Useless Fact of the Day

• The longest foot race in the world is 3,100 miles (more than the distance from New York to Los Angeles) -- the 10th Annual Self-Transcendence 3,100 Mile Race

• Runners circle one city block in Queens, NY, for 51 days straight, lapping the block over 5,000 times

• 60 miles per day; 6,000 calories per day

• The winner gets a T-shirt and a plastic trophy

What is Debugging?

• “Debugging is twice as hard as writing the code in the first place. Therefore, if you write the code as cleverly as possible, you are, by definition, not smart enough to debug it.” – Brian W. Kernighan

• Solving runtime errors

• Also known as “bugs”

• These are errors that allow your program to compile and run, but show up when you’re testing it

• Not normally solving complication errors -- errors that keep the code from compiling (the red squiggly line errors in Eclipse)
How to Debug

1. Be able to recreate the bug (this can often be rather hard!)
   • This will give you insight into exactly what the program is doing when the bug happens
2. Try to identify the last place the code reaches during correct execution
3. Anticipate what should happen next, and compare this to what actually happens next
4. Determine out exactly where in the code the bug is, and why it happens -- then, fix it!

Breakpoints

• Double-clicking on the thin left bar in Eclipse creates a breakpoint at that point in the code execution

```java
int r, s;
Area grid = new Area();
for (r = 0; r < getSectors(); r++)
{
    for (s = 0; s < getRings(); s++)
    {

```

• Clicking the “bug” icon in the toolbar will run the program, but stop at the first breakpoint

The Console

• Often, runtime errors appear in the console as red text
• Normally, clicking the topmost link to a file you recognize (LunarLander.java, for example) will take you to where the error is in your code
• Examples of common errors:
  • ArrayIndexOutOfBoundsException
    • Occurs when you try to index an array with a negative number or a number >= the size of the array (example: blocks[-3])
  • NullPointerException
  • Occurs when you try to use an object (using the dot operator) without having first created that object with a new statement
Debugging Classwork

- 1. Snarf the project “04_buggy”
- 2. Guided practice on PolarGrid.java
- 3. Solo/partner practice on RectangularGrid.java