Current Programming System

Current Programming System

- difficult for end-users
- repetitive and mundane for software developers

End-to-End Programming System

End-to-End Programming System

- input-output examples
- demonstrations
- natural languages

Example 1

Consider a high-school teacher who wants to modify a collection of student scores. These scores are represented as a list $x = [l_1, \ldots, l_n]$ of lists, where each list l_i contains the i-th student's scores. The teacher's goal is to write a function `dropmins` that transforms x into a new list where each student's lowest score is dropped. For instance, we require that

```
dropmins [[1,3,5],[5, 3, 2]] = [3, 5], [5, 3].
```

(from "Synthesizing Data Structure Transformations from Input-Output Examples". PLDI 2015)

Example 1

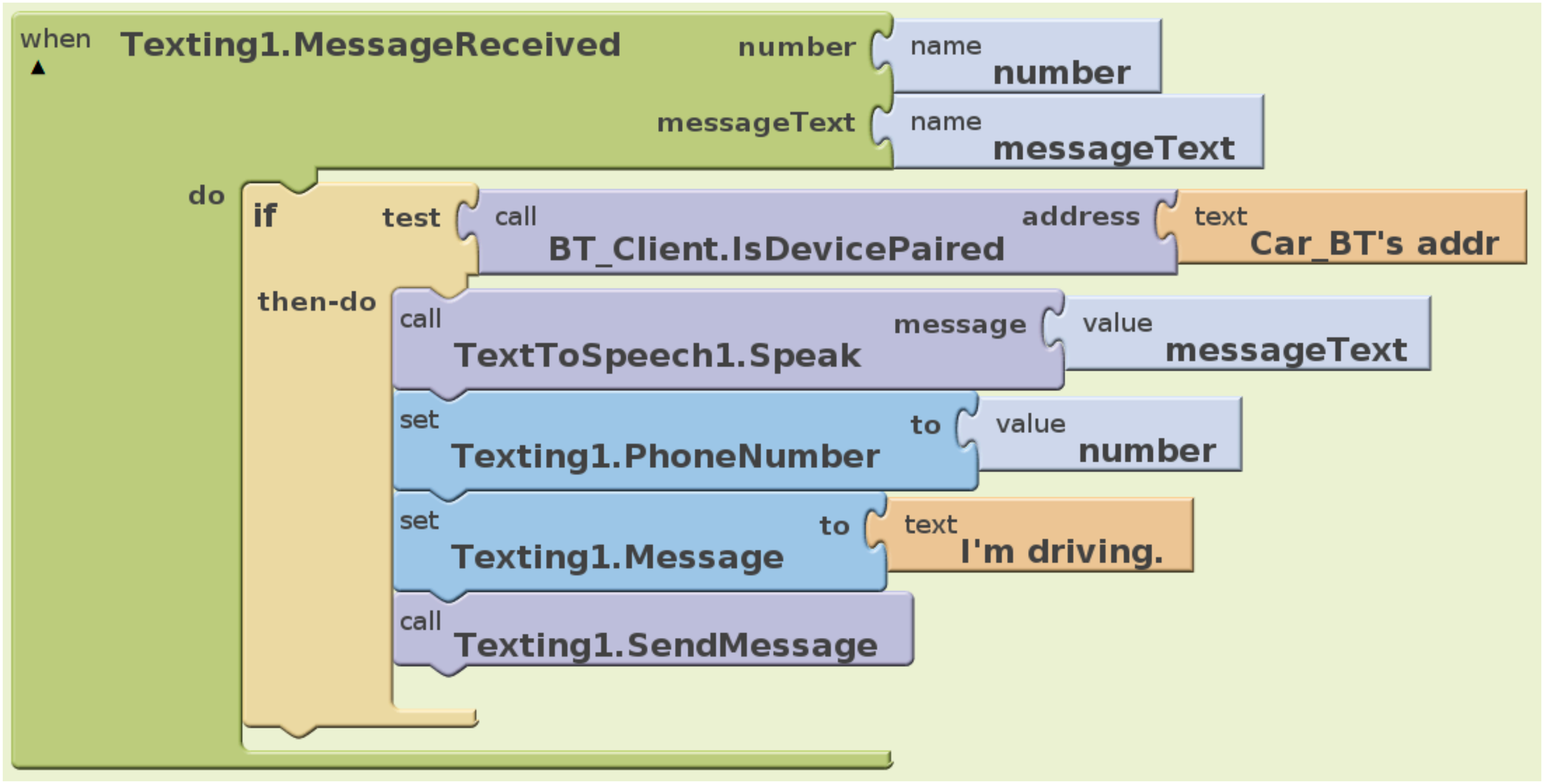
```
[] ↦ []
[[1]] ↦ [[]]
[[1, 3, 5], [5, 3, 2]] ↦ [[3, 5], [5, 3]]
[[8, 4, 7, 2], [4, 6, 2, 9], [3, 4, 1, 0]] ↦
          [[8, 4, 7] [4, 6, 9], [3, 4, 1]]
```

Example 1

```
[] ↦ []
[[1]] ↦ [[]]
[[1, 3, 5], [5, 3, 2]] ↦ [[3, 5], [5, 3]]
[[8, 4, 7, 2], [4, 6, 2, 9], [3, 4, 1, 0]] ↦
          [[8, 4, 7] [4, 6, 9], [3, 4, 1]]
```

```
dropmins x = map f x
      where f y = filter g y
            where g z = foldl h False y
                  where h t w = t || (w < z)
```

Example 2



(from "SmartSynth: Synthesizing Smartphone Automation Scripts from Natural Languages". MobiSys13)

Example 2

"When I receive a new SMS, if the phone is connected to my car's bluetooth, it reads out loud the message content and replies the sender *"I'm driving."*."

Example 2

"When I receive a new SMS, if the phone is connected to my car's bluetooth, it reads out loud the message content and replies the sender *"I'm driving."*."

```
when (number, content) := MessageReceived()
    if (IsConnectedToBTDevice(Car_BT) then
        Speak(content);
        SendMessage(number, "I'm␣driving");
```

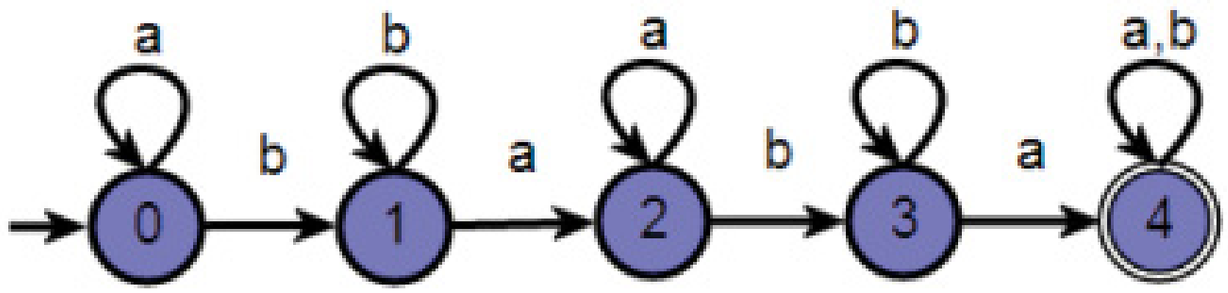
Example 3

Problem Description

Twice 'ba'

Construct a DFA A over the alphabet {a,b} such that A accepts the set of all strings in which 'ba' appears exactly twice as a substring.

1st Attempt



(from "How Can Automatic Feedback Help Students Construct Automata?". MobiSys13)

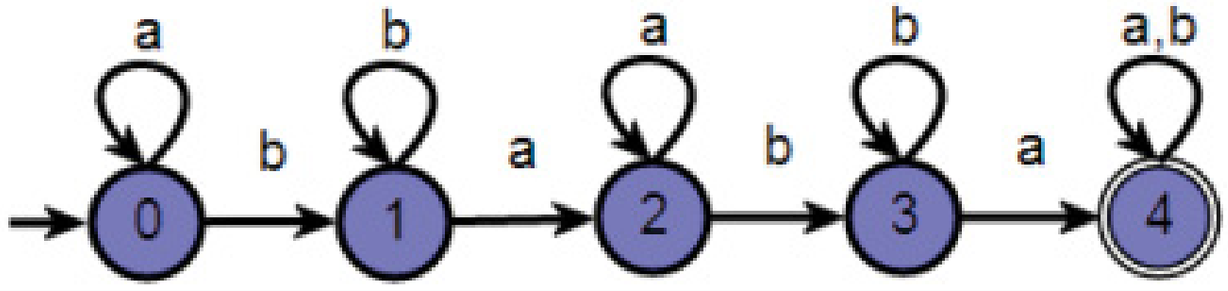
Example 3

Problem Description

Twice 'ba'

Construct a DFA A over the alphabet {a,b} such that A accepts the set of all strings in which 'ba' appears exactly twice as a substring.

1st Attempt



Feedback

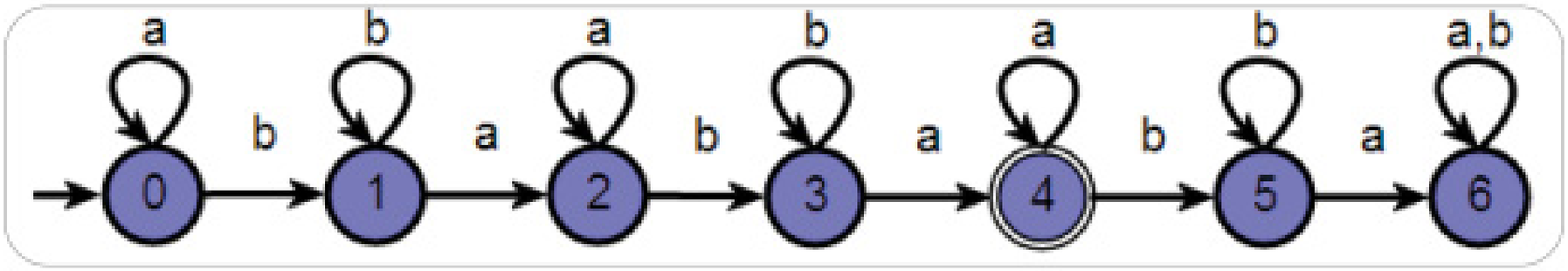
Incorrect!

Your solution accepts the following set of strings:

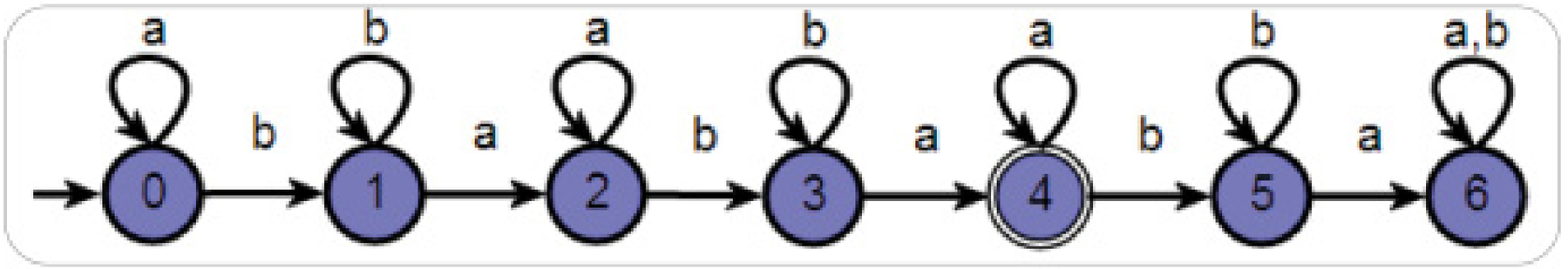
{ *s* | '*ba*' appears in *s* **at least** *twice* }

(from "How Can Automatic Feedback Help Students Construct Automata?". MobiSys13)

2nd Attempt



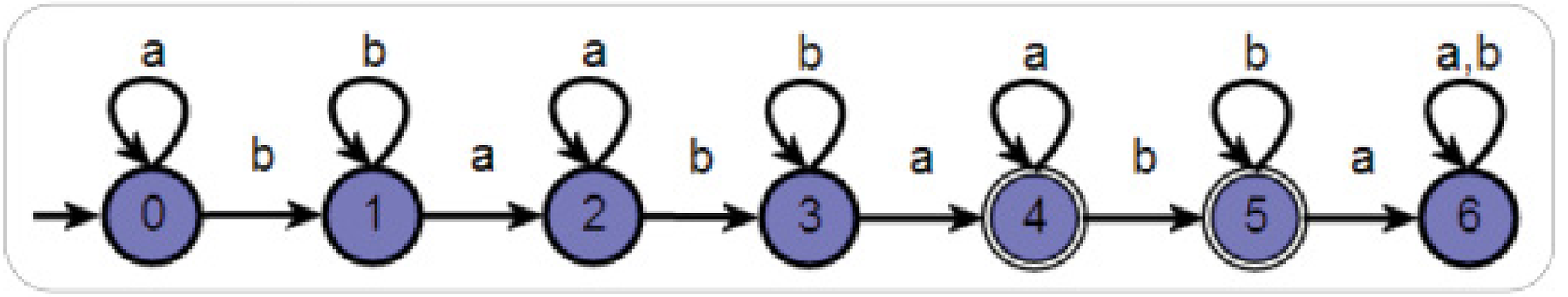
2nd Attempt



Feedback

Incorrect!
You need to change the acceptance condition
of one state;

3rd Attempt



Feedback

Correct!