Debugging pa1, HTTP

Last time: transactions
Using transactions in a database-backed program (pizza3, music3, etc. Also via JPA in pizza2/music2):
• Do DB actions, individually in DAO methods
• Commit or Rollback, in service layer
• Note we can rollback based on data we see, not just DB problems. For example, we figure out the user is not authorized to do something.
• Note that the database doesn't have to be relational to have transactions: mongodb supports transactions. See Transaction support in Mongodb 4.2+. It's more complicated to use, however.
• Cloud notes: AWS Aurora DB uses a special cloud-based storage engine under mysql or PostgresSql, i.e., it's a cloud-based relational DB with transactions (of course).
• An AWS whitepaper emphasize the importance of short transactions or just leaving auto-commit on.

Eclipse Debugging Demo (on Windows 10)
Use pizza1 for debugging demo, since like current project.
Run SystemTest from its source file in Project Explorer: right-click SystemTest.java, select Run As>Java application. This works for any program that can run without arguments.
If you need to specify arguments, set up a "Run Configuration" and use it to launch the app.
1. Break it by changing insertOrder to insertOrderX in PizzaOrderDAO
See red stars in eclipse, but suppose we're not using that...
Need to rebuild to get fresh jar:
mvn clean package
Fails with compilation error:
StudentService can't find insertOrder
Harder case: it compiles but doesn't run...

Project Compiles but Unit test fails
2. Break it by putting "sizeName = null at start of insertOrder
String sizeName = null; // order.getPizzaSize().getSizeName();
No red stars in eclipse, so this compiled
mvn clean package: see compilation, but JUnit test fails, so jar never built
java.sql.SQLException: no such pizza size available
at cs636.pizza.dao.PizzaOrderDAO.insertOrder(PizzaOrderDAO.java:44)
... close to error
at cs636.pizza.dao.PizzaOrderDAOTest.testMakeOrder(PizzaOrderDAOTest.java:47)
... Run Junit tests in eclipse: right-click project, Run As>JUnit test

Failing Unit test: in eclipse
Try it in eclipse: right-click project, Run As>JUnit test
See nice display showing the one test that fails because of the defective insertOrder, and the backtrace as above
Moral: run the JUnit tests before building the jar. Maven does this with "mvn package"
In-music: keep the JUnit tests current by uncommenting parts

Bug in service layer crashes DAO code
3. Break it by putting "order = null" just before call to insertOrder in PizzaOrderDAO
Try JUnit tests, the badMakeOrder test succeeds, because it's testing something else wrong. It should be called badinsertOrder test, because it doesn't use makeOrder, only insertOrder.
But the DeleteToppingTest (of the service layer) fails because it expects a Service Exception but sees a NullPointerException at insertOrder line 42
line 42 String sizeName = order.getPizzaSize().getSizeName();
so order = null here, a clue, but let's build and run the jar and see how that goes.
mvn clean package: see compilation, but JUnit test fails
mvn clean package skips JUnit tests
Run with "runOnH2 SystemTest", see backtrace and NullPointerException reported from line 42 in insertOrder in DAO, same as JUnit test failure
Note that the bug is in StudentService, not in the DAO, but our original clues come from the DAO.
Bug in service layer crashes DAO code
Run SystemTest with debugger in eclipse: right-click SystemTest.java in project explorer, select Debug-as java application
See crash report, same as running with runOnH2, except link to PizzaOrderDAO.java, site of crash (line of code) and its caller, etc:
java.lang.NullPointerException
at cs636.pizza.PizzaOrderDAO.insertOrder(PizzaOrderDAO.java:42)
at cs636.pizza.service.StudentService.makeOrder(StudentService.java:82)
at cs636.pizza.presentation.SystemTest.run(SystemTest.java:98)
at cs636.pizza.presentation.SystemTest.main(SystemTest.java:64)

Web servers used in hw3
• Departmental web server: Apache on www.cs.umb.edu, at port 80
  - URL: http://www.cs.umb.edu/ (same as www.cs.umb.edu/), a class home page
  - The file found by special ~ syntax handling is http://www.cs.umb.edu/~username/test.html for hw3
• Tomcat: run on pe07.cs.umb.edu:9002
  - URL: http://pe07.cs.umb.edu:9002/adminController/adminWelcome.html
  - Tomcat can also run as a shared server, with multiple apps using URLS like pizza3/welcome.html
• Code on Tomcat: run on port 8080 of pe07, with doc root at /var/svid36/tomcat-8/webapps

Using the debugger
Can also step into: run with breakpoint in SystemTest, step into makeOrder, etc.
Note debugger perspective, different from Java perspective, switch back and forth with perspective buttons.
You don't have to live with what is shown in the Debugger perspective:
Example: add Project Explorer view to Debugger display.
Sometimes you see undesired red stars on some source files in Project Explorer. This can be fixed by deleting the project by top-of-window Projects Clean.
Click levels in back trace, see editor windows on various files.
If you forget to clean out a crashed debugging session by using the red square button and double-click on source files in Project Explorer, it can be fixed by doing Maven>Update Project.
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Bug in service layer crashes DAO code: using a breakpoint
Set breakpoint in PizzaOrderDAO: double-click along blue-left-hand edge of editor window at desired line.
Run again with debugger: use little bug icon at top of Debug window.
When breakpoint is reached, whole IDE window format changes over from "Java Perspective" to "Debug Perspective"
See before-crashed state in SystemTest, with back trace in window, editor on PizzaOrderDAO.java showing breakpoint in green highlight.
Click levels in back trace, see editor windows on various files.
Click makeOrder level, see its code, obvious problem user = null, but we'll pretend we don't see it yet.
Set breakpoint in caller, makeOrder, to find the cause.
Run again with debugger, stops in makeOrder, step over button to advance line by line, seeing variable values change.
Finally see user become null, that's the bug.

The pizza3 webapp
In hw3, you explored the pizza3 webapp by firing requests at it, for example, HTTP GETs to
http://pe07.cs.umb.edu:9002/welcome.html showed home page
http://pe07.cs.umb.edu:9002/studentWelcome.html showed student welcome page
http://pe07.cs.umb.edu:9002/adminController/adminWelcome.html

Although these URLs end with .html, they do not access HTML files, but instead are interpreted by a Java servlet running on pe07, and the servlet uses JSP (Java Server Pages) files to generate the responses.
So for example, access to welcome.html ends up executing welcome.jsp. As we will see, a JSP file looks like HTML, with some additional elements.

The pizza3 webapp
We see that this app [pizza3] owns even the top-level URLS—it’s not pizza3/welcome.html, but just welcome.html.
This is because this tomcat web server is serving only one app, not sharing the server with other apps as we would normally see with apache servers.
• It is using Spring Boot, which knows how to run tomcat as an embedded server, i.e., running inside the pizza3 java app.
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