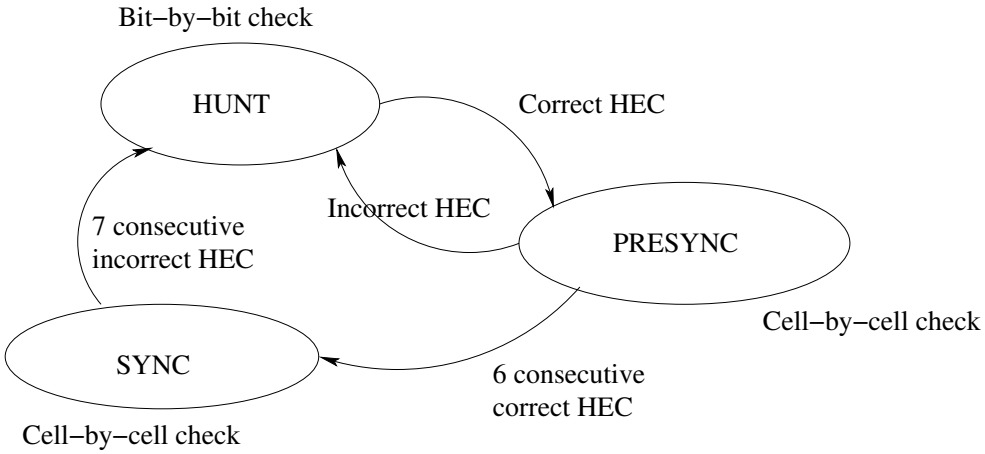
Note: due to delays in the publishing the extra exercise the dead-line is extented to May 21.

1. Consider the use of 2.4 Gbit/s fiber optics link for transporting voice circuits (each requiring 64 kbit/s capacity) via ATM.
   (a) What is the minimum size of the VCI?
   (b) What is the minimum size of the VCI if the 2.4 Gbit/s link is divided into 16 STM-1 ATM channels?
   (c) Why can we achieve a reduction in the size of the VCI by having smaller channels? What is the hidden cost?

2. Consider the following scale up by a factor of l for a three stage factoring of a rearrangeable network via $N = p \times q$ as shown in slide 4-38. Suppose now we replace each edge by l edges, each $p \times p$ switch by an $lp \times lp$ switch, and each $q \times q$ switch by $lq \times lq$ switch. Show that the resulting $lN \times lN$ switch is rearrangeable. Furthermore, show that the above scale up has unneccessary crosspoints for constructing $lN \times lN$ rearrangeable network. (Hint: Consider an equivalent $lN \times lN$ Clos network.)

3. Construct a 128×8 concentrator using 8×8 crossbars and 4×1 multiplexers. The concentrator should be non-blocking in the sense that any 8 out of the 128 inputs can be connected to the 8 outputs.

4. ATM cell delineation process is based on three state state-machine (see the figure below). The SYNC state is the normal operation state, HUNT state is used in start-up and error situations to find a correct cell header, and PRESYNC is used to make sure that the correct cell delineation is really found. In this case a correct header is considered to contain no bit errors.



   (a) Create a Markov model describing the system and calculate the transition intensities for STM-1 link with bit error probability $p = 4.2 \cdot 10^{-3}$.
   (b) Solve the state probabilities for each state.

5. What is the reliability of the system below. Define the partition of the system into subsystems.