**Debugging**

# Basic Strategy:

1. Observe a failure
2. Invent a hypothesis
3. Make predictions
4. Test the predictions using experiments and observations
   1. Correct? Refine the hypothesis
   2. Wrong? Try again with a new hypothesis
5. Repeat steps 3 and 4 as needed

# Debugging Tactics:

* Code Review
* Code instrumentation (print out)
* Single-step execution
* Take a break

# Tactics for Bug Localization:

* Supply different inputs;
* Instrument the program;
* Run the program
* Set breakpoints
* Examine internal state

# Bug Types:

* basic bug (behaves predictably, uncommon)
* Heisenberg’s bug
  + Race Conditions
    - 2 things run in parallel
  + Memory Errors
    - Reading an uninitialized variable
  + Optimization

- Hardware bug