CSE 461 Homework 1
Due Friday October 6, 2000

1. Delay. The speed of light in a glass fiber is roughly 2.0×10^8 meters per second. Yes, that's 2/3 the speed of light in a vacuum.

   (a) It's 2496 miles (4016 km) to Boston. If there's just one fiber between seattle and boston, and I put a new bit on that wire every 10ns, how many bits have I sent before the first one reaches Boston? (assume that the signal isn't attenuated beyond recognition)

   (b) How long (in meters) is that 10ns bit?

2. Framing. HDLC denotes the beginning and end of a frame with the bit sequence 01111110. Use the HDLC bit stuffing rule to encode the following string (spaces are just for readability). You don't need to add the HDLC frame markers.

   0111 0100 1111 1011 1011 1111 0011

3. Bit encoding.

   (a) Use table 2.5 on pg 83 to encode the following bit string using 4B / 5B encoding:
       0111 0100 1111 1011 1011 1111 0011

   (b) Encode the resulting string using NRZI.

4. Error detection. If the bit error rate on a link is 0.00001 (1×10^{-5}), what is the likelihood that a 576-byte frame will include an error?

5. Switching. Assume that a 6 port Banyan switch is constructed using 3x3 crossbars to implement each switching element. The 3x3 crossbar is arranged so that there are two inputs and two outputs, and the extra input and output are internally used to route data to (and from) a buffer to deal with collision. There are only 8 crossbar switching elements in this 3x3 crossbar, since the buffer needn't be switched to itself.
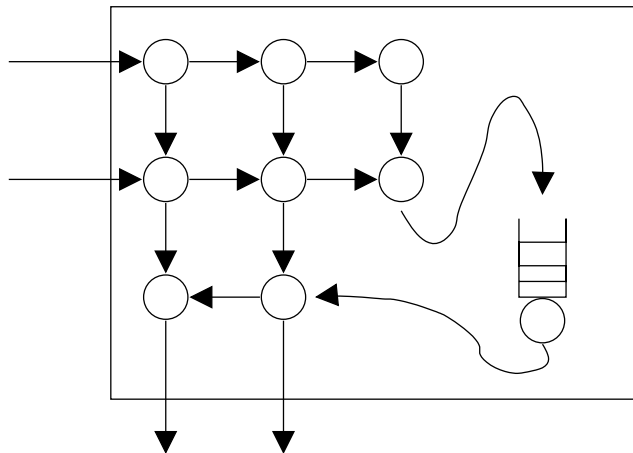
   (a) Does this 6 port Banyan or a 6 port crossbar use fewer crossbar switching elements?

   (b) If they are both 16 ports?

6. Structures as messages. The following bytes (in hexadecimal) make up the IP header of a packet. Decode the IP header: For each field in the header, what is it's value (in decimal)?

   The definition of the ip header I would like you to use is in /usr/include/netinet/ip.h, struct ip (not iphdr).

   45 00 01 ae ed 3e 00 00 3e 06 ae 51 80 5f 02 18 80 5f 04 60

   I'll get you started, ip_v = 4

   HINT: If you're having trouble, look at the "Internet Header Format" section of RFC 791.

7. Assume a switch is implemented using only input queues. The switch has two input and two output ports, both of which run a 1Mbit/sec.

   The switch forwards three streams which enter it at fixed rates. Stream A runs at 500kbit/sec, arrives at the first input port, and is forwarded to the first output port. Stream B also runs at 500kbit/sec and is forwarded to the second output port. Stream C runs at 750kbit/sec as is also forwarded to the second output port.
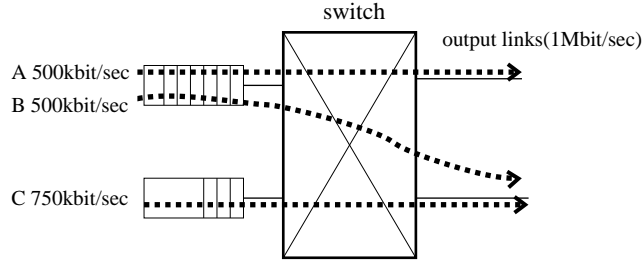
   Please give a short, *qualitative* description of the performance of *stream A* as it leaves the switch.

8. Page 62 #14.

9. Page 157 #5

10. Page 158 #10