Answer to Question #2, Homework #6

The basic idea is to repeatedly compare bits from the number to the left of the #, to the corresponding bits from the number to the right of the #. The algorithm starts with the highest order bits of the two numbers, and works its way down to the lowest order bits of the two numbers. If it ever finds a bit position in the left number that contains a 1 where the corresponding position in the right number contains a 0, then the first number is bigger. Note that an "X" is written over a bit once it has been examined.

	0	1	#	X	B
q0	(q1,X,R)	(q7,X,R)	(q10,#,R)	-	-
q1	(q1,0,R)	(q1,1,R)	(q2,#,R)	-	-
q2	(q4,X,L)	(q3,1,R)	-	(q2,X,R)	-
q3	(q3,0,R)	(q3,1,R)	-	-	(q5,0,R)
q4	-	-	(q6,#,L)	(q4,X,L)	-
q5	-	-	-	-	-
q6	(q6,0,L)	(q6,1,L)	-	(q0,X,R)	-
q7	(q7,0,R)	(q7,1,R)	(q8,#,R)	-	-
q8	(q9,0,R)	(q4,X,L)	-	(q8,X,R)	-
q9	(q9,0,R)	(q9,1,R)	-	-	(q5,1,R)
q10	-	-	-	(q10,X,R)	(q5,0,R)

q0 – determine what the leftmost unexamined bit of the first number is, and call it Lbit; if it's a 0, go to state q1 (remember Lbit=0), and if it's a 1, go to state q7 (remember Lbit=1); a # indicates the numbers are equal.

q1 – Lbit was a 0, look for the leftmost unexamined bit of the second number; pass over the lower order bits to get to the #, and cross over it.

q2 – Lbit was a 0, look for the leftmost unexamined bit of the second number; skip over any previously examined bits that are marked X.

q3 – the leftmost bit of the second number is a 1, since the corresponding bit of the first number (Lbit) is a 0, scan all the way to the right, and write a 0 (i.e., the second number is larger).

q4 – the leftmost corresponding bits of the two numbers are equal, so start scanning all the way to the left to start over (the next highest bits of the two numbers need to be compared); first scan left to the #.

q5 – this is the “halt” state, the numbers have been compared, and the correct value has been written to the right of the second number.

q6 – continue scanning to the left to start over, now go all the way to the beginning.

q7 & q8 are similar to q1 & q2, respectively, but where the Lbit is a 1.

q9 – the highest order bit of the second number is a 0, since the highest order bit of the first number (Lbit) is a 1, scan all the way to the right, and write a 1 (i.e., the first number is larger).

q10 – if the numbers are equal, scan to the far right and write a 0.