

Question 6.

A *telephone switch* monitors the phone lines connected to it, and establishes connections (phone calls) between pairs of telephones. Suppose you are part of the team designing the software for a new generation of digital telephones and telephone switches. Instead of sending analogue signals, these components communicate by sending packets of bytes over the phone lines. For example, when a person picks up a phone to make a telephone call, this *source phone* sends an "off hook" packet to the switch. The dial tone that the user hears is caused by the switch sending a "dial tone" packet to the phone.

For a very simple phone call, here are the responsibilities:

1. The source phone goes "off hook" (i.e., a person picks up the phone).
 2. The switch sends dial tone to source phone.
 3. The source phone sends the series of numbers corresponding to the phone number that the person dials.
 4. The switch attempts to set up the call. (It processes the dialed numbers to determine the destination being called, sends a ring signal to the destination phone, and sends a ring-back signal to the source phone).
 5. The destination phone goes "off hook" (i.e., someone answers the phone).
 6. The switch establishes a connection between the source phone and the destination phone. (It sends a voice connection message to the source phone and to the destination phone.)
 7. The source phone goes "on hook" (i.e., the person who made the phone call hangs up).
 8. The switch takes down the connection. (It sends a disconnect message to the destination phone.)
 9. The destination phone goes "on hook".
- (a) Draw a UCM showing the three major components of this system (source phone, switch, and destination phone), illustrating these responsibilities. To indicate where the responsibilities occur, label the path(s) in the UCM "1", "2", "3", etc., using the same numbers that are used in the list of responsibilities above. Do not define or include any other responsibilities.
- (b) If the user does not complete dialing within a certain amount of time after taking the source phone "off hook", the switch should send a special "off hook" signal (loud beeps) to the phone, as it has likely accidentally been left "off hook". Again, this signal is sent until the source phone goes back "on hook". Draw a UCM illustrating this scenario. You need only show two components: the source phone and source's local switch, and the responsibilities corresponding to them. Define and label any additional responsibilities that are required.