Computer Organization' 2013
Tutorial # 3

September 10, 2013

1. What modifications are required in the following figure to perform the signed multiplication, so that if the result is negative, it is represented as two's complement.

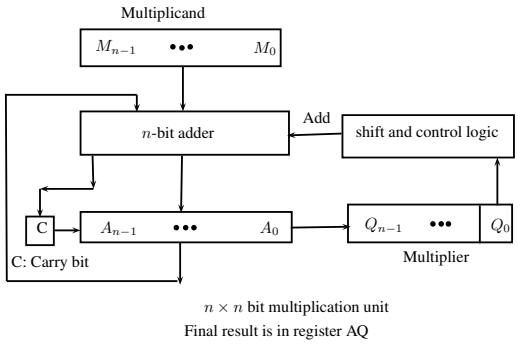
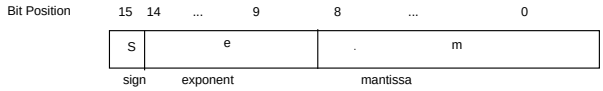


Figure 1: nxn bit multiplication.

2. Construct a circuit to autoincrement / autodecreemnt a 4-bit binary number.
3. Suggest a circuit which receives an input bit-stream along with clock signal. If the bit string even/odd parity then it sets/resets a flip-flop.
4. Design a 4-bit priority encoder.
5. Express the decimal 0.5, -0.123 as signed 6-bit fractions.
6. Assuming a 6-bit exponent, 9-bit normalized fractional mantissa, and exponent is represented in biased format, add the number below:A = 0 100001 111111110, B=0 011111 0010110101. Assume an implicit 1 to the left of mantissa.
7. Assuming all numbers are in 2's complement representation, which of the following numbers is divisible by 11111011? (A) 11100111 (B) 11100100 (C) 11010111 (D) 11011011
8. How overflow can be detected, if the carry bit is not used? I.e., decide it only based on the values of A, B, $C = A + B$ and $C = A - B$. Assume that two's complement is used for negative numbers.
9. The following is a scheme for floating point number representation using 16 bits.



Let s, e, and m be the numbers represented in binary in the sign, exponent, and mantissa fields, respectively. Then the floating point number represented is: $(-1)^s(1 + m \times 2^{-9})2^{e-31}$, if the number $\neq$ 111111, and 0 otherwise.

What is the maximum difference between two successive real numbers representable in this system? (A) 2^{-40} (B) 2^{-9} (C) 2^{22} (D) 2^{31}