ENCS336 – Second Exam

Question 2: (15 marks)

Given the following number stored in floating point format with biased exponent and normalized significand:

1	00110011	1100111
Sign	Exponent (8 bits)	Significand (7 bits)

Store the same number in the same floating point format with the following bit distribution:

Sign	Exponent (10 bits)	Significand (5 bits)

Solution:

The sign does not change. (2 marks)

The bias for an 8-bit exponent is $2^{8-1}-1=127$ (2 marks)
The exponent is $(2^0+2^1+2^4+2^5) - 127 = 51-127 = -76$ (3 marks)
The bias for a 10-bit exponent is $2^{10-1}-1=511$ (2 marks)
The exponent will be stored as -76 +511 = 435 = 0110110011 (3 marks)

The significand is 1.1100111
It will be rounded in order to fit in 5 bits instead of 7.
The trailing 11 are rounded UP, which means 1 is added to the fifth bit from the radix point.
The significand becomes 1.11001 + 0.00001 = 1.11010 (3 marks)
The number stored is 11010

1	0110110011	11010
Sign	Exponent (10 bits)	Significand (5 bits)

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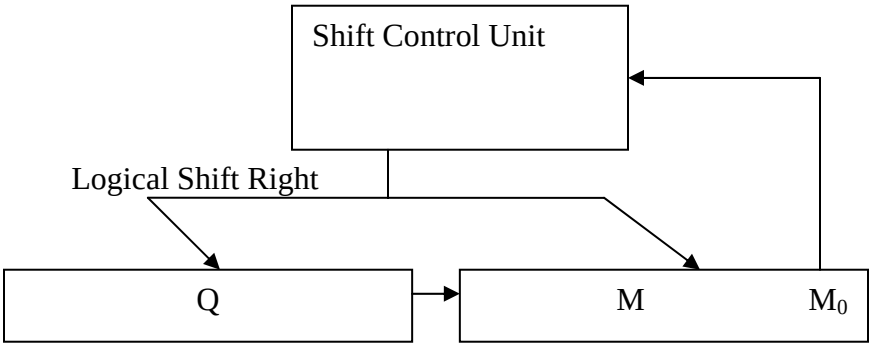
Question 3: (20 marks)

Given an 8-bit unsigned number stored in register Q, we wish to design an algorithm for division of Q by an 8-bit unsigned *power-of-2* number stored in M. the result should be stored in "Q.M" fixed-point format, where Q is the number left of the radix point, and the M is the number right of the radix point. Draw the flowchart for this algorithm, along with a diagram showing Q and M and any needed blocks.

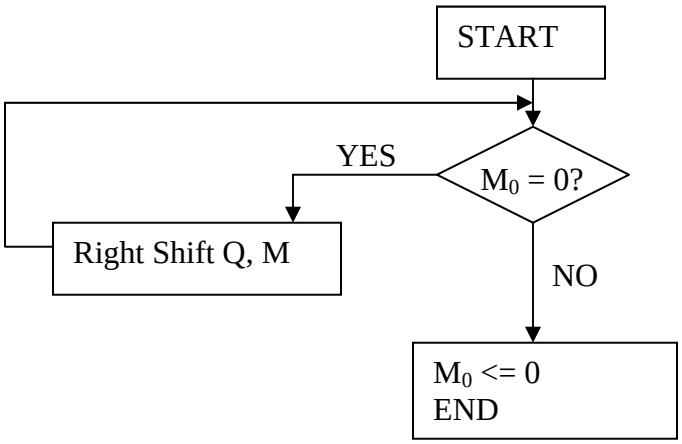
Solution:

This operation is a logical right shift by the number of leading zeros in M. For example, if M is 1000, then Q is shifted to the right by 3 bit positions.

The only block we need besides Q and M is a shift control unit.



(6 marks)



(14 marks)