

Announcements

- More examples of blackbox testing using TSLGenerator linked on the class website
- Project 1 code grade released
- Project 2 rubric uploaded on class website

CS3300 Introduction to Software Engineering

Lecture 17: Black-Box Testing

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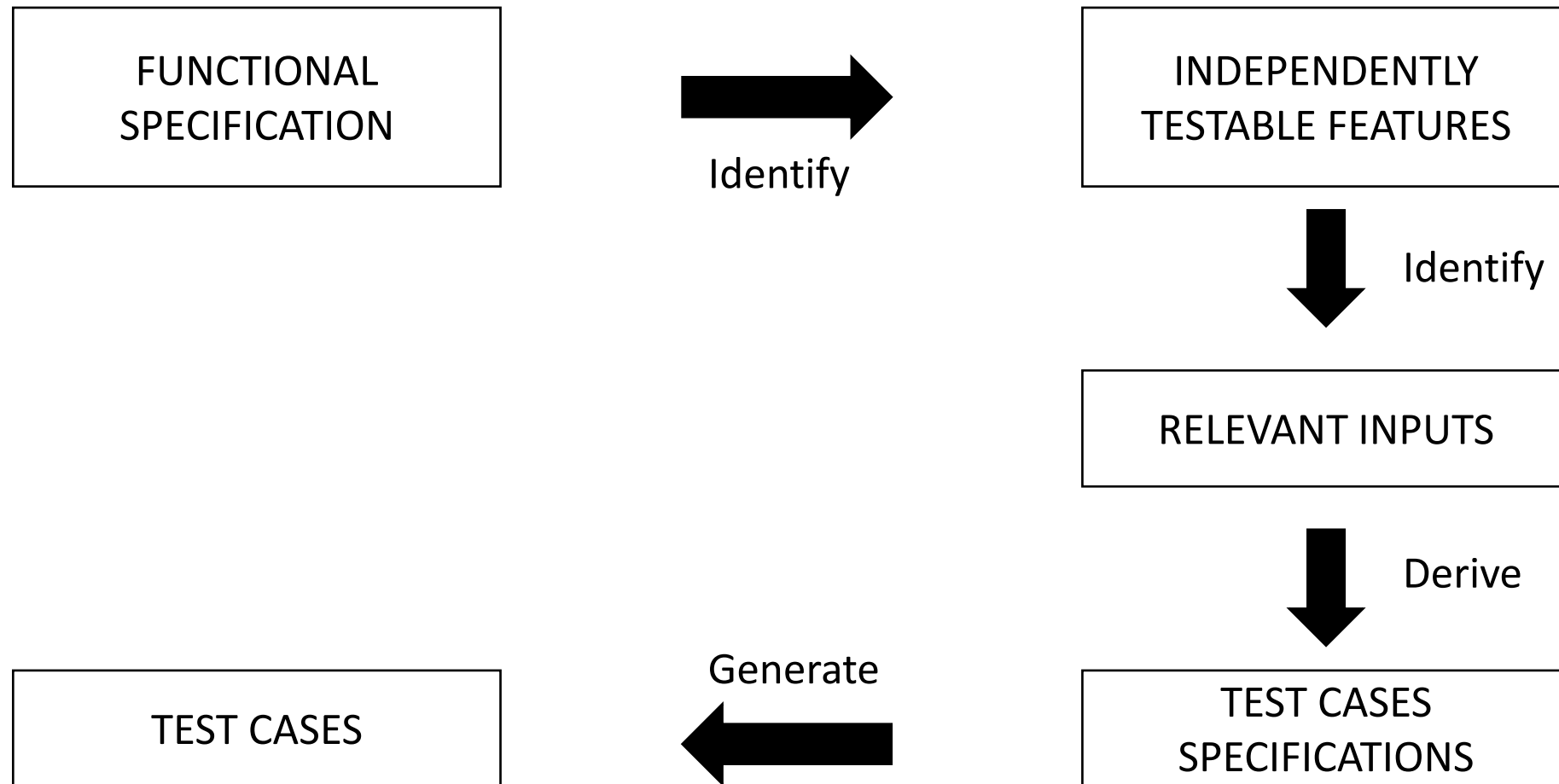
Black- Box Testing



Advantages

- Focus on the domain
- No need for the code
 - Early test design
 - Prevents the highly occurring scenario of no-time-for-testing
- Catches logic defects
- Applicable at all granularity levels

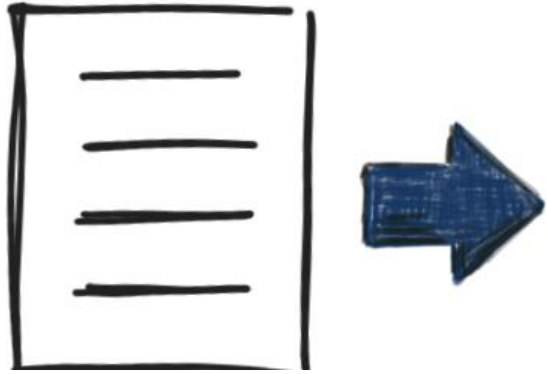
A systematic Functional-Testing Approach



Decoupling; Automated Sub-tasks; Monitor testing process

A systematic Functional-Testing Approach

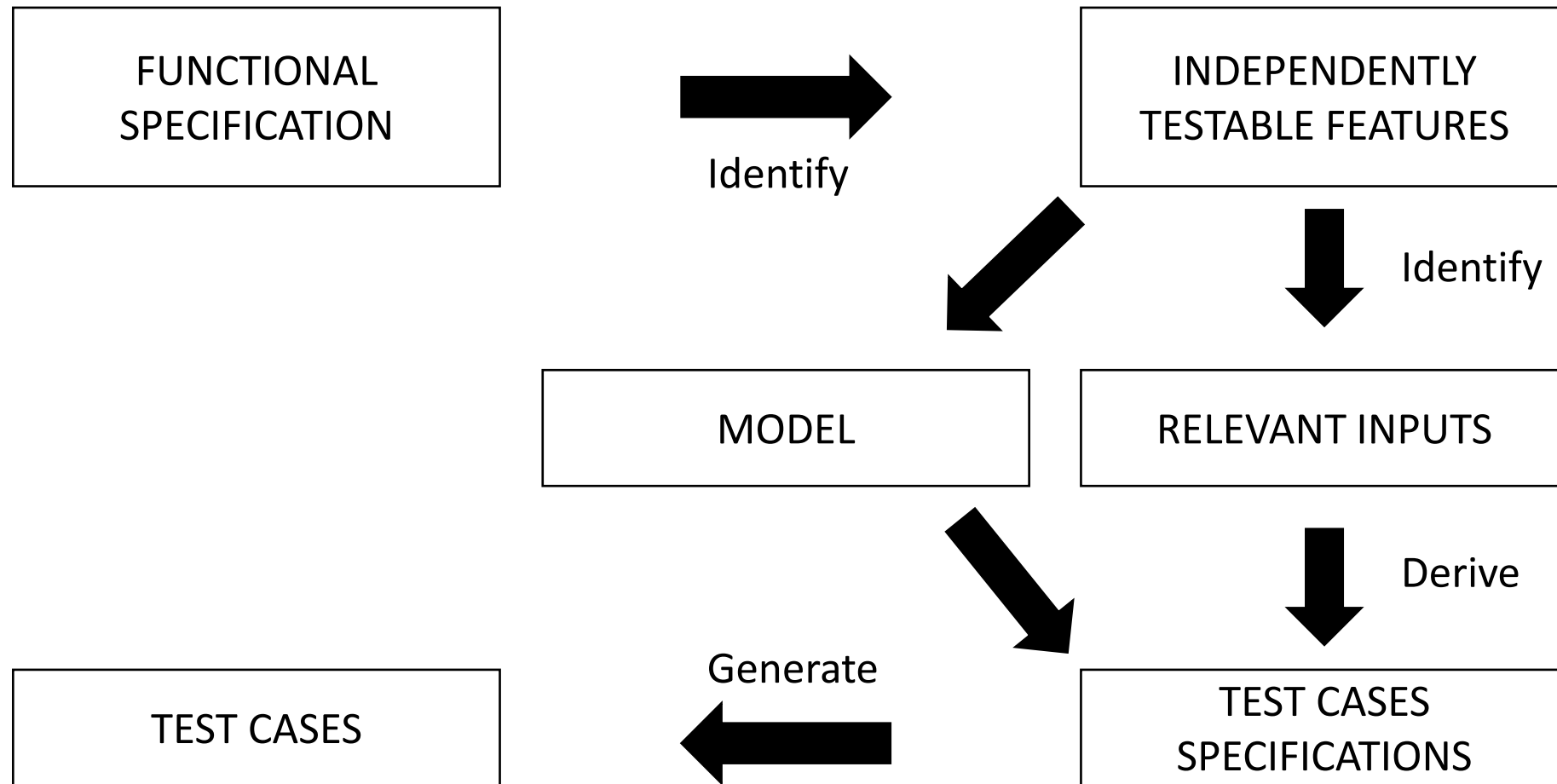
The Category-Partition Method



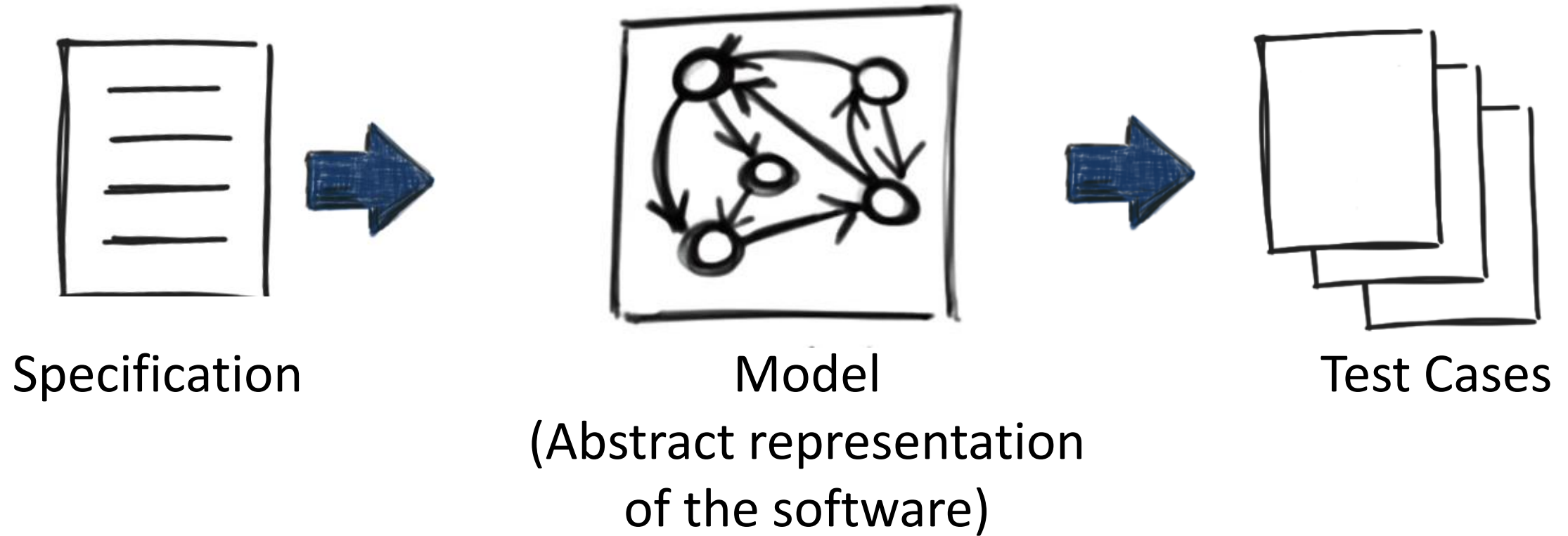
Functional
Specification

1. Identify independently testable features
2. Identify Categories (characteristic features of input)
3. Partition Categories into choices (interesting values – boundary values)
4. Identify constraints among choices (PROPERTY---- IF, ERROR, SINGLE)
5. Produce/Evaluate test case specifications (Produce test frames, can be automated using TSLGenerator)
6. Generate test cases from test case specifications (by instantiating)

Model-Based Testing

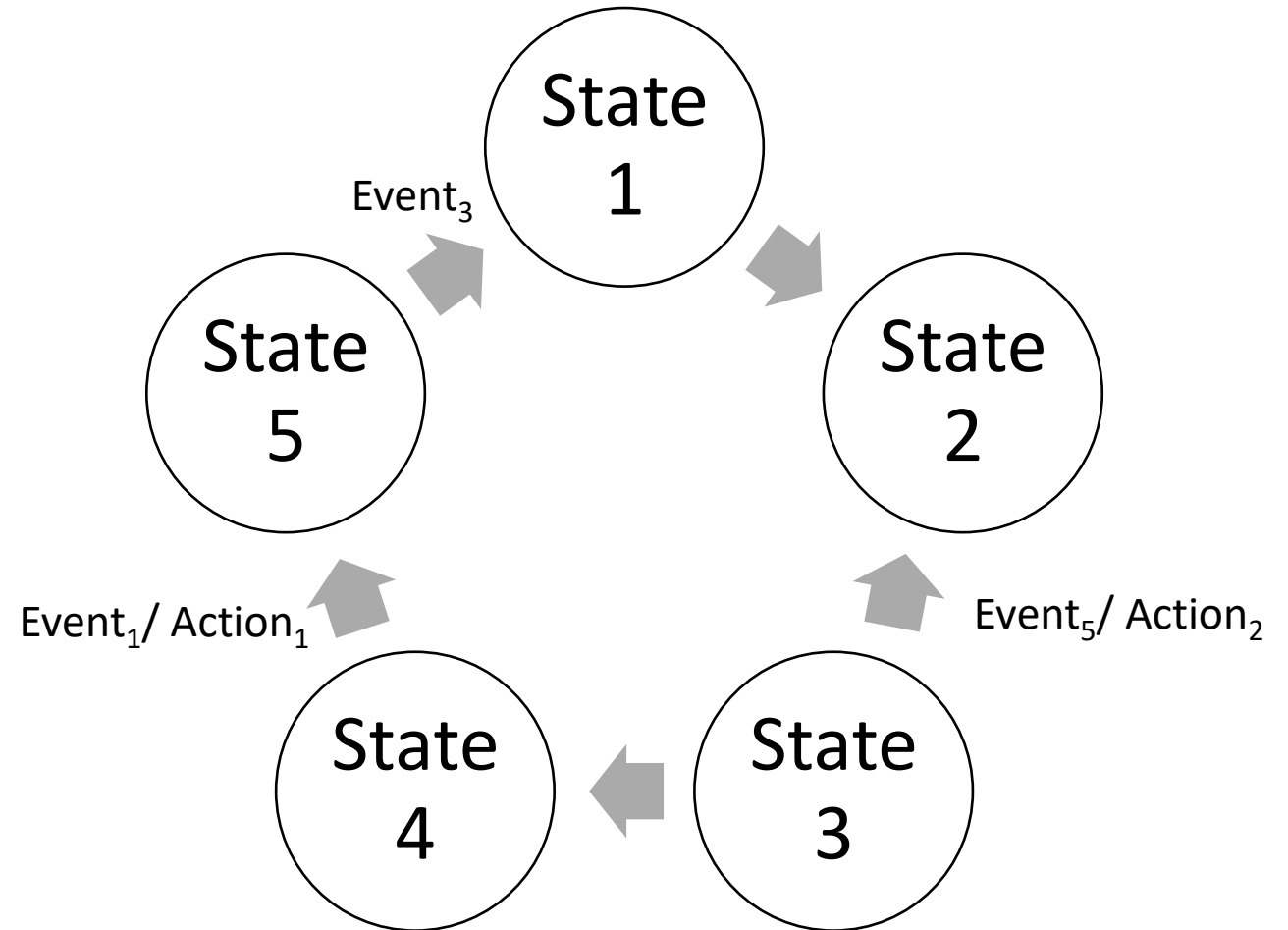


Model-Based Testing



Finite State Machines (FSM)

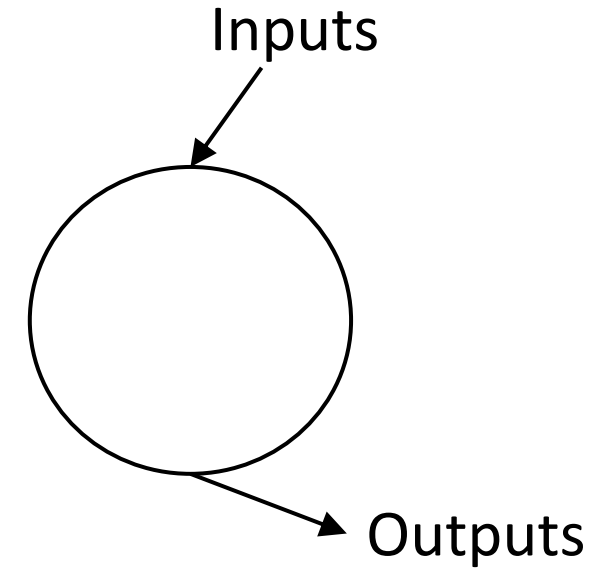
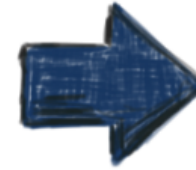
Nodes = States
Edges = Transitions
Edge Labels =
Events/Actions



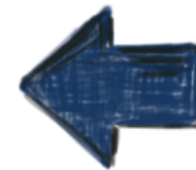
Building an FSM



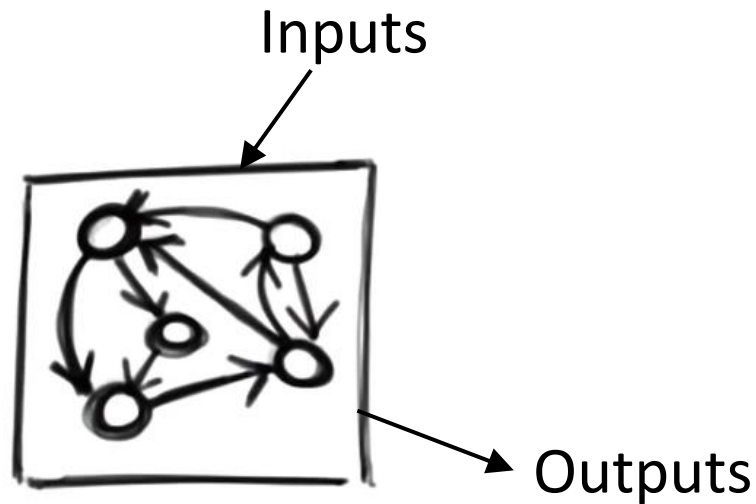
Identify System's Boundaries, and Input and Output



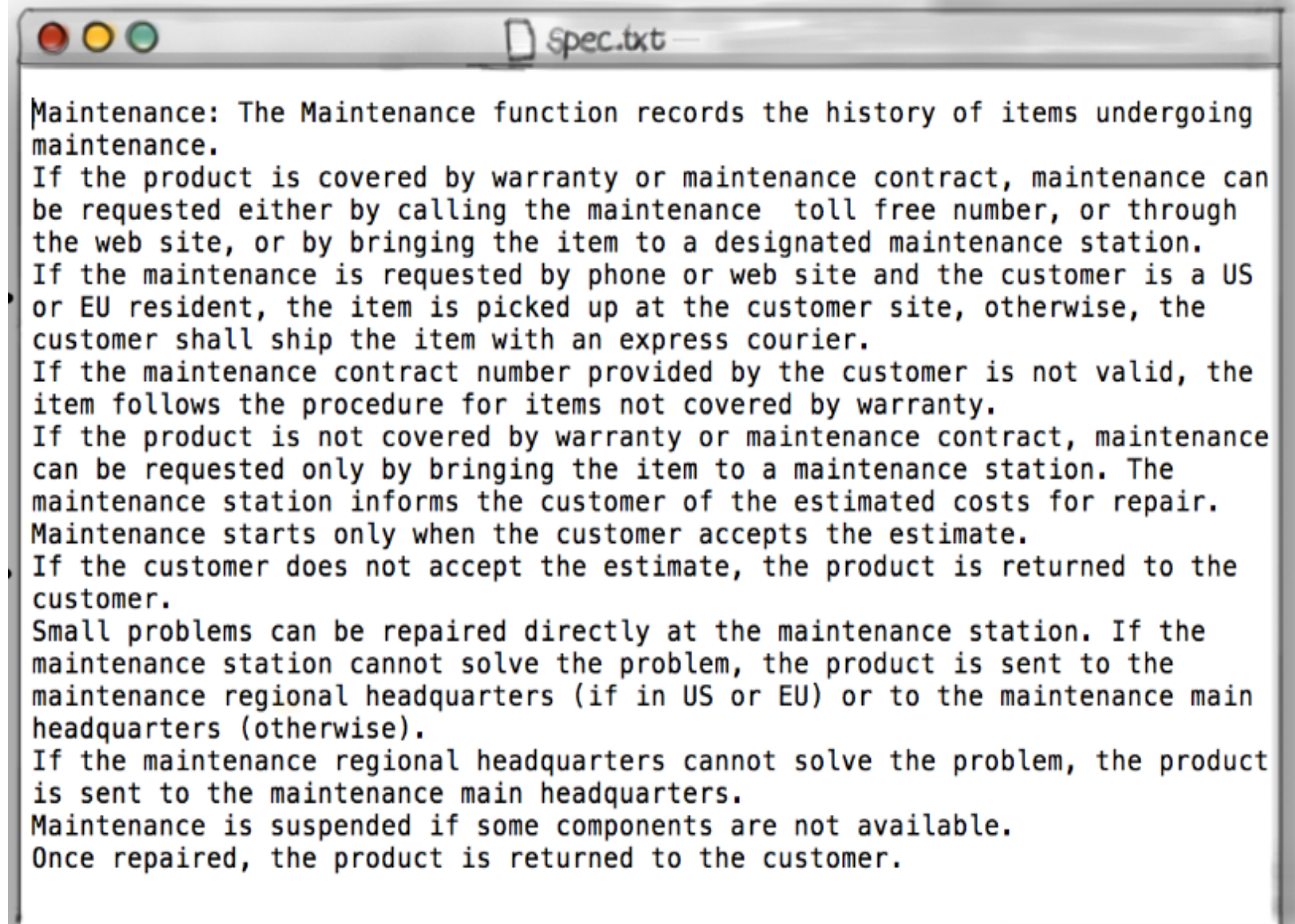
Identify relevant states and transitions



Specification



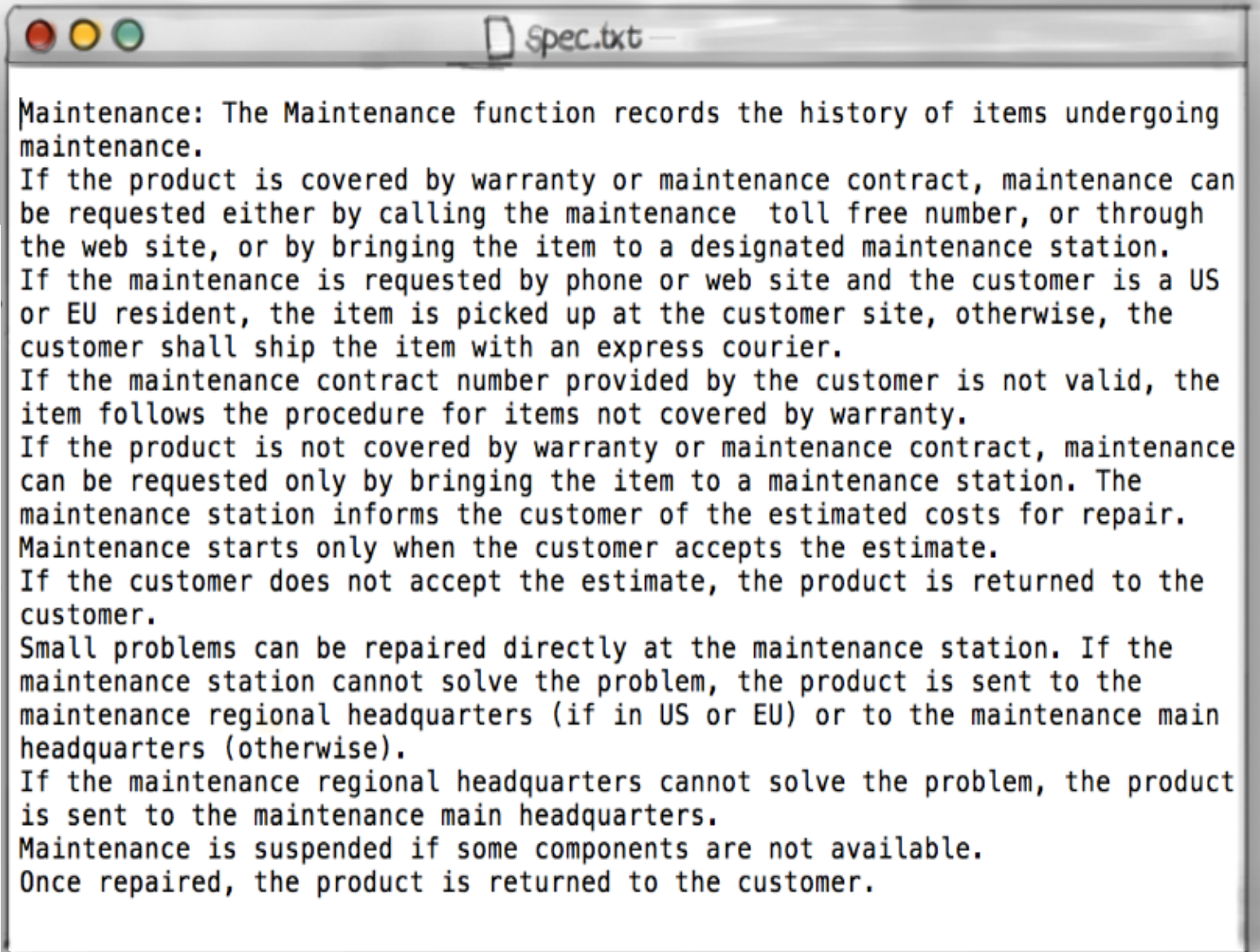
From an Informal Specification...



```
Maintenance: The Maintenance function records the history of items undergoing maintenance.
If the product is covered by warranty or maintenance contract, maintenance can be requested either by calling the maintenance toll free number, or through the web site, or by bringing the item to a designated maintenance station.
If the maintenance is requested by phone or web site and the customer is a US or EU resident, the item is picked up at the customer site, otherwise, the customer shall ship the item with an express courier.
If the maintenance contract number provided by the customer is not valid, the item follows the procedure for items not covered by warranty.
If the product is not covered by warranty or maintenance contract, maintenance can be requested only by bringing the item to a maintenance station. The maintenance station informs the customer of the estimated costs for repair. Maintenance starts only when the customer accepts the estimate.
If the customer does not accept the estimate, the product is returned to the customer.
Small problems can be repaired directly at the maintenance station. If the maintenance station cannot solve the problem, the product is sent to the maintenance regional headquarters (if in US or EU) or to the maintenance main headquarters (otherwise).
If the maintenance regional headquarters cannot solve the problem, the product is sent to the maintenance main headquarters.
Maintenance is suspended if some components are not available.
Once repaired, the product is returned to the customer.
```

From an Informal Specification...

Multiple
choices here →



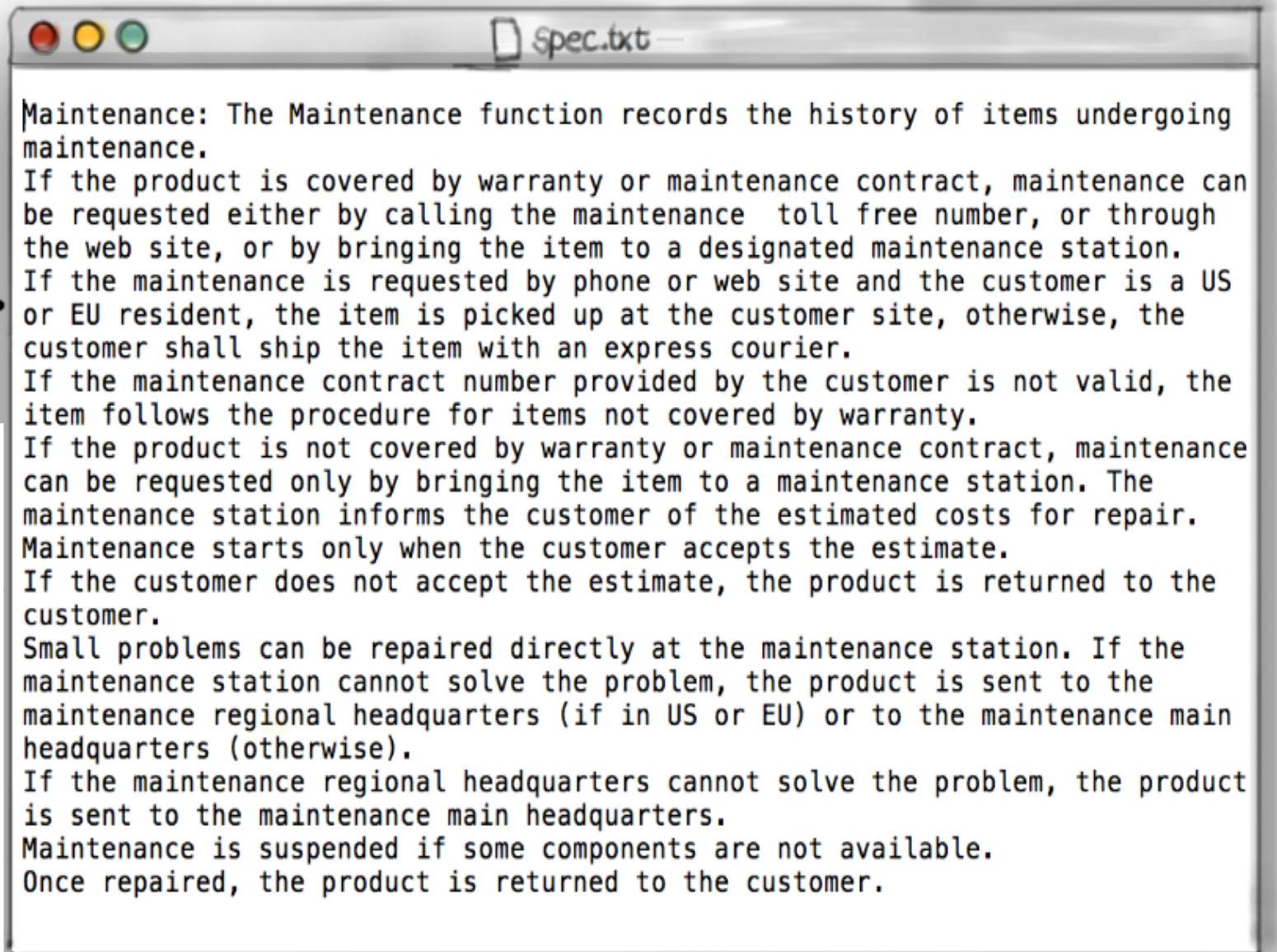
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Spec.txt

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From an Informal Specification...

Multiple choices here

Determine the next step



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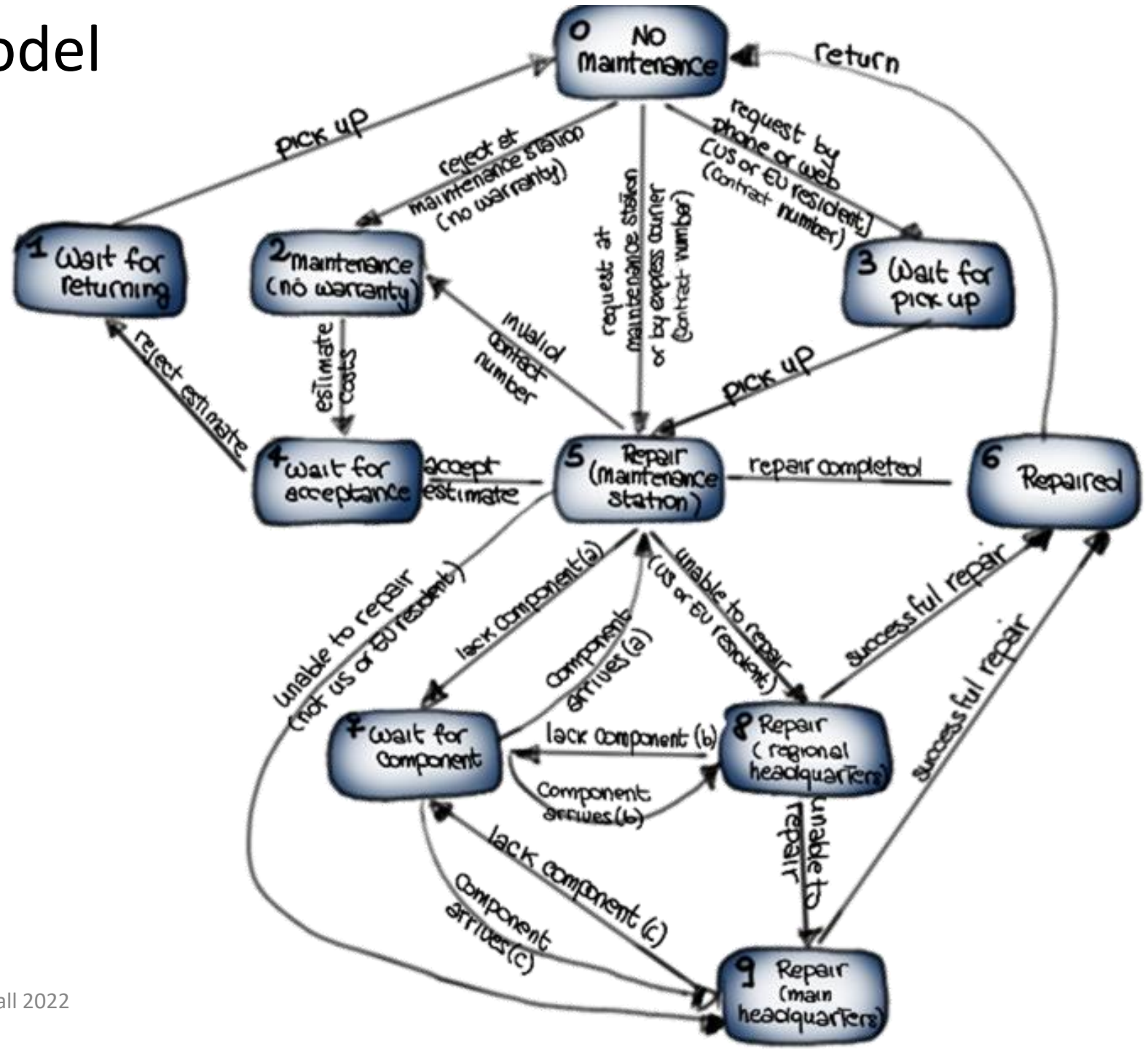


and so on

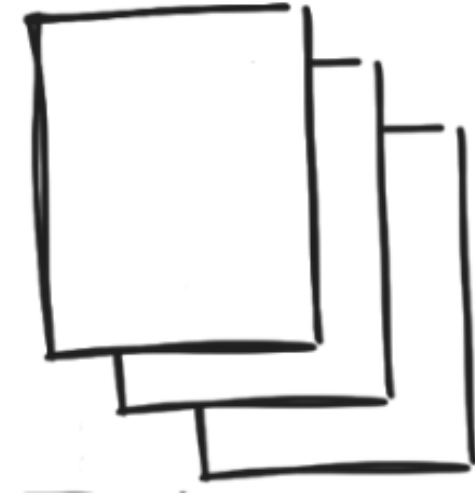


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... To a Finite State Model



Finite State Model to a Set of Test Cases

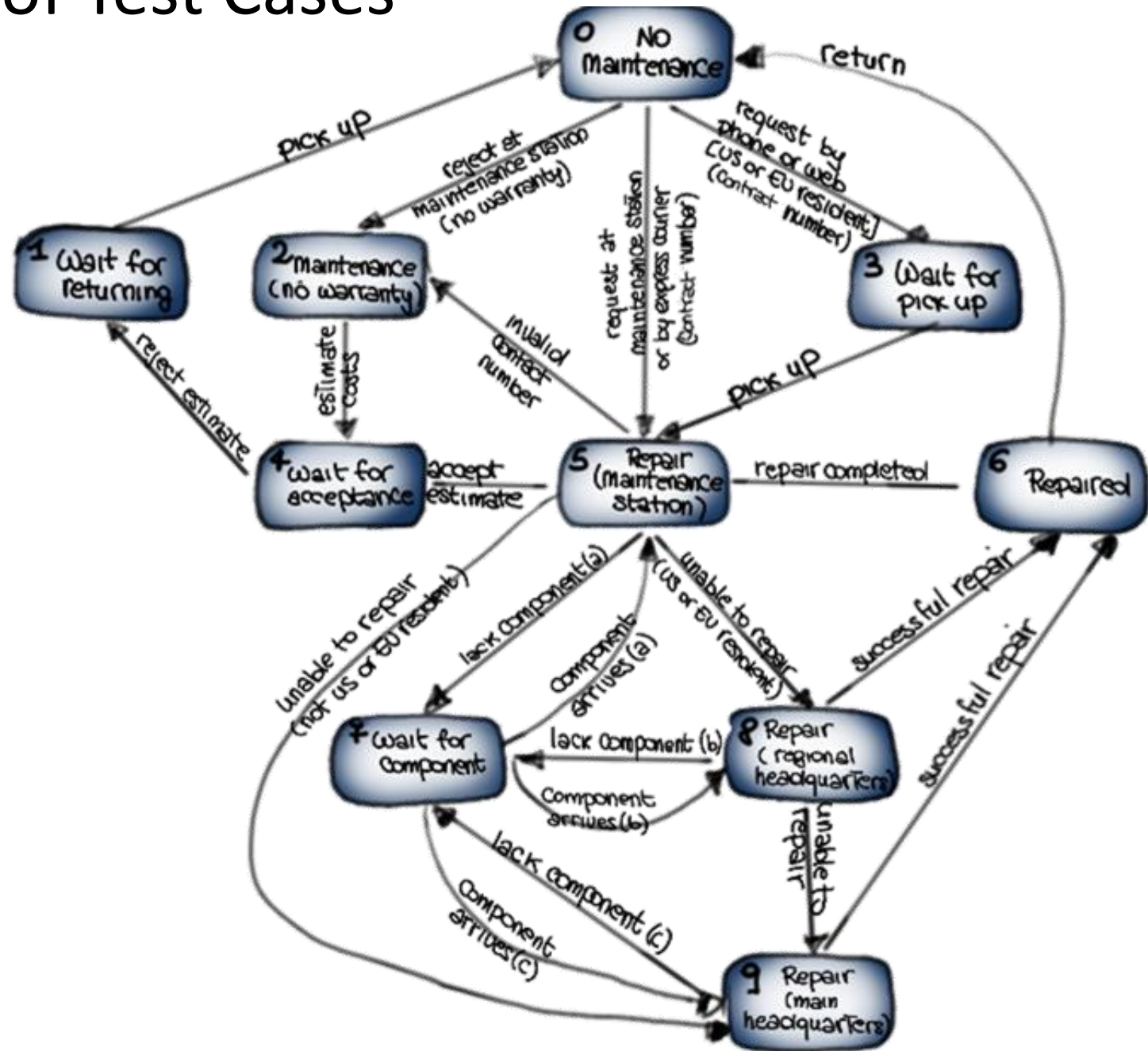


Test Cases

Finite State Model to a Set of Test Cases

Cover the behaviors represented by the state machine.

- Cover all the states
- Or Identify paths in state machine that go through all states in the machine

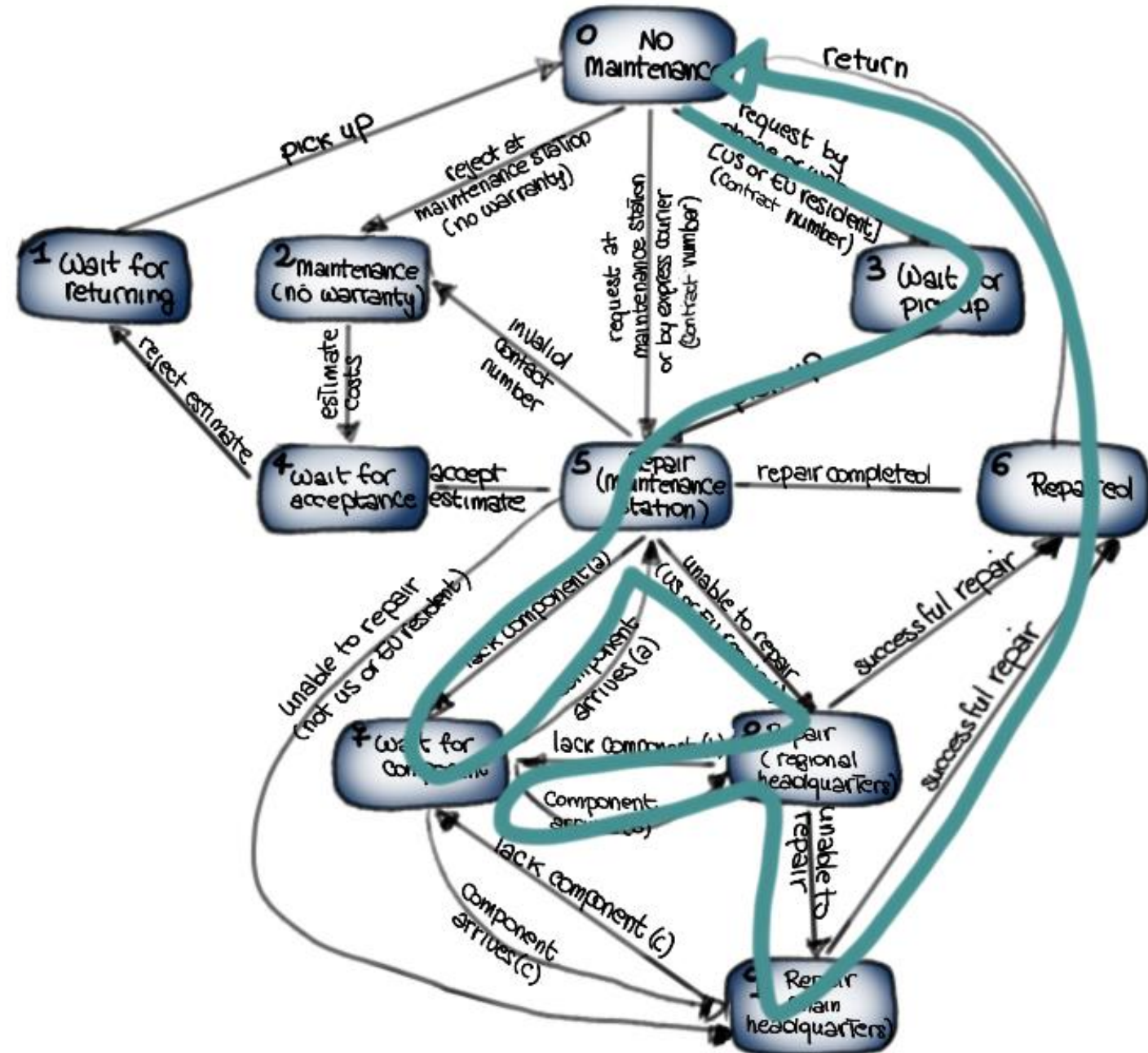


Finite State Model to a Set of Test Cases

Cover the behaviors represented by the state machine.

- Cover all the states
- Or Identify paths in state machine that go through all states in the machine

TC1: Φ , 3, 5, 7, 5, 8, 7, 8, 9, 6, Φ



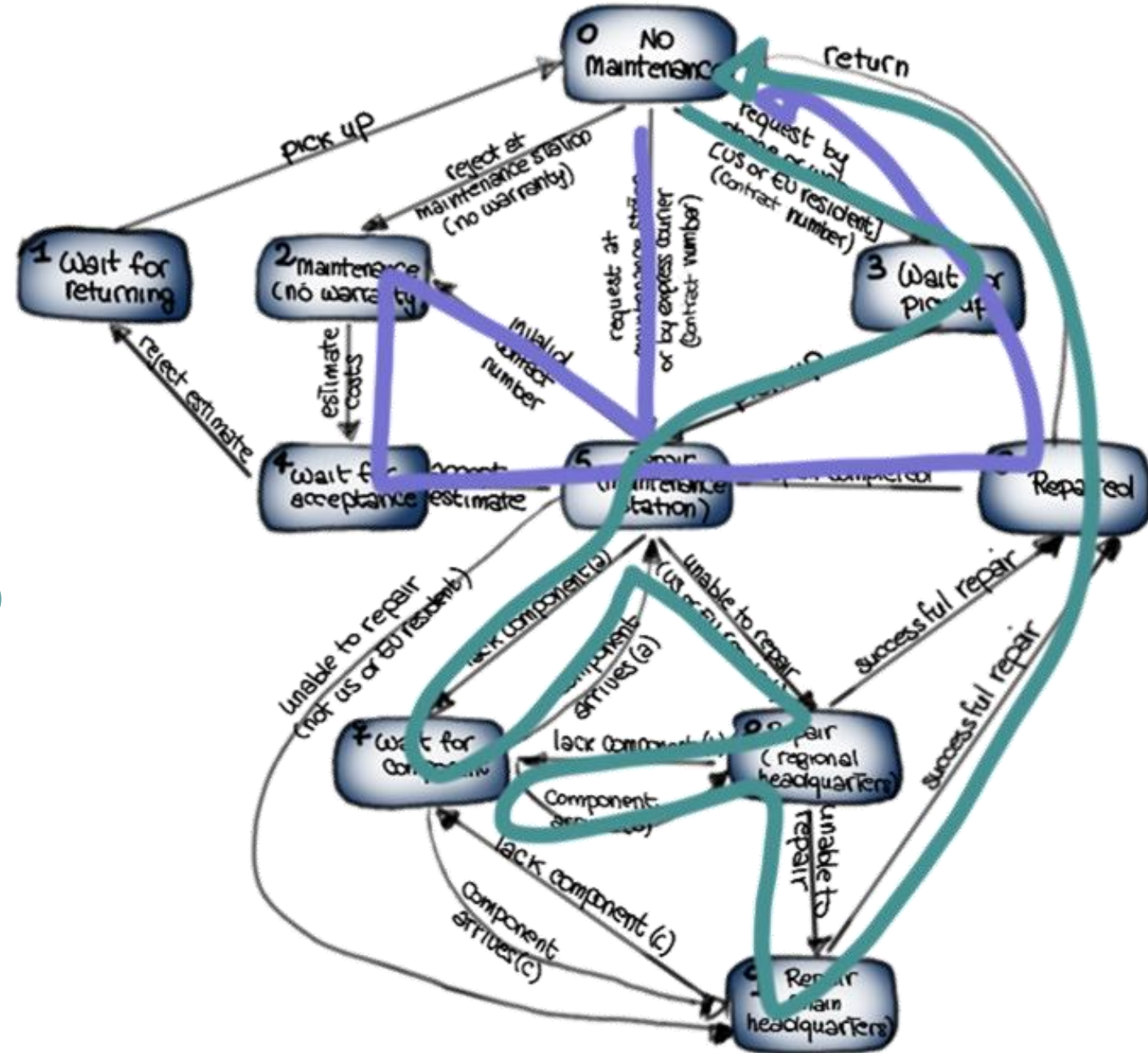
Finite State Model to a Set of Test Cases

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TC1: Φ , 3, 5, 7, 5, 8, 7, 8, 9, 6, Φ

TC2: Φ , 5, 2, 4, 5, 6, Φ



Finite State Model to a Set of Test Cases

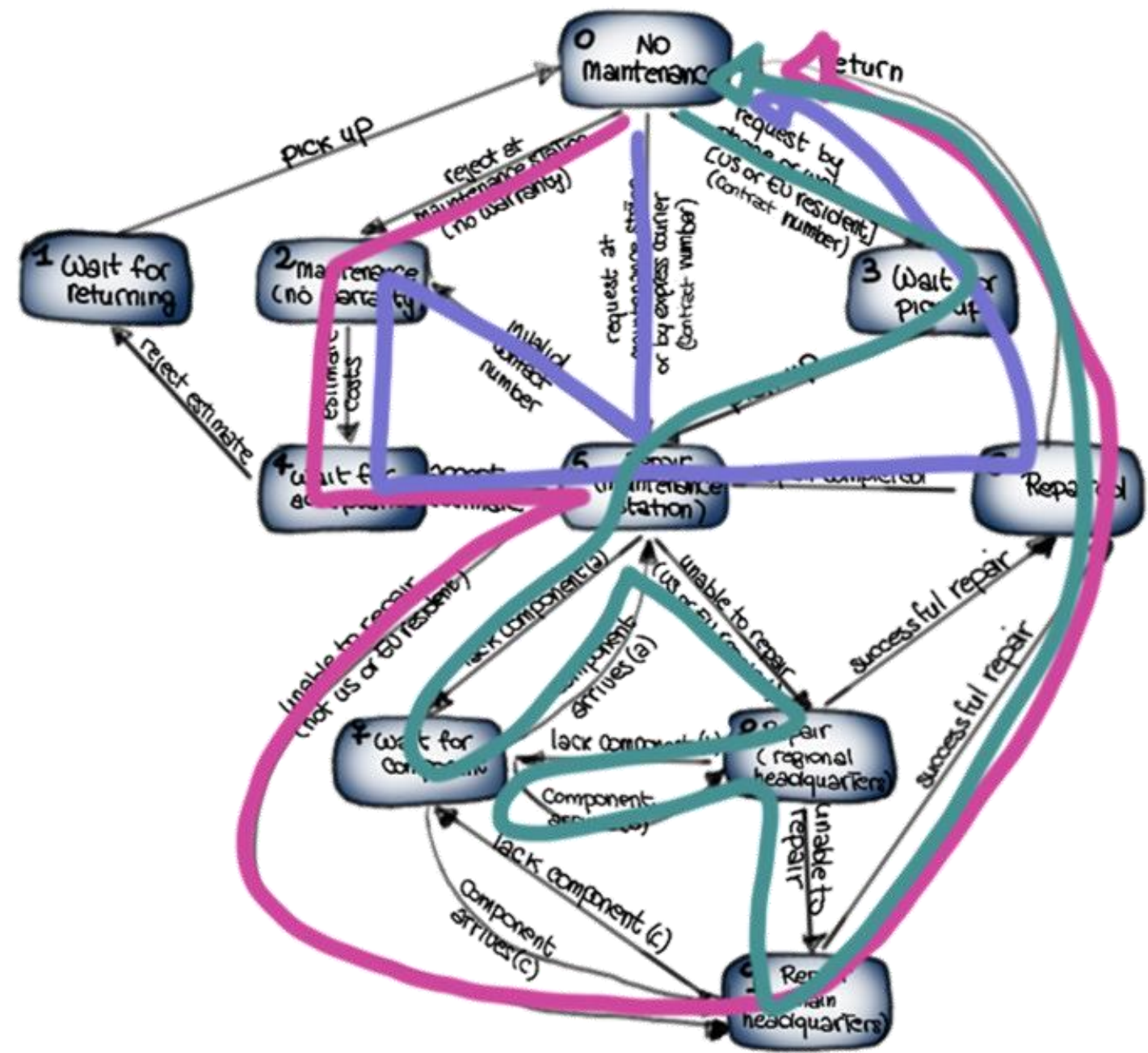
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TC1: $\Phi, 3, 5, 7, 5, 8, 7, 8, 9, 6, \Phi$

TC2: $\Phi, 5, 2, 4, 5, 6, \Phi$

TC3: $\Phi, 2, 4, 5, 9, 6, \Phi$



Finite State Model to a Set of Test Cases

Cover the behaviors represented by the state machine.

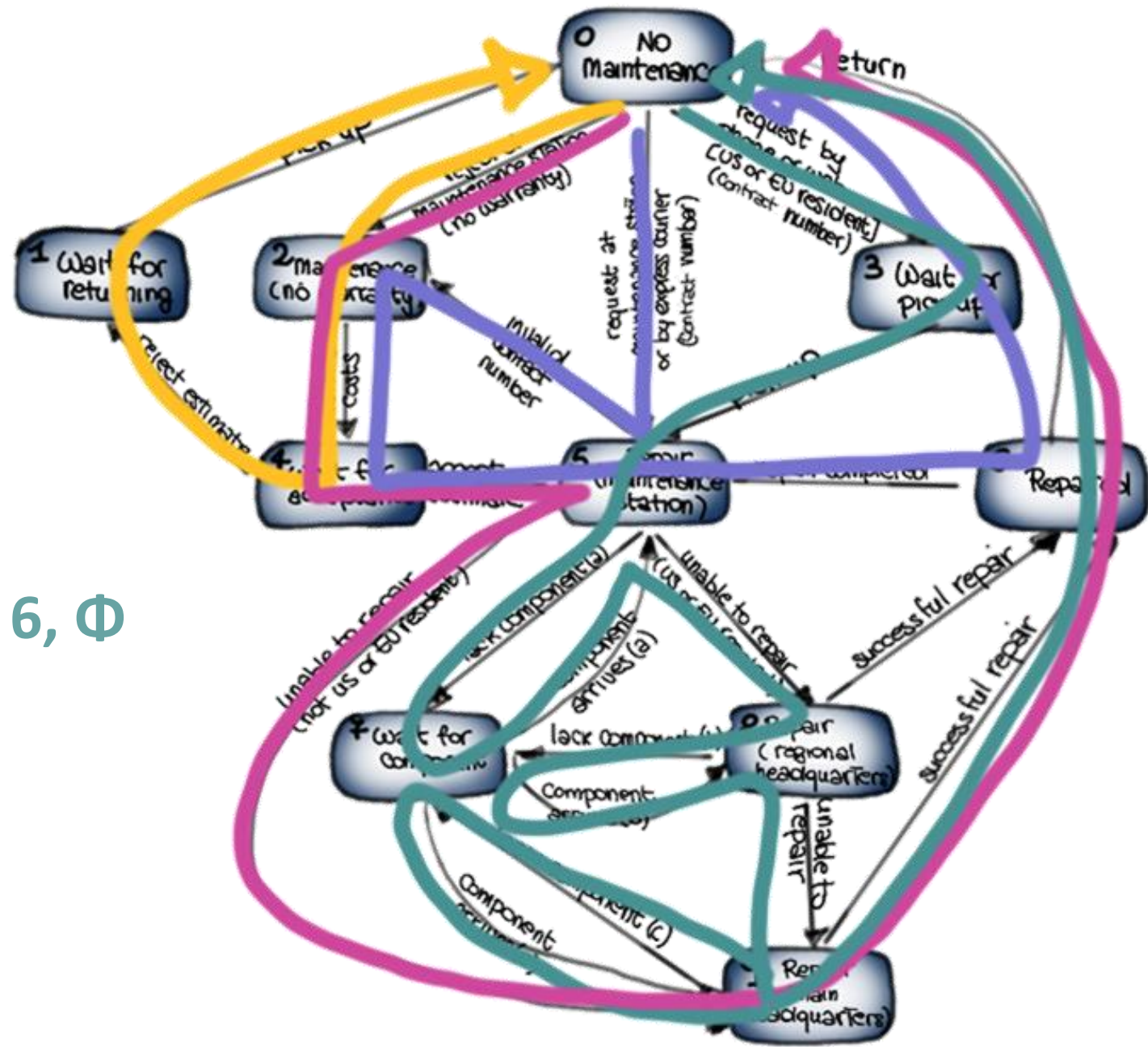
- Cover all the states
- Or Identify paths in state machine that go through all states in the machine
- Or cover all transitions

TC1: $\Phi, 3, 5, 7, 5, 8, 7, 8, 9, 7, 9, 6, \Phi$

TC2: $\Phi, 5, 2, 4, 5, 6, \Phi$

TC3: $\Phi, 2, 4, 5, 9, 6, \Phi$

TC4: $\Phi, 2, 4, 1, \Phi$



Finite State Model to a Set of Test Cases

Cover the behaviors represented by the state machine.

- Cover all the states
- Or Identify paths in state machine that go through all states in the machine
- Or cover all transitions

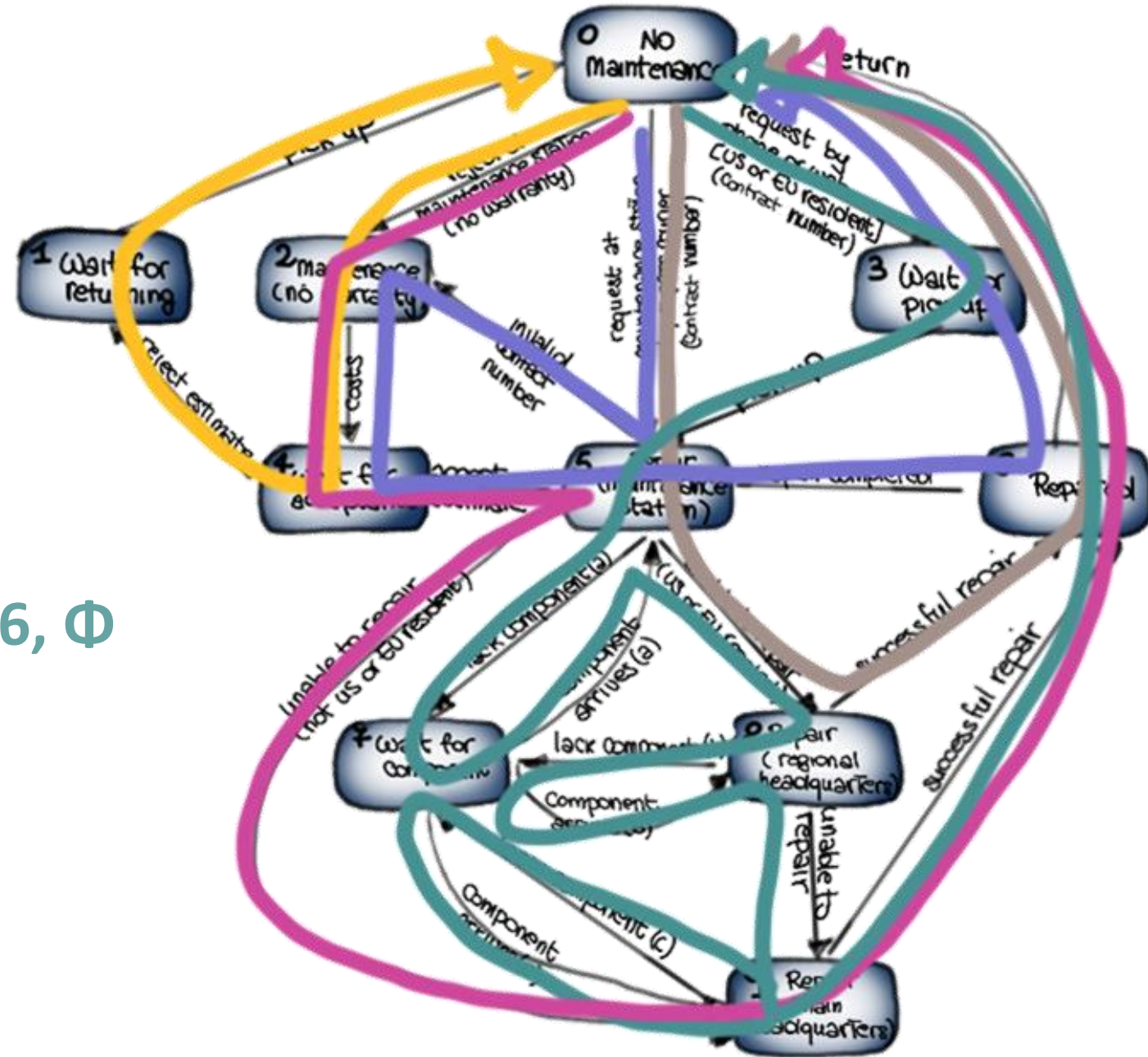
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TC3: $\Phi, 2, 4, 5, 9, 6, \Phi$

TC4: $\Phi, 2, 4, 1, \Phi$

TC5: $\Phi, 5, 8, 6, \Phi$



Some Considerations

Applicability

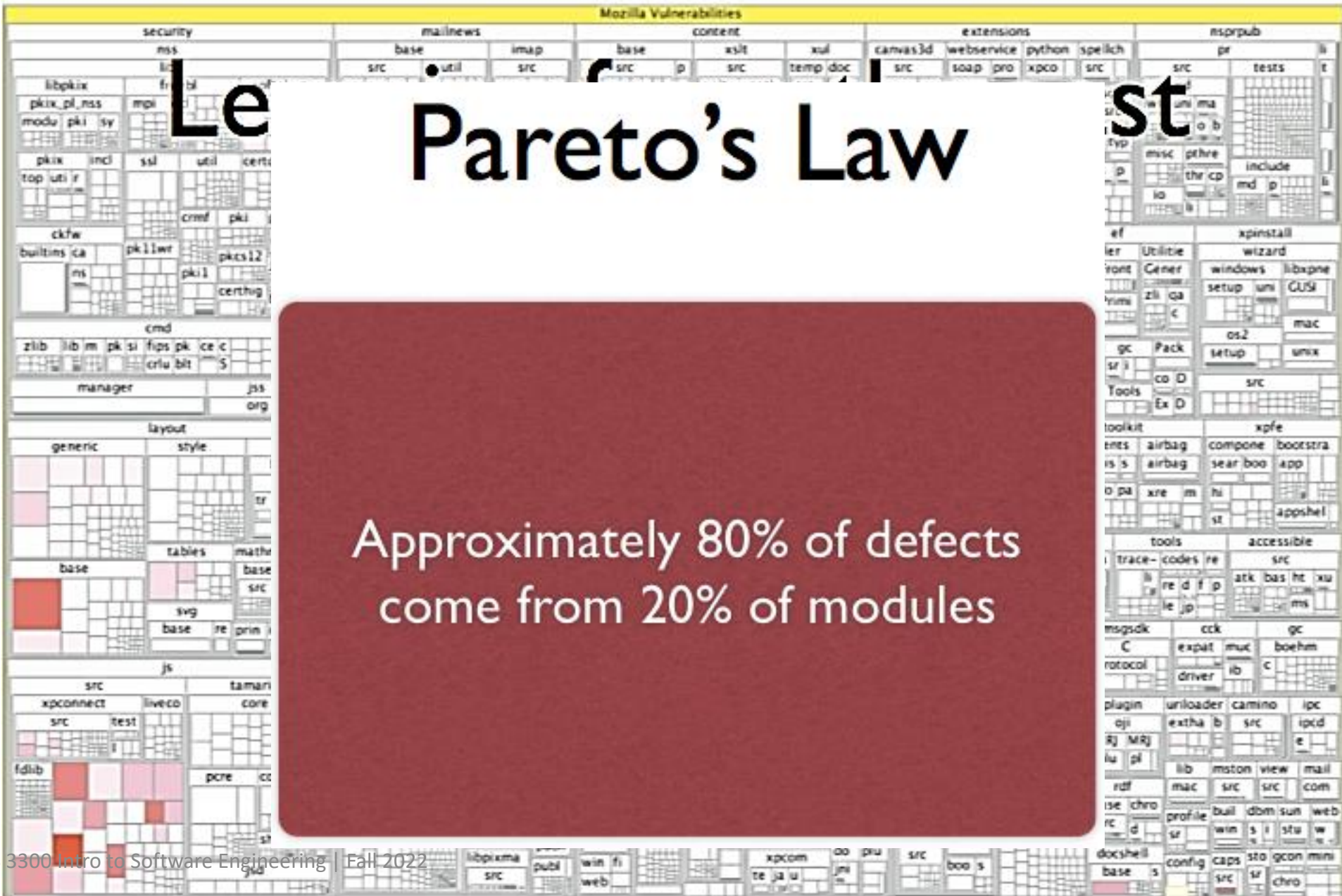
- Very General Approach
- In UML, state machine are readily available

Abstraction is key

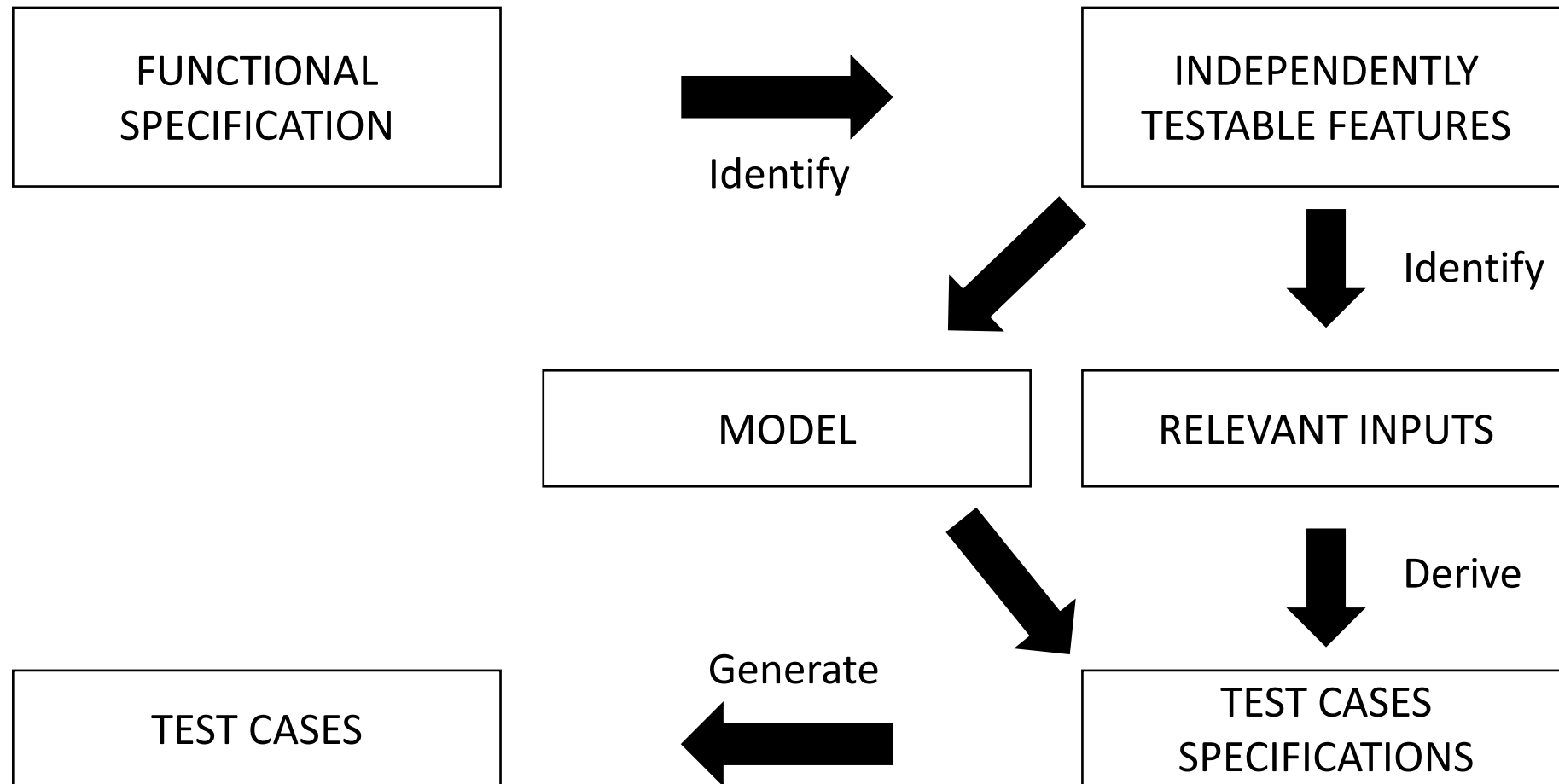
Many other approaches

- Decision tables
- Flow graphs
- Historical Models
- ...

Historical models



Black-Box Testing



Decoupling; Automated Sub-tasks; Monitor testing process

Industry Standards Today

- Many techniques of Black Box Testing
 - 2 important techniques discussed in class- Category partition & Model based testing
- Automating Black-Box Testing is very important
- Tools popular in Industry:
 - [UFT \(Unified Testing Tool\)](#)
 - designed for automated regression, and functional testing.
 - widely used by many big companies like Microsoft, IBM, Apple
 - difficult to use on GUI-rich browser-based applications.
 - [Selenium WebDriver](#)
 - designed as a language-independent automated black-box testing tool (open source)
 - most popular open-source solution for web application functional and regression testing
 - recording and playing back scripts, exporting and importing test cases from one language to another, debugging capabilities, and creating custom commands
 - [Watir](#) (Ruby), [Ranorex Studio](#) (commercial solution), [SilkTest](#), [Squish](#)
- AI in Testing – gaining popularity