Homework 1

due Oct. 12th at 1pm

1. Modify my programs for finding good polynomials for the fast compuation of CRC to find the minimum-degree polynomial that is divisible by that degree-32 CRC generator polynomial (implicit in my programs) and has at least eleven zeroes between any two ones.

2. In controlled prefix expansion with variable stride, what is the minimum number of trie nodes we need so that no more than two memory accesses are needed to perform an IP lookup (i.e., longest prefix match) against the rule set below. Please show some dynamic programming steps if you would like to receive partial credits.

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P1 = 0000*
P2 = 0001*
P3 = 0010*
P4 = 001*
P5 = 01*
P6 = 1*
P7 = 110*
P8 = 111*
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3. Please draw the grid of tries (destination trie first and with switch pointers) that correspond to the two-dimensional packet classification rule set shown in Table 1.

4. Given the rule set shown in Fig. 12.3 (on page 275 of the textbook), in the equivalenced cross-producting scheme for packet classification, how many equivalent classes are formed from the partial cross product of source IP and source port? Please show steps for partial credits.

5. Essay question concerning packet scheduling and fair queueing. Writing down the correct answer(s) will result in full credit(s). You are however welcomed to show intermediate steps for partial credits.

Rule	Destination	Source
R_1	01*	0*
R_2	01*	11*
R_3	10*	1*
R_4	0*	01*
R_5	0*	10*
R_6	*	00*
R_7	*	11*

Table 1: A rule set with seven destination-source rules

We consider a packet scheduling scenario in which there are 3 flows (denoted as 1, 2, and 3) with equal weights. The j_{th} packet of flow i is denoted $p_{i,j}$. Its arrival time and length (in bits) are denoted as $a_{i,j}$ and $l_{i,j}$ respectively. Let $a_{1,1} = a_{2,1} = a_{3,1} = 0$. Let $a_{1,2} = a_{2,2} = a_{3,2} = 1$ and $a_{1,3} = a_{3,3} = 2$. Let $l_{1,1} = 2$, $l_{1,2} = 3$, $l_{1,3} = 6$, $l_{2,1} = 6$, $l_{2,2} = 3$, $l_{3,1} = 3$, $l_{3,2} = 1$, and $l_{3,3} = 6$. Suppose the service rate of the link is 1 bit per second. Then

- (a) What is the GPS finish time of all these packets?
- (b) What is the service order of these packets under WFQ?
- (c) What is the service order of these packets under WF^2Q?
- (d) What is the service order of these packets under DRR when the quantum size is 3 bits?

6. Essay question concerning switching fixed-size packets (called cells) using the iSLIP algorithm. As shown in Figure 1 (will be drawn on the blackboard and posted on T-square soon), the switch is the same as shown in Figure 13.9 (in the textbook, p318) in the textbook. However, the inputs and the starting values of accept/grant pointers are different. You have the option to show intermediate steps (like Figures 13.9 and 13.10 in the textbook) for partial credits just in case.

- (a) Please draw cell transmission timing chart like shown in Fig. 13.11.
- (b) Please write down the values of grant and accept pointers **after** the transmission of all these cells.