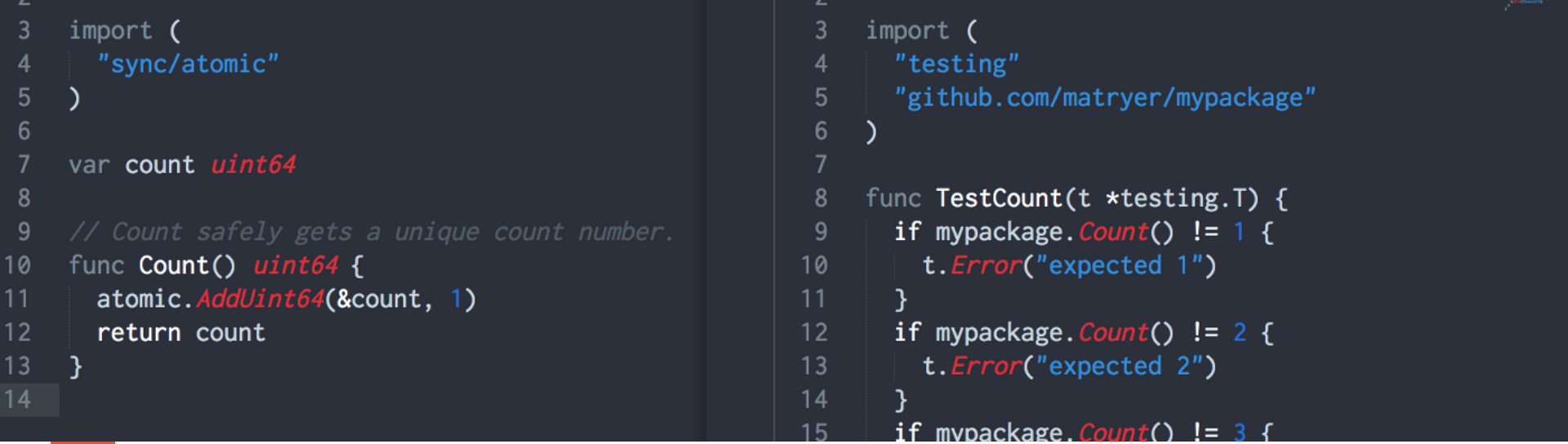

Software Testing for Continuous Delivery

Seminar 6.5: Specification-based Testing (theory) - CON'T

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Content adapted from “Developer Testing” by Alexander Tarlinder 1st Edition (2016)
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Specification-based Testing

- Okay, I know how to write a unit test, but what should I test?
- How many tests should I write?
- Have I thoroughly tested this unit? How can I show this?
- How can a developer think like a tester (practically vs. theoretically)?

Writing Tests

- **Order of Tests**
  1. **Degenerate case**—Start with a test that operates on an "empty" value like zero, null, the empty string, or the like.
  2. **Happy path tests**—lay the foundation for the implementation while remaining focused on the core functionality
  3. **Provide new information or knowledge**—Try approaching the solution from different angles and exercising different parts
  4. **Error handling and negative tests**—These tests are crucial to correctness - in many cases, they can safely be written last.

- **Red to Green Strategies**
  - **Faking**—This is the simplest way to make a test pass. Just return or do whatever the particular test expects. If the test expects a specific value, then just hand it over
  - **The obvious implementation**—Sometimes beating about the bush just isn't worth it. If we know what to type, then we should type it.
  - **Triangulation** - Some algorithms can be teased out by providing a number of examples and then generalizing

RECAP

Equivalence Partitioning

- Concept from partition-based testing - basic ideas:
  - Members in equivalence class are treated as **“equivalent”**
  - Defining meaningful partitions — sampling from partitioned subsets for different types of partitions
  - Coverage of partitions: uniform
- Ex: Integer-based calculator - all integers are in the same equivalence partition or ***equivalence class***, are subsets of data in which all values are equivalent to each other

Testing for Partition Coverage

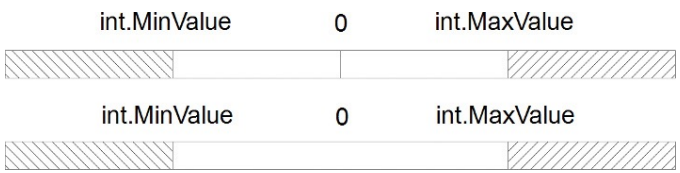
Sensitize test cases

- i.e., defining specific input variables and associated values to exercise certain parts of the program in the white-box view or to perform certain functions in the black-box view
- e.g., function `add(int a, int b)`
- considering valid/invalid input values of *a* and *b*
- How many cases are in exhaustive test?

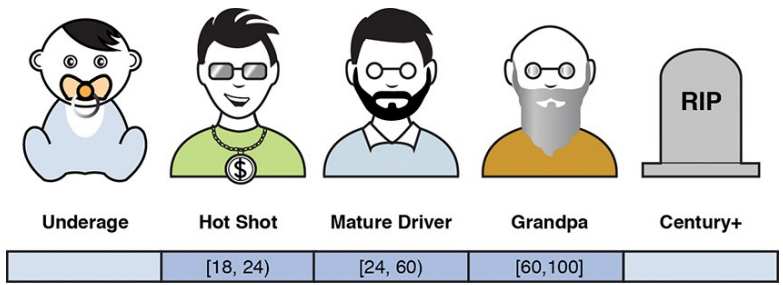
Test Case	Condition		Input	
	int a	***int b***	***a***	***b***
1	False	False	3.2	-0.4
2	False	True	"MSU"	2
3	True	False	7	3/4
4	True	True	-9	-2

Domain Equivalence

- A **developer** would know the **range** of a data type and base the partitioning on that…
- Whereas the **tester** would probably think more about the **domain** and partition from that viewpoint. This could lead to different partitioning
- Near endless possibilities, and it's the **specification** and **test scenario** that should guide the choice of relevant equivalence partitions




```
public double getPremiumFactor(int age) {
   if (age >= 18 && age < 24) {
      return 1.75;
   } else if (age >= 24 && age < 60) {
      return 1;
   } else if (age >= 60) {
      return 1.35;
   }
}
```



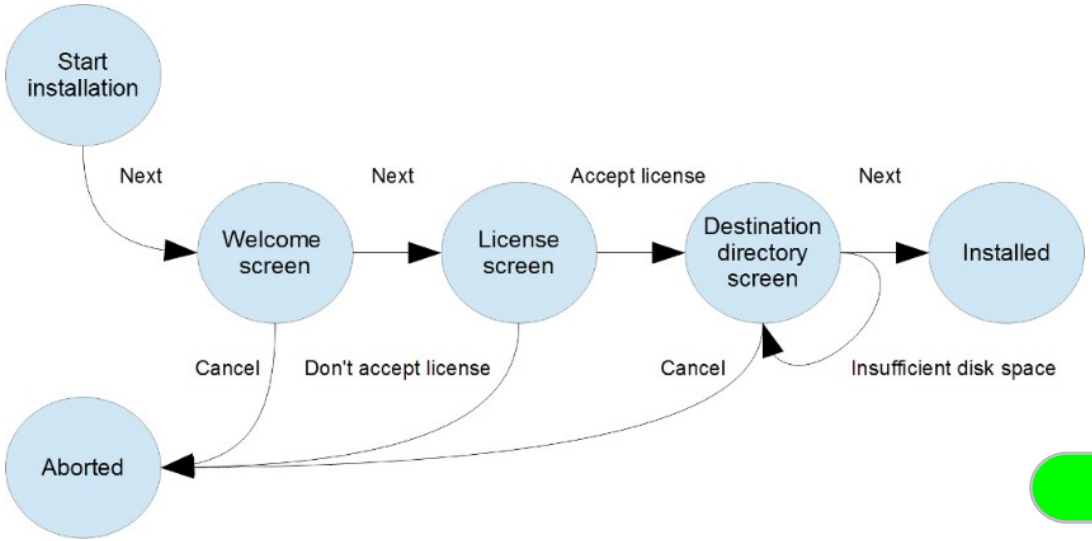
RECAP

Boundary Value Analysis

- ***Values that occur at the boundary of an equivalence partition***
- If no equivalence partitions have been identified, think of boundary values as occurring at the edges of **the domain of *allowed* input**
  - often called **edge cases**
- **Derived**: from the spec; the size of a data type; and/or common sense
- Developers have both access to a **specification** and **knowledge** about the **ranges of the data types** they are using.
  - no excuses for not checking potential edge cases

State Transition Testing

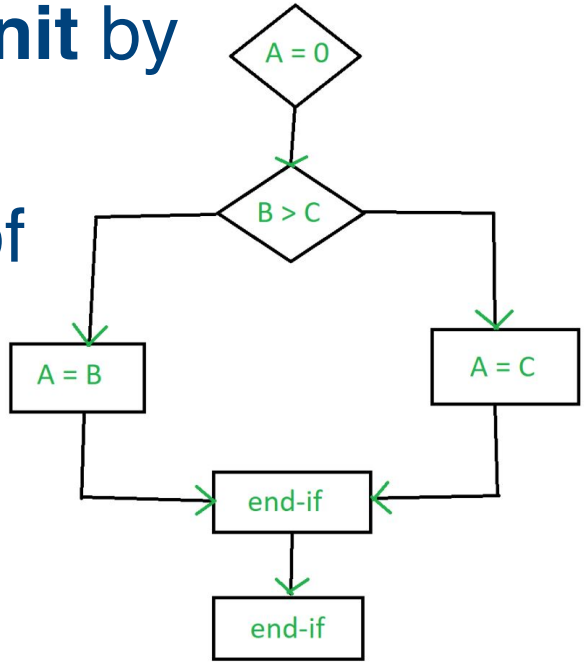
- Certain applications or components of a system can be modeled as state machines (e.g., installation wizards, page navigation, control systems, etc)



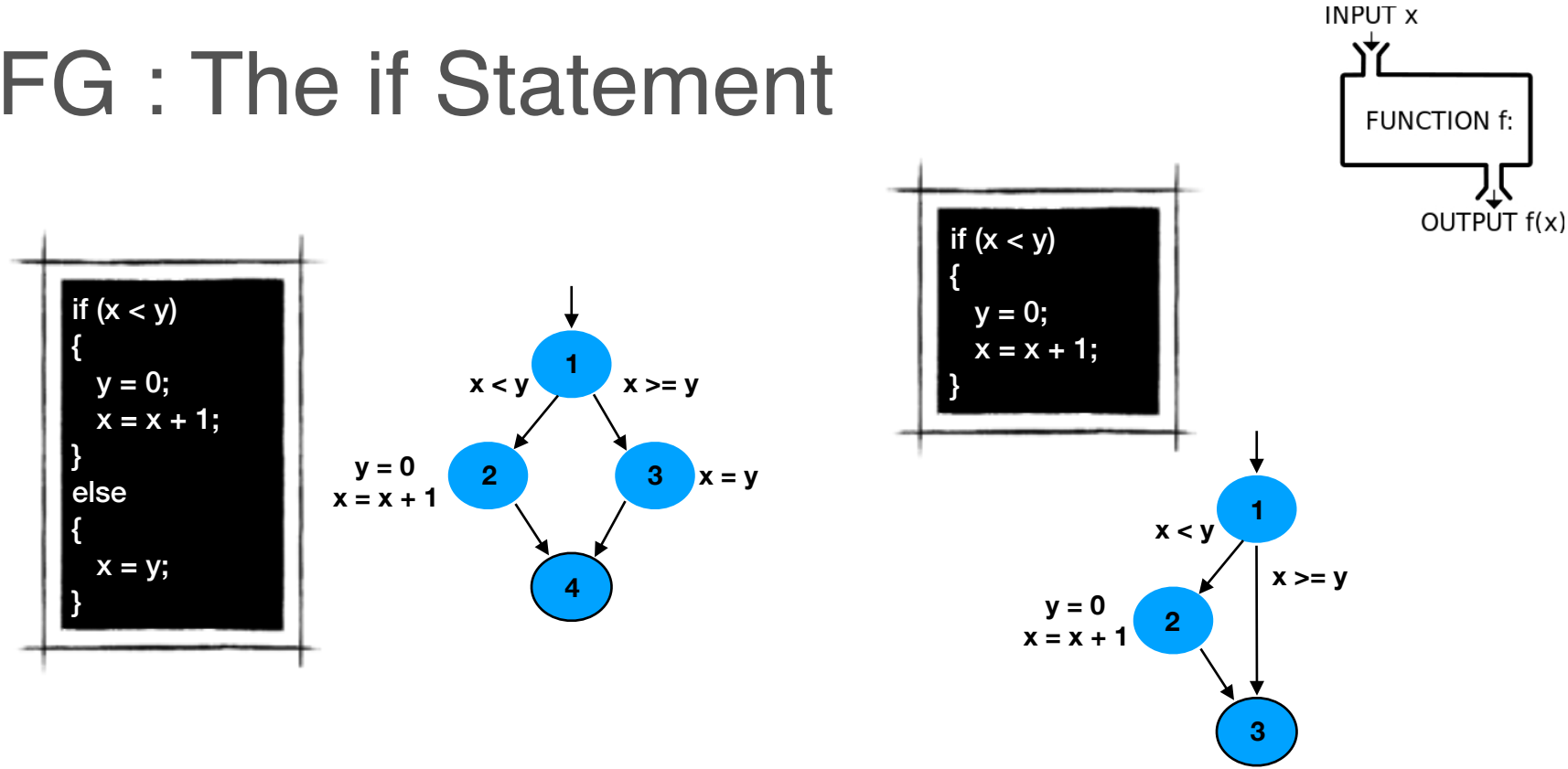
State diagrams can be drawn at **different levels of abstraction.** That's probably the greatest strength of this technique.

Control Flow Graphs / Testing

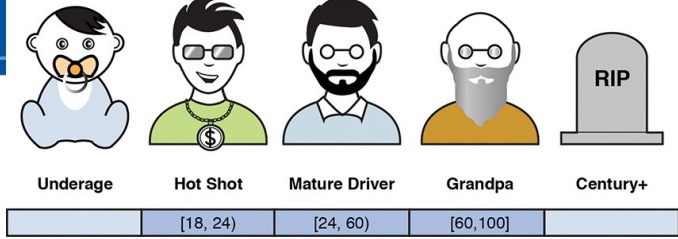
- A CFG models all executions of a **unit** by describing **control structures**
- Nodes : Statements or sequences of statements (basic blocks)
- Edges : Transfers of control



CFG : The if Statement



Decision Tables



- Premium is also affected by the driver's gender — statistics show women to be safer drivers
- Can indicate ***business rules*** using decision tables:
  - capture all combinations of variables and possible outcomes
- Often inputs to automated acceptance testing tools (e.g., FitNesse, Concordion, or Cucumber) for parameterized tests

Age	18–23	18–23	24–59	24–59	60+	60+
Gender	Male	Female	Male	Female	Male	Female
Premium factor 1	N	N	N	Y	N	N
Premium factor 1.05	N	N	Y	N	N	N
Premium factor 1.25	N	N	N	N	N	Y
Premium factor 1.35	N	N	N	N	Y	N
Premium factor 1.65	N	Y	N	N	N	N
Premium factor 1.75	Y	N	N	N	N	N
Fraud investigation	N	N	Y	Y	Y	N

Age	18–23	18–23	24–59	24–59	60+	60+
Gender	Male	Female	Male	Female	Male	Female
Premium factor	1.75	1.65	1.05	1	1.35	1.25
Fraud investigation	N	N	Y	Y	Y	N