状态图练习题

1. The lights in a lecture theatre are controlled by a panel of three switches, labeled 'On', 'Off' and 'Dim'. 'On' switches the lights on to their full brightness, and 'Off' switches them off. There is also an intermediate level of brightness, used when slides and other projected material are being shown. The 'Dim' switch reduces the lighting level from full to this intermediate level; full brightness can be restored by pressing the 'On' switch again. Draw a state diagram modelling the behaviour of the lighting system in this lecture theatre.

2. A window in a window management system can be displayed in one of three states: *maximized*, where it takes up the entire screen; *normal*, where it is displayed as a bordered window with a given size and position on the screen; and *iconized*, where it is displayed as a small icon. When a window is opened, it will be displayed as a normal window, unless *minimize on use* has been selected, in which case it will be displayed as an icon. A normal window and an icon can be maximized; a maximized window and a normal window can be minimized, or reduced to an icon. Maximized windows can be restored to their normal size, and icons can be restored to the size they had before they were minimized. Icons and normal windows can be moved, and normal windows can also be resized. No matter how it is displayed, a window can always be closed.
Draw a state diagram expressing these facts about the display of windows.

3. A description of the behaviour of an automated telling machine (ATM) is given below. Produce a state diagram describing its behaviour. List any assumptions you have to make as a result of ambiguity, unclarity or incompleteness of the description.

A user begins a transaction at the ATM by entering a bank card. Assuming that the card is readable by the machine, the user is prompted to enter their personal identification number (PIN). Once this number has been entered, a menu is presented to the user containing the following options: show account balance, withdrawal with receipt or withdrawal without receipt. If the user selects one of the withdrawal options, they are prompted to enter an amount of money to withdraw; the amount entered must be a multiple of 10.

The user's PIN is validated when the ATM sends the details of the transaction to the bank's remote computer. If the PIN was invalid, the user is given the option of

reentering it, and the selected transaction is retried. This is repeated if the new PIN is also invalid. Once three invalid PINs have been entered, the transaction is terminated and the user's card is retained by the machine.

If a valid PIN was entered, further processing depends on the transaction type selected. For a 'show balance' transaction, the balance is displayed on the screen, and after confirming this, the user is returned to the transaction menu. A withdrawal transaction may fail if the user has exceeded the amount of money that can be withdrawn from the account; in this case an error message is displayed, and after confirmation, the user is returned to the transaction menu. Otherwise, the user's card is returned and the money is issued, followed by the receipt if required.

At any point where user input, other than a simple confirmation, is required, a 'cancel' option is provided. If this is selected, the user's card is returned and their interaction with the ATM terminates.

4. A simple digital watch consists of a display showing hours and minutes separated by a flashing colon, and provides two buttons (A and B) which enable the display to be updated.

(*a*) To add two to the number of hours displayed, the following actions should be performed, where button B increments the hours display:

Press A; press B; press B; press A; press A.

Draw a simple statechart showing precisely this sequence of events.

(*b*) In the above interaction, the hours displayed could be incremented by any required number, and the whole interaction could be repeated as often as required. Redraw the statechart to incorporate these generalizations.

(*c*) To increment the number of minutes displayed by the watch, button A can be pressed twice, followed by repeated presses of button B, each of which increases the minutes displayed by 1.

Draw a complete statechart for the watch, incorporating updates to both the hours and minutes displayed. Give the states in your statechart meaningful names, and add appropriate actions to any transition labelled 'press B'.

(*d*) The watch is subsequently enhanced to incorporate an alarm, and the following interaction is proposed as a way of setting the time of the alarm:

Press A; press A; press B (repeatedly); press A; press B (repeatedly); press A.

The intention is that the user presses button A twice in quick succession, like a 'double click' with a mouse. Explain how this proposal would introduce non-determinism into the statechart for the digital watch. Show how you could

remove the non-determinism by introducing an extra state into the statechart.

5. Draw a statechart summarizing the information given in the following description some of the events that can arise in the life cycle of a thread in Java.

When a thread is created, it does not start running immediately, but is left in the *New Thread* state. When the thread is in this state, it can only be started or stopped. Calling any method besides *start* or *stop* makes no sense, and causes an exception to be raised.

The *start* method causes system resources to be allocated to the thread, and calls the thread's *run* method. At this point the thread is in the *Running* state.

A thread becomes not runnable if either its *sleep* or *suspend* methods are called. The *sleep* method has a parameter specifying the length of time the thread should sleep for; when this time has elapsed the thread starts to run again. If the *suspend* method has been called, the thread only runs again when its *resume* method is called.

A thread can die in two ways. It dies naturally when its *run* method exits normally. A thread can also be killed at any time by calling its *stop* method.