutputStream out) throws IOException {
        out.defaultWriteObject();
    }

    private void readObject(ObjectInputStream in) throws IOException, ClassNotFoundException {
        in.defaultReadObject(); // Reads previously serialized fields
        calculateAge(); // Calculates age from birthYear and current year and assigns it to the age attribute
    }
}
Quiz 5: Serialization (C#)

```csharp
[Serializable] class Student {
    public string name;
    public int birthYear;
    [NonSerialized] public int age = 19;
}

Student student = new Student() { name = "B. Meyer",
                                   birthYear = 1950, age = 64 };
IFormatter formatter = new BinaryFormatter();
using (FileStream fs = File.Create("my.bin"))
    formatter.Serialize(fs, student);

using (FileStream fs = File.OpenRead("my.bin")) {
    student = (Student)formatter.Deserialize(fs);
    Console.WriteLine(student);
}

B. Meyer 1950 (age 0)
Initializers (as well as constructors) are omitted during deserialization
```
Quiz 5: How to make it work?

[Serializable] class Student {
    public string name;
    public int birthYear;
    [NonSerialized] public int age;

    [OnDeserialized]
    private void ComputeAge(StreamingContext context)
    {
        age = DateTime.Now.Year - birthYear;
    }
}
public class Student {
    public string name;
    public int birthYear;
    [XmlIgnore] public int age = 19;
}

Student student = new Student() { name = "B. Meyer", birthYear = 1950, age = 64 };
XmlSerializer xs = new XmlSerializer(typeof(Student));
using (Stream s = File.Create("my.xml"))
    xs.Serialize(s, student);
using (Stream s = File.OpenRead("my.xml"))
    student = (Student)xs.Deserialize(s);
Console.WriteLine(student);

XML deserialization invokes the default constructor and initializers
Quiz 6: Schema evolution (Java)

Suppose we added a method to class *Student*:

```java
class Student implements Serializable {
    public void subscribe(Course c) { ... }
    ... // The rest as before
}
```

What happens if we try to deserialize a student from a file, created on previous slides?

*InvalidClassException*

If `serialVersionUID` is not defined explicitly, even a small change to the class code leads to incompatibility.
Quiz 7: db4o updates

class StudyTrack {
    private int code;
    private String name;
    ...
}

class Student {
    private StudyTrack track;
    private String name;
    ...
}

ObjectContainer db = Db4o.openFile(...);
StudyTrack se = new StudyTrack (117, “Software Engineering”);
StudyTrack is = new StudyTrack (118, “Information Security”);
db.store(new Student(se, “Sheldon”));
db.store(new Student(is, “Penny”));
db.close();
// see next slide...

Exception handling omitted
Quiz 7: What is printed?

```java
List<Student> result = db.query(new Predicate<Student>() {
    public boolean match(Student s) {
        return s.getName().equals("Sheldon");
    }
});
Student found = result.get(0);
found.getTrack().setCode(666);
db.store(found);

// In another session:
List<Student> result = db.query(... // the same predicate)
Student found = result.get(0);
System.out.println(found.getTrack().getCode());
```

As a default, child objects are updated automatically only until depth 1. To activate the whole object structure would be too expensive.
Db4o.configure().objectClass("Student").cascadeOnUpdate(true); // before opening a db
ObjectContainer db=Db4o.openFile(...);
List<Student> result=db.query(new Predicate<Student>() {
    public boolean match(Student s){
        return s.getName().equals("Sheldon");
    }
});
Student found=result.get(0);
found.getTrack().setCode(666);
db.store(found);

Now the track is updated, regardless of the depth
Quiz 8: db4o transactions

List<Student> result = db.query(new Predicate<Student>() {
    public boolean match(Student s) {
        return s.getName().equals("Sheldon");
    }
});

Student found = result.get(0);
found.prependTitle("Dr."); // prepends title to the name

db.store(found);

... // Oops, she didn't pay the exam fee!
db.rollback();

System.out.println(found.getName());

Dr. Sheldon

"Live" (memory) objects are not rolled back! Call db.ext().refresh to refresh memory explicitly