Testing (II)
Admin

- Mid-term
- Project milestone 2
- Project milestone 3.A
Testing coverage

- Statement coverage
- Branch coverage
- Condition coverage
- Path coverage

- Other
  - Data flow coverage
  - Mutation coverage
How to compute coverage (automatically)?

- You can instrument the program, and add counters here and there ...
Coverage measurement tool

- gcov
What is a “good” test set?

• Achieve good coverage
• Little redundancy
How to design good test set manually?

• White-box testing
  • Obtain the list of test properties to cover
  • Cover at least one new property at a time
  • Cover all properties that can be covered
    • Some properties may be infeasible to cover
Cyclomatic complexity & basis path set testing

• Cyclomatic complexity
  • Based on program flow graph
    • Calculated by E-N+2
  • Represents # of (linearly) independent paths in a graph
    • If one path covers at least one edge/node not covered by existing paths, it is independent
  • Upper bound of branch coverage

• Basis path set testing
How to automatically generate test set?

• To be covered later, if we have time

• For C programs, non-structural inputs

• For structural inputs

• For even more structural inputs (how to test a compiler?)
How to conduct black box testing?
How to conduct black box testing?

• Equivalence class
  • Divide the input spaces into several equivalence classes; test at least one input in each class

• Boundary cases
  • If the expected input is a range of value, ...
  • If ..... is a set of value, ...
  • If ..... is a string, ...

• Common bug patterns

• Fuzz testing
Integration testing

• Use special values as function parameters
Can testing prove bug free?

• No!

• What is the implication of 100% path coverage?
Non-functional testing

- Performance testing
- Security testing
- ...

Misc.

• To cover later, if we have time
• ...
• Why we need testing (Ariane 5 story)?
• How to save regression testing effort?
• Can we test only part of the program?
• Research topics on testing