CS232 Project4
sp2021
streller

PROBLEM STATEMENT:

Given a five button character combination lock; write a program which will simulate the behavior of the lock when five characters are entered. The actions are unlock (if correct sequence entered) and an alarm (if the incorrect sequence is entered). A table ADT must be used to store the transition table and action table of the finite state machine (FSM) which models the behavior of the lock. The correct combination will be given in a file

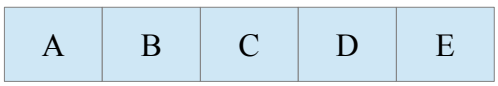
PROBLEM BACKGROUND :

Some of the best known of all table-driven algorithms are based on a model known as a finite state machine (FSM). A finite state machine has five parts:

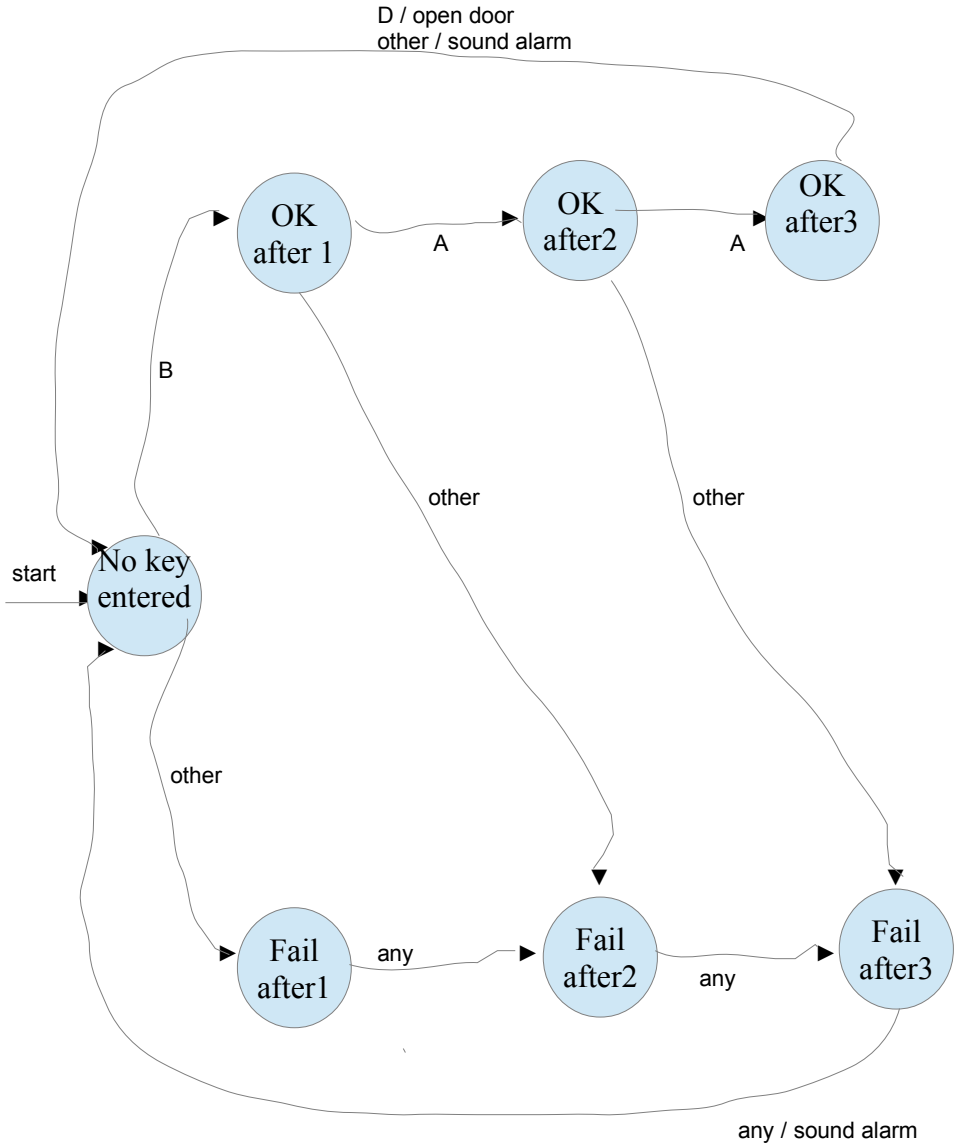
- A set of states
- A start state (which is an element of the set of states)
- A set of potential conditions (and/or events)
- A transition function that defines how to progress from one state to the next
- An action function that associates an action with each transition

State machines are typically pictured in state diagram form as a group of bubbles (one for each state) and arcs (one for each transition and associated action) The transition arrow is labeled with a condition or event (or both) under which such a transition occurs. This condition or event is the first part of any transition label (to the left of a forward slash, "/", symbol).
Many state machines can be directly translated into highly efficient table-driven algorithms. Such algorithms are based on the insight that transitions and actions can be characterized as two tables. One of these tables, often called the transition table, stores the transition function of the state machine. The other table, sometimes called the action table, stores the action associated with all transitions. The transition table and the action table have an identical number of rows and columns. Each table has a separate row for each state and a separate column for each possible event or condition from the state machine. The entries in the transition table indicate the state following the transition, sometimes called the next state.
The action table also contains entries that are appropriate for the outgoing transition from a state and an event or condition. The entries in the action table are actions.

The lock :



Finite State Machine for “BADD” combination



In other words, the entry in the OK After 1 row and the column labeled B indicates that from state OK After 1 a B event (pressing the B key) should make a transition into the Fail After 2 state. The action table also contains entries that are appropriate for the outgoing transition from a state and an event or condition. The entries in the action table are actions.

The action table for the above contains many empty entries to represent transitions that have no associated action.

With a 4 button sequence to unlock there are only 7 **states** that the FSM can have

nke – no key entered (aka the “start”)
ok1 – ok after 1 (first button entered is part of the correct combination to unlock)
ok2 – ok after 2 (second button entered is part of the correct combination to unlock)
ok3 – ok after 3
fa1 – fail after 1 (first button entered is NOT part of the correct combination to unlock)
fa2 – fail after 2
fa3 – fail after 3

The **transition function** for the FSM is dependent upon the correct combination to unlock.

For example, if the correct unlocking combination is “BADD”
and we are in state ok1 and the user enters “A” we would transition to state ok2.
If the user was in state ok1 and entered “E” we would transition to state fa2. And so on.

The **action function** is also contingent upon the correct combination.
For example, if the user is in state ok3 and enters “D” what is the action?
If the user is in state fa2 and enters “D” what is the action ?

As discussed, tables represent functions
(a Table is really a function; the function is an input to the table constructor.
Every table will have its own mapping function.)

So for this scenario we have 2 tables: a transition table and an action table.

The transition table will be generated by a function, say t,

$$t(state, keyEntered) = newState$$

For example, from above,

$$t(ok1, A) = ok2$$

The action table contains entries that are appropriate for the outgoing
transition from a state and an event or condition. The entries in the action table
are actions. The action table for the above contains many empty entries to represent
transitions that have no associated action. For our problem, there are obviously only 2 actions

Similarly,the action table will be generated by a function, say a,

$$a(state, keyEntered) = action$$

For example, from above,

$$a(ok3, D) = ?$$

CODE:

A table is an unordered group of “records”, each of which has a designated field called the key field Records within the table are identified by the value of the key field. For the operations provided by the table see pair.h and table.h.. The table is an appropriate ADT for information retrieval systems in which individual records must be accessed frequently (and quickly) but the entire collection of records must never be processed sequentially.
Complete the table implementation.
use table to store the transition table.
use table to store action table.
the lock will always be the characters A , B , C , D , E.
the combination will always be a four character sequence
Must use accompanying files – with no additions/changes
Your program must run multiple times: give the user the option to enter as key code an unlimited number of times.

GRADING:

In addition to the usual grading standards, your program will be run with the provided action and transition tables. Your program will also be demoed/run with different transition, action tables (in the correct format of course)

DELIVERABLES:

soft: in a zipped file, called CS232_P4_yourLastName,
submitted to blackboard CS232P4_ANS

1. documented source code
2. user manual.
3. Programmer manual(s) (one for each class also)
4. release version executable

As usual, any other file(s) submitted will receive a 5 point deduction for each file.

Due Date : 6:00am 5 May 2021