1.00 Lecture 2

Interactive Development Environment: Eclipse

Reading for next time: Big Java: sections 4.1-4.5

What's an IDE?

- **An integrated development environment (IDE) is an environment in which the user performs development tasks:**
  - **Creating and naming files to store a program**
  - **Writing code in Java or another language**
  - **Compiling code (checking syntax but not logical correctness, generating executable program)**
  - **Reviewing and testing the code with the debugger**
  - **And many other tasks: version control, projects, code generation, etc.**
- **Eclipse is a popular Java IDE**
  - **You must use it in 1.00 homework, lecture, and recitation**
  - **People write better software with an IDE**

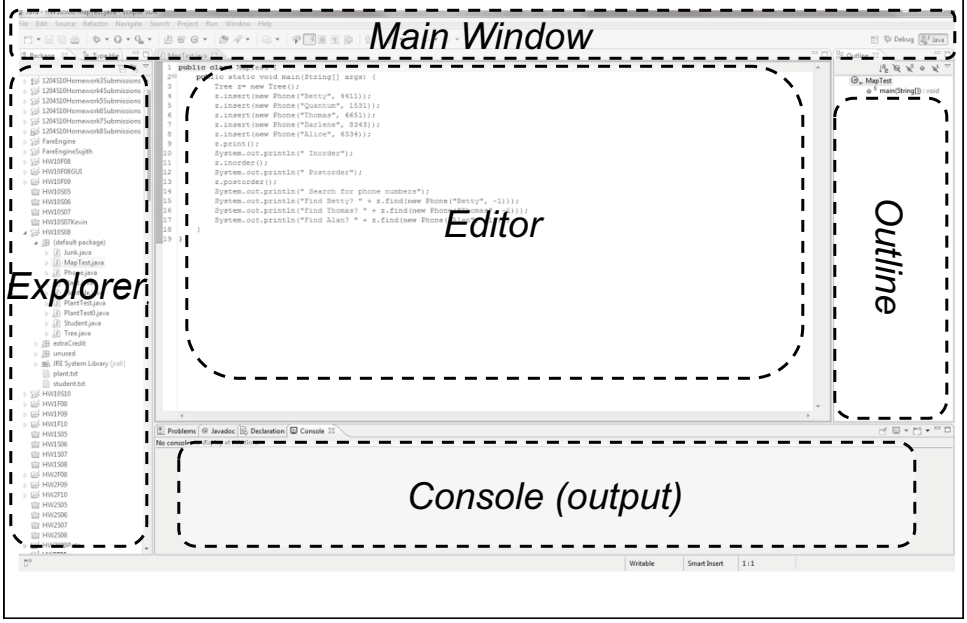
What Does an IDE Do?

- **What does an IDE provide?**
  - **Visual representation of program components**
  - **Ability to browse existing components easily, so you can find ones to reuse**
  - **Quick access to help and documentation to use existing libraries and tools versus writing your own**
  - **Better feedback and error messages when there are errors in your program**
  - **A debugger, which is not primarily used to debug, but is used to read and verify code**
  - **Communication between programmers in a team, who share a common view of the program**
- **Your programs in 1.00 are small, but Eclipse will make life much easier**
  - **In large projects, the benefits are greater still**

Starting Eclipse

- **Start Eclipse by double clicking the icon on your desktop.**
- **Identify all the interface areas labeled on the next slide.**
  - **The Main Window is the command center, holding menus, tabs, and buttons.**
  - **The Explorer allows you to manage files and sets of files (projects) that form programs.**
  - **The working area holds editor, compiler, outline, output or debugger windows as appropriate.**

Anatomy of Eclipse



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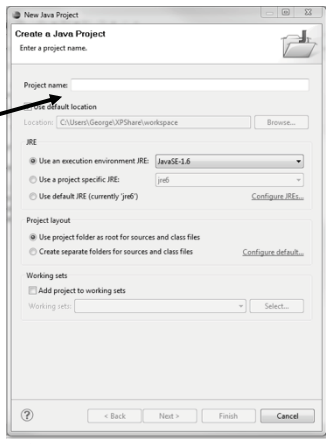
Creating a Project

Choose File-> New-> Java Project

A 'New Java Project' page appears

Project name: Lecture2



Make sure 'Use project folder' is checked
Your project folder will be in folder eclipse/workspace
Hit 'Finish'

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Creating a Class

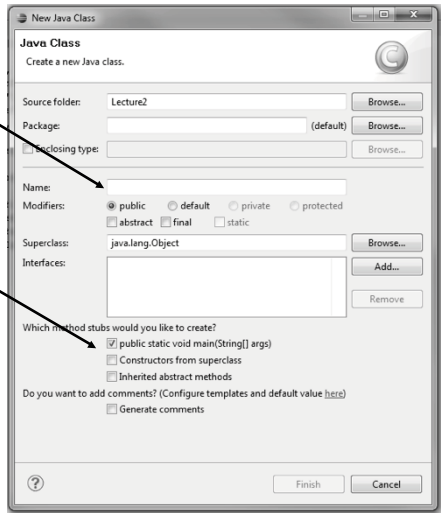
File-> New-> Class (or click 'New' icon)

Type class name: NauticalMile

Make sure 'public static void main…' is checked

Hit 'Finish'

main() is a method



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The `NauticalMile` Program

- **A nautical mile is defined as the average length of a 1 minute arc of latitude on the earth's surface.**
- **The circumference of the earth is 24859.82 statute miles**
- **A statute mile contains 5280 feet**
- **The circumference is 360 degrees, and each degree contains 60 minutes**
- **Calculate the length of a nautical mile in feet as:**

$$nm = \frac{\text{number of feet in circumference}}{\text{number of minutes in circumference}}$$

- **Be careful about data types and division!**
- **Output your answer using System.out.println(…);**

NauticalMile.java

```
public class NauticalMile {
   public static void main( String[] args ) {
    double circum = 24859.82*5280;
    int minutesInCircle = 360*60;  // This is a comment
    double nautMile = circum / minutesInCircle;
    System.out.println(
        "Feet in a nautical mile = " + nautMile);
   }
 }  // Java is case sensitive
```

- Write this Java program using Eclipse
  - Delete the Eclipse-generated comments at top
- Save it (ctrl-S or File->Save); Eclipse will compile it
- If you get any errors, fix them
- After it compiles, make some errors, experiment

Compile Time Errors

- Remove the semicolon from the end of the line that starts with

  `double circum`
- Move the mouse over the wavy line. You should see:

  `Syntax error, insert ";" to complete BlockStatements`
- There is also a red box on the right and a red circle on the left
- Fix the error
- Remove the semicolon from the next line
  - The error message is slightly different

Running `NauticalMile` in Eclipse

- Once you're able to save with no errors, select Run-> Run As-> Java Application
- Or use the green circle icon
- Save changes if prompted (OK)
- Part of working area may change from problem view to console view

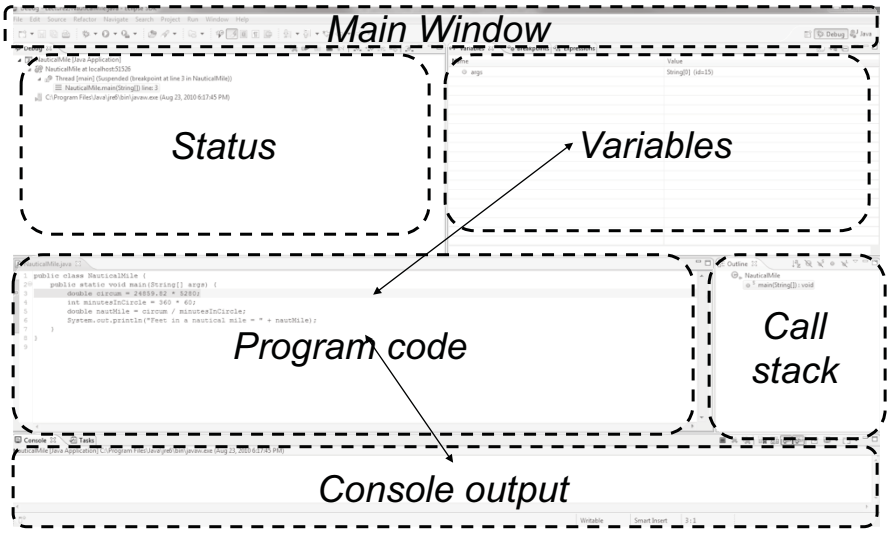
Neat Things About Eclipse

- Key words are highlighted in purple.
  - Strings are highlighted in blue
- Click on a variable to see all occurrences in your file
  - Refactor -> Rename if you want to change its name
- Java classes have 'tool tips' that display info when you place your mouse over them (e.g., System)
- Eclipse will format your file
  - Mess up the alignment of the text lines.
  - Then right click in the editor window and select `Source-> Format` or `Source-> Correct Indentation`.
  - Or use ctrl-A, ctrl-I.
- Get full documentation of Java methods
  - Place cursor on any built-in Java method or class
    - String or System, for example
  - Hit Navigate-> Open Attached Javadoc
- Expand explorer view to see variables, methods

Reading `NauticalMile`

- **Set a breakpoint to stop your program at or near its beginning**
  - **Right click on the left margin of the text editor at the desired line (`double circum= …`)**
  - **Select "Toggle Breakpoint"**
- **Select Run->Debug As -> Java Application**
  - **Or use the toolbar (bug icon) , but be careful what it runs**
- **Eclipse displays the Debug Perspective**
  - **Your program stops at the breakpoint line**

Eclipse Debug Perspective



Stepping Through

- Now step through NauticalMile line by line
  - Use the 'Step Over' icon or hit F6

  - Later we'll use 'Step Into' (F5) and 'Step Return' (F7)
  - We can use 'Resume' (F8) to run to the next breakpoint
  - And we use 'Terminate' to quit the program
- Variable values display in the Variables window

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Stepping Through, 2

- The Step buttons are a functional family unit:
  - Step Into (F5) means stop at every line of code including every step of methods that are invoked.
  - Step Over (F6) means stop at every line of code in the current method but execute method calls in one step.
  - Step Return (F7) means run everything in the current method and stop when the method returns. In other words, run to the end of the method.
  - (All we have is a single main() method right now, but we'll have a lot more soon.)
- Click Step Over

Examining Variable Values

- In the top right frame of the Debugging View, you'll see the variables
- Click Step Over once more to advance another line.
  - You should see that you just defined another variable, `minutesInCircle`.
- Set another breakpoint at the last line (`System.out…`)
- Click the Resume button

- The program stops at the last line.
- Click Resume or Step Over
  - The program output appears, and the program exits.

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Breakpoints

- What if you are trying to figure out what is wrong with a homework program that's about 100 lines long?
  - Set a breakpoint at the beginning.
  - Run->Debug As->Java Application
  - Step Over line by line looking at variable values until you find an error
  - Go back to Java Perspective, fix the error, save the file
    - Don't fix it in Java Debug Perspective—less confusion
  - Set a breakpoint at the line you fixed
  - Run->Debug As-> Java Application (or toolbar icon)
  - The program will run to the line you fixed
  - Resume using Step Over from there
- You can right click and select 'Toggle Breakpoint' to get rid of unneeded ones

Exiting the Debugger

- Sometimes you want to exit the debugger without allowing your program to run to completion.
- Just click the Terminate button (red square) near the Resume button
- Occasionally you need to clean up the Status (Debug) window in the upper left frame
  - Right click in the Debug Window
  - Select Remove All Terminated
  - If something is still there, right click on it
  - Select Terminate and Remove

Managing Files in a Project

- Adding files:
  - Same as the first one: File->New Class and so on.
- Copying files:
  - Ctrl-C, Ctrl-V and give new name
- Deleting files:
  - Right click on file and delete
- Moving files:
  - Drag and drop
- Downloading files
  - Navigate to zip file, download to directory on laptop
  - Unzip the file in Download or 100 folder
  - Drag and drop the .java files into Eclipse browser
- Uploading files
  - Zip the .java files in the workspace folder, not .class files
  - Upload files. (Practice today, doesn't count.)

Exercise

- A bicyclist goes up a hill at 30 km/hr and comes down the same hill at 90 km/hr.
- Find and output the cyclist's average speed for this trip
  - It is not 60 km/hr
- Also find and output the average speed if the bicyclist goes up at 20 km/hr and comes down at 100 km/hr
- Before writing any code, make sure you understand the problem and can write the equation needed for the solution
- To use double values rather than int values, as this program requires, write all values as 1.0, 30.0, etc. rather than 1, 3, etc.
- File -> New-> Class -> Bicycle
- Write your code in the main() method
- Include comments that document your logic
- Save/compile and run your code. Step with the debugger.

1.00 / 1.001 / 1.002 Introduction to Computers and Engineering Problem Solving
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