Model-Based Testing

(DIT848 / DAT261)

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Lecture 6
More on EFSMs

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So far…

We have seen

- Testing in general
  - Black box testing
  - White box testing
  - Beyond Unit testing
- Interactive exercises on EFSM

This lecture:

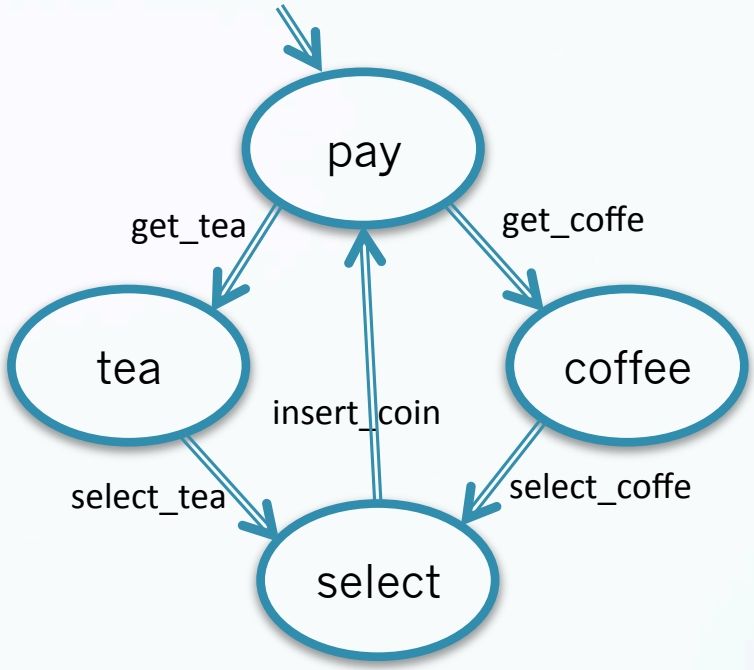
- More interactive exercises on EFSM

Vending machine (1)

A programmer wants to develop a simple program to control a vending machine that provides coffee and tea.

This is the specification of how the machine should operate:
**"The machine should first allow the insertion of a (machine) coin, and
only then allow the customer to select the drink to finally get it".**

The programmer made a first model according to the specification above, getting the Finite State Machine (FSM) depicted in the figure on the right.



- Is the FSM depicted in the picture above correct according to the specification? If not, explain what is wrong and modify the model so that it conforms to the specification

Groups 2-5 persons: 5-7 min

Vending machine (1)
Proposed Solution

- NO! It is not correct

  Solution: invert all the arrows

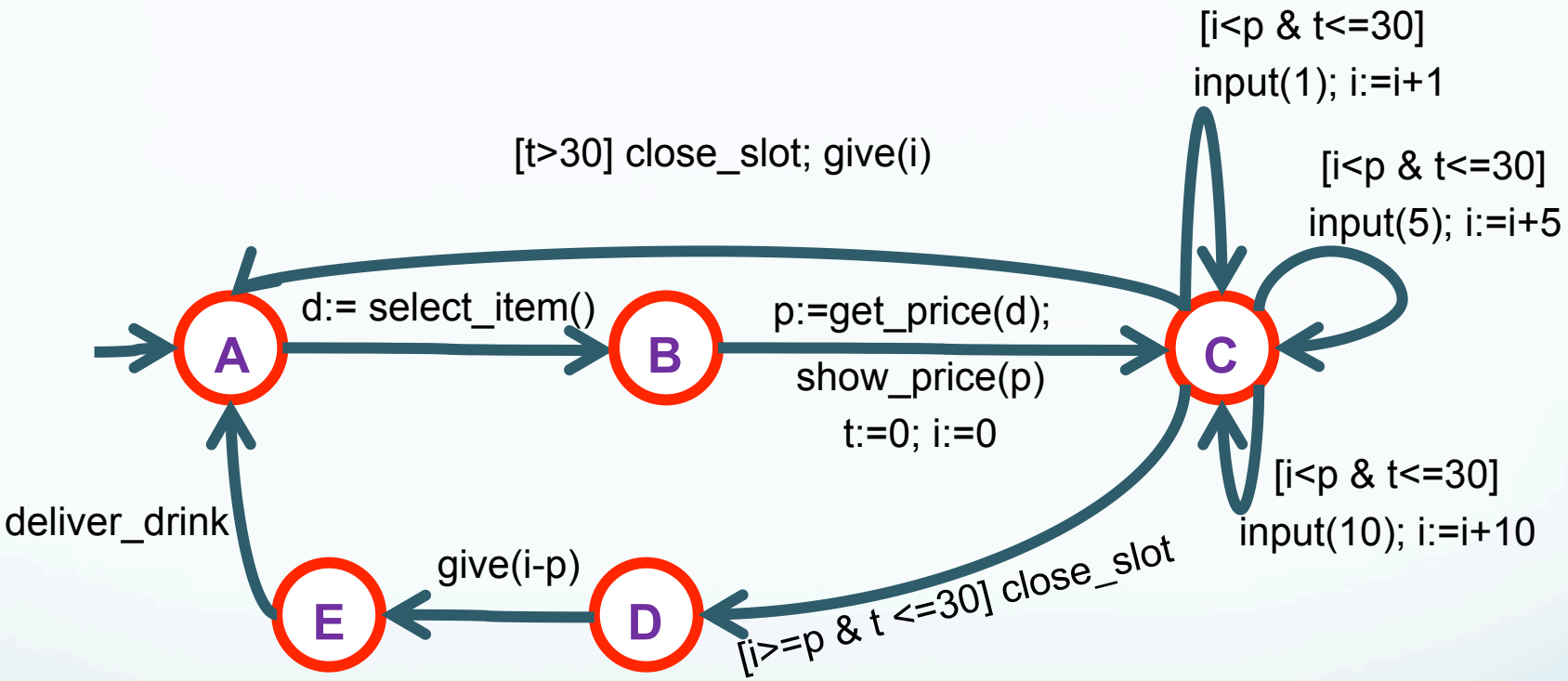
Vending machine (2)

Give an **Extended Finite State Machine (EFSM)** that models a vending machine offering 45 different items. Each item has a defined cost. The vending machine operates as follows.

1. First the client must select one of the items, a display then shows the value for that item.
2. The customer is then required to input Swedish coins (1, 5 or 10 SEK) to cover at least the cost of that item.
3. The slot accepting coins is closed (not accepting more coins) as soon as the inserted money is equal or higher than the cost of the selected item.
4. The machine gives change (if applicable) and delivers the item.
5. If the customer takes more than 30 seconds to input coins to cover the cost, the slot accepting coins is closed and it gives all the coins inserted so far by the customer.

Groups 2-5 persons: 15 min

Vending machine (2)
Proposed Solution



Vending machine (2)
Proposed Solution

Some remarks:

- The way actions are written as ”methods” is intentional
  - You can write them in a different way
- If you assume that your machine is ”eager”, then checking whether t<=30 is redundant in all the transitions it appears (as the the transition with label ” [t>30] close_slot; give(i)” will be automatically taken with the timeout)
- If the specification would say that the user should not be *inactive* for more than 30 seconds, a reset to the timer should be added in each loop in state C.
- You might (also) want to distinguish between ”internal” actions (done by the machine) and ”external” (interactions from the user)

Wireless between car and smart phone

- This task is concerned with a wireless communicating system between a car onboard computer and a smart phone. The smart phone is used to open and close the car, and also to upload statistical information from the car computer, automatically transferred to the mobile phone when this is detected on a given radius of proximity (after having opened the car with the phone). Due to security concerns this transmission is not done to any mobile phone in the range of the wireless communication, but only to the phones of the owners (which have been previously registered in a database in the car computer). It is assumed that the car computer already has those phones registered in the database.

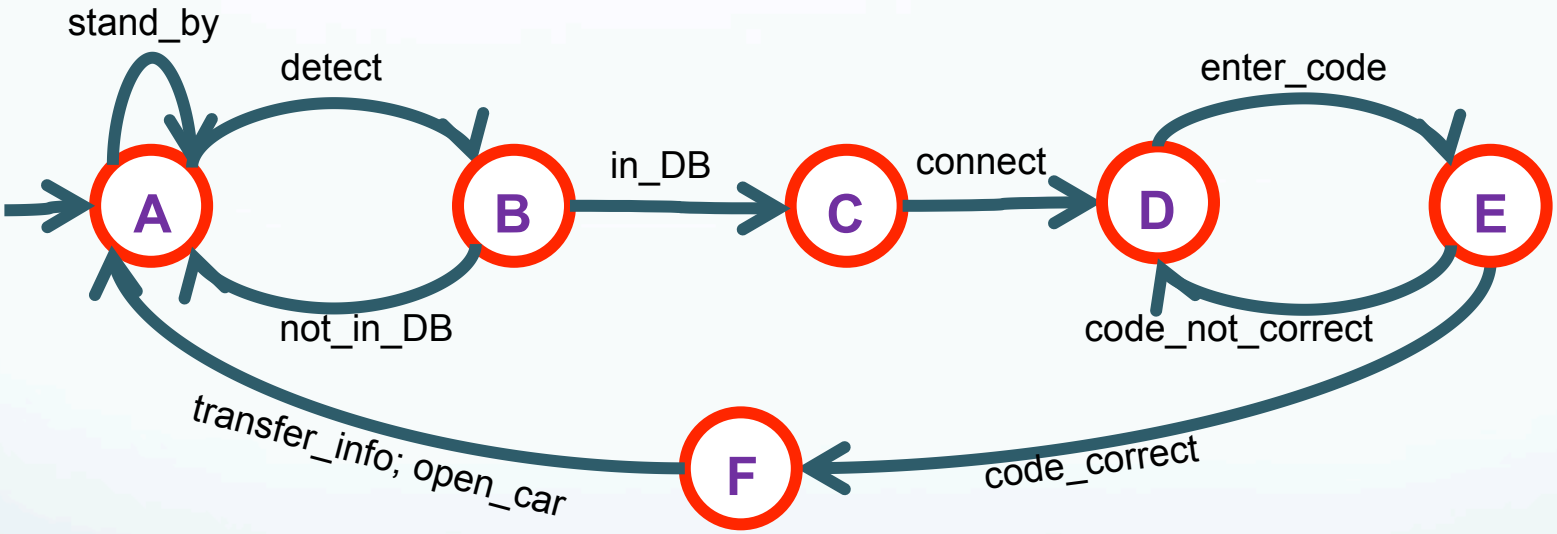
Wireless between car and smart phone (1)

- Your task is to **define a Finite-State Machine (FSM)** for the car computer according to the following specification:

1. The car computer keeps waiting on a standby state till a mobile phone is detected;
2. If the mobile phone is not in the database then it is ignored;
3. If the mobile phone is already registered (it is in the database) then a connection is established and a window asking for a code is shown in the screen of the phone;
4. If the correct code is entered then the car is opened; if not the car computer keeps waiting for the correct code;
5. After the car is opened (due to the input of the correct code) then certain predefined data is automatically uploaded into the mobile phone;
6. The transmission is then finished and the car computer goes back to standby.

Groups 2-5 persons: 10-15 min

Wireless between car and smart phone (1)
Proposed Solution



Note:

- The ”stand_by” event is for completeness, though strictly speaking is not an active event (so it could be removed)

Wireless between car and smart phone (2)

- Give **2** test cases that **can** be extracted from your FSM, and **2** that **cannot** be extracted from it.

Note: Consider test cases you might want to extract given a ”full” specification of the system (consider that the FSM is given as a first step towards a full description of the system)

Groups 2-5 persons: 5 min

Wireless between car and smart phone (2) Proposed Solution

- Test cases you can extract:
  1. Not possible to open the car if code is not correct
  2. Automatic standby after data transmission

- Test cases you cannot extract:
  1. After 3 failed attempts the phone is blocked in the database
  2. Timeouts

Wireless between car and smart phone (3)

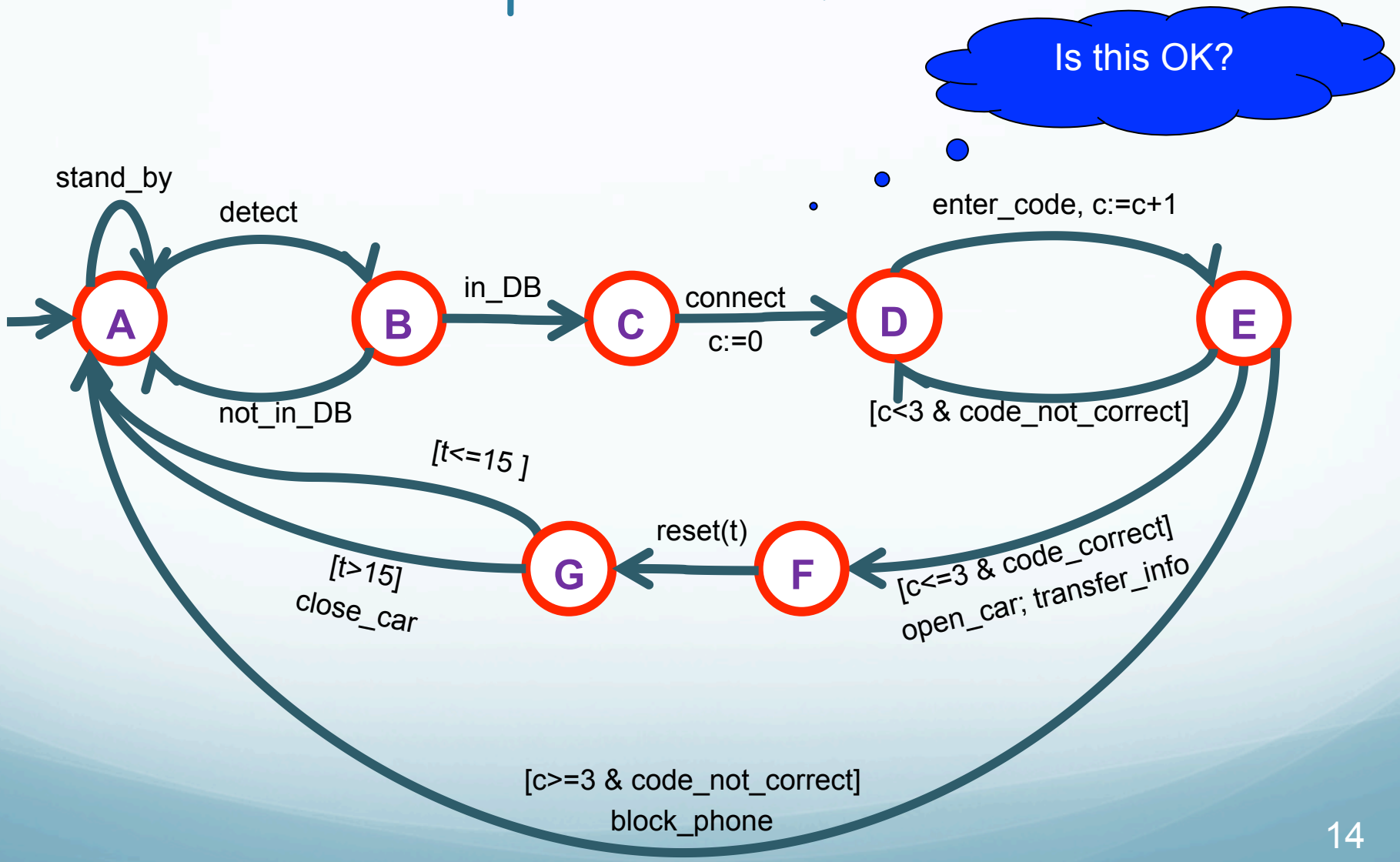
- Draw an **Extended Finite-State Machine (EFSM)** for a modified extension of the system described (1). The new description of the system is as follows:

1. The car computer keeps waiting on a stand-by state till a mobile phone is detected;
2. If the mobile phone is not in the database then it is ignored;
3. If the mobile phone is already registered (it is in the database) then a connection is established and a window asking for a code is shown in the screen of the phone;
4. The user of the phone can only have 3 failed attempts to enter a correct code; if the correct code is entered then the car is opened; after failing 3 times the phone is blocked and the car computer goes to stand-by;
5. After the car is opened (due to the input of the correct code on the phone, not when opened with a normal key) then certain predefined data is automatically uploaded into the mobile phone;
6. After the data is transmitted there is a timeout for the engine: it must start within 15 min, otherwise the car is automatically closed and the car computer goes to stand-by;
7. If the engine starts within 15 min then the car computer goes to standby.

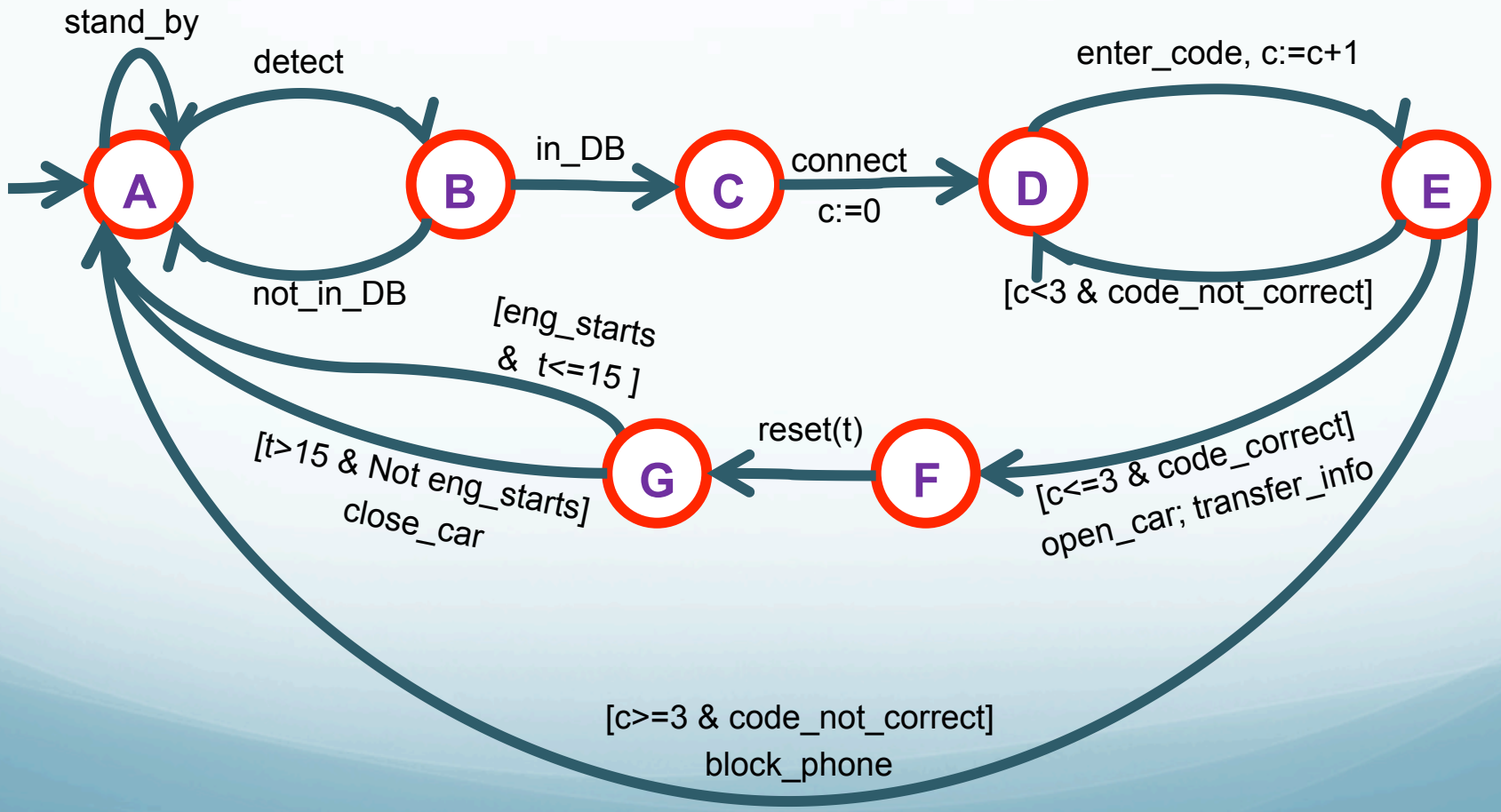
Groups 2-5 persons: 20 min

Wireless between car and smart phone (3)

Proposed Solution



Wireless between car and smart phone (3)
Proposed Solution



Next Lecture…

Introduction to MBT