March 06

- Chapter 4 – Multiplication/Division

- By Popular demand! The second exam will be 22 March, the SECOND Class after Spring Break.

- Everyone know about the forum?
  - ID = COMP120-001
  - PASSWD =
- Don’t give the password to anyone outside the class.

Multiplication Facts

- N digit number TIMES a M digit number produces: ?

  a (N+M) digit number

- 32 bit number TIMES a 32 bit number produces: ?

  a 64 bit number

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  123
x  45
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  615
492
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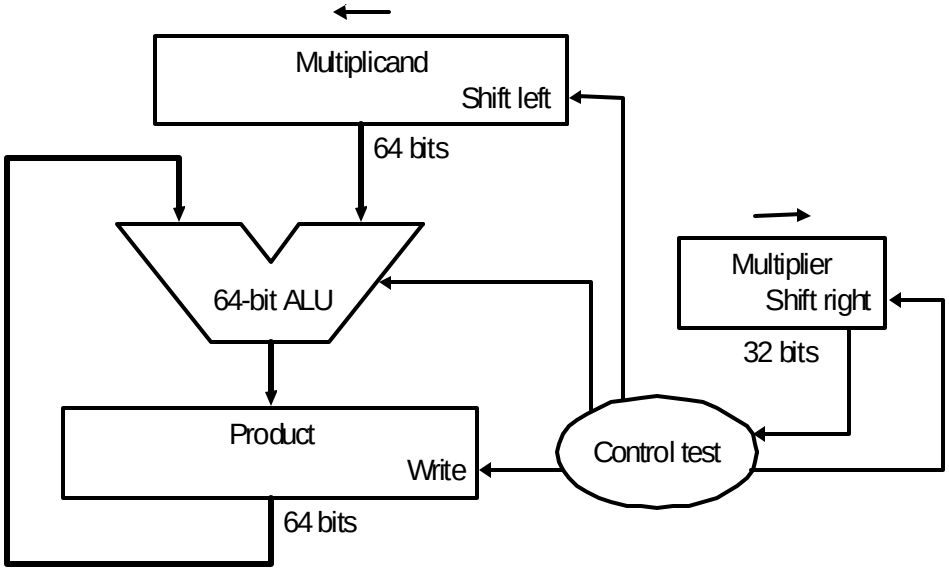
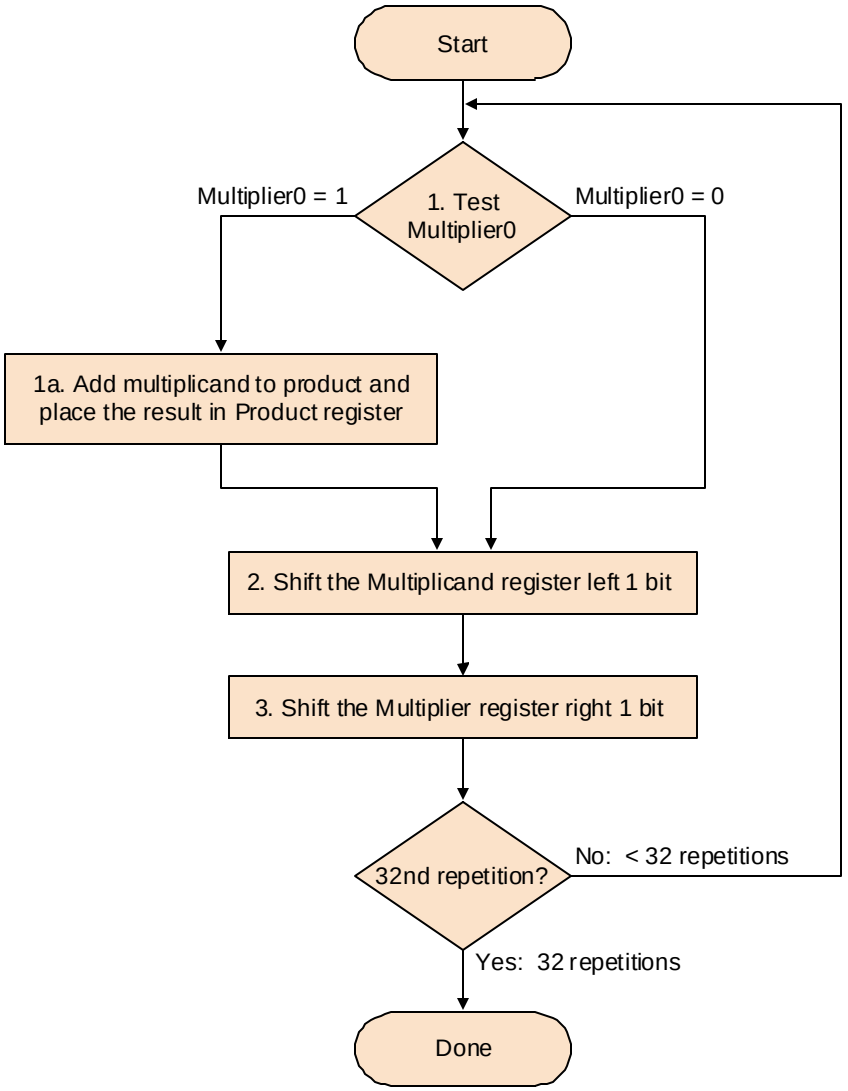
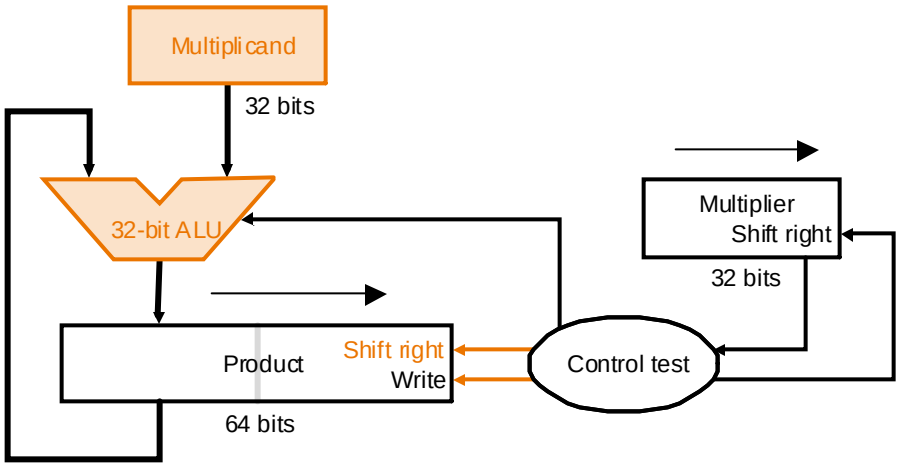
5535
```

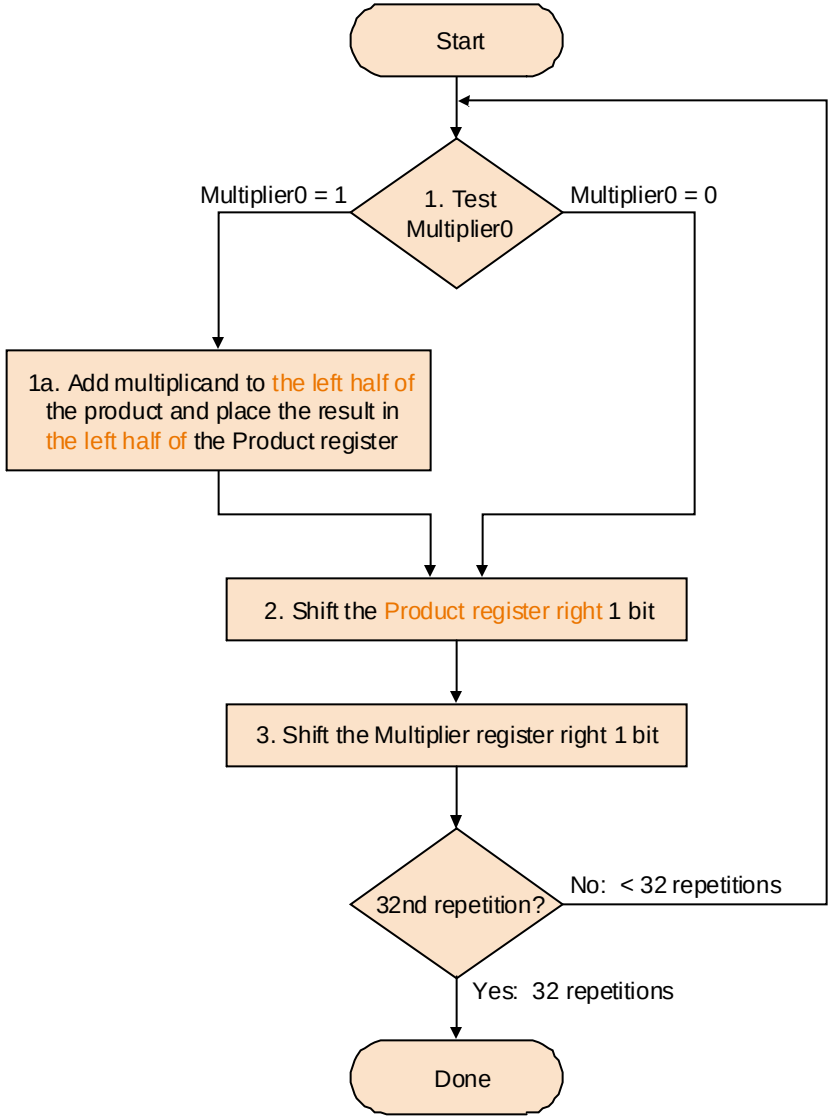
Multiplication: Implementation





Second Version

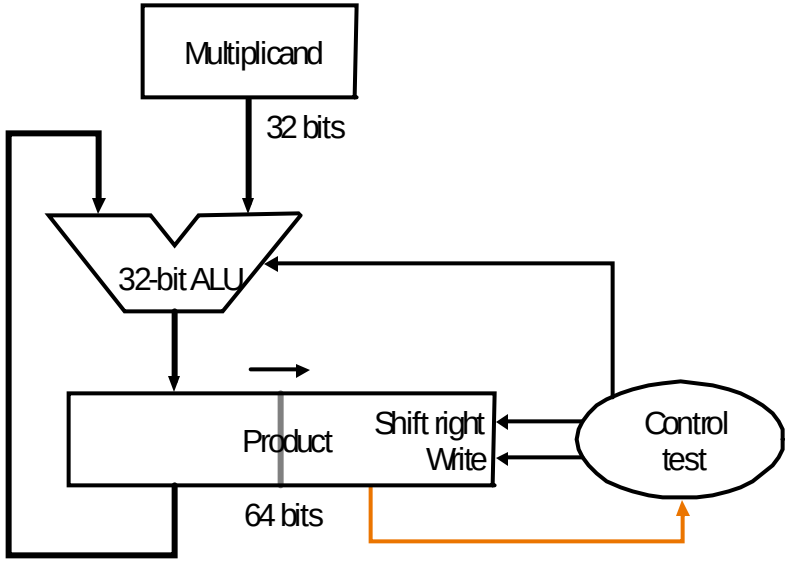


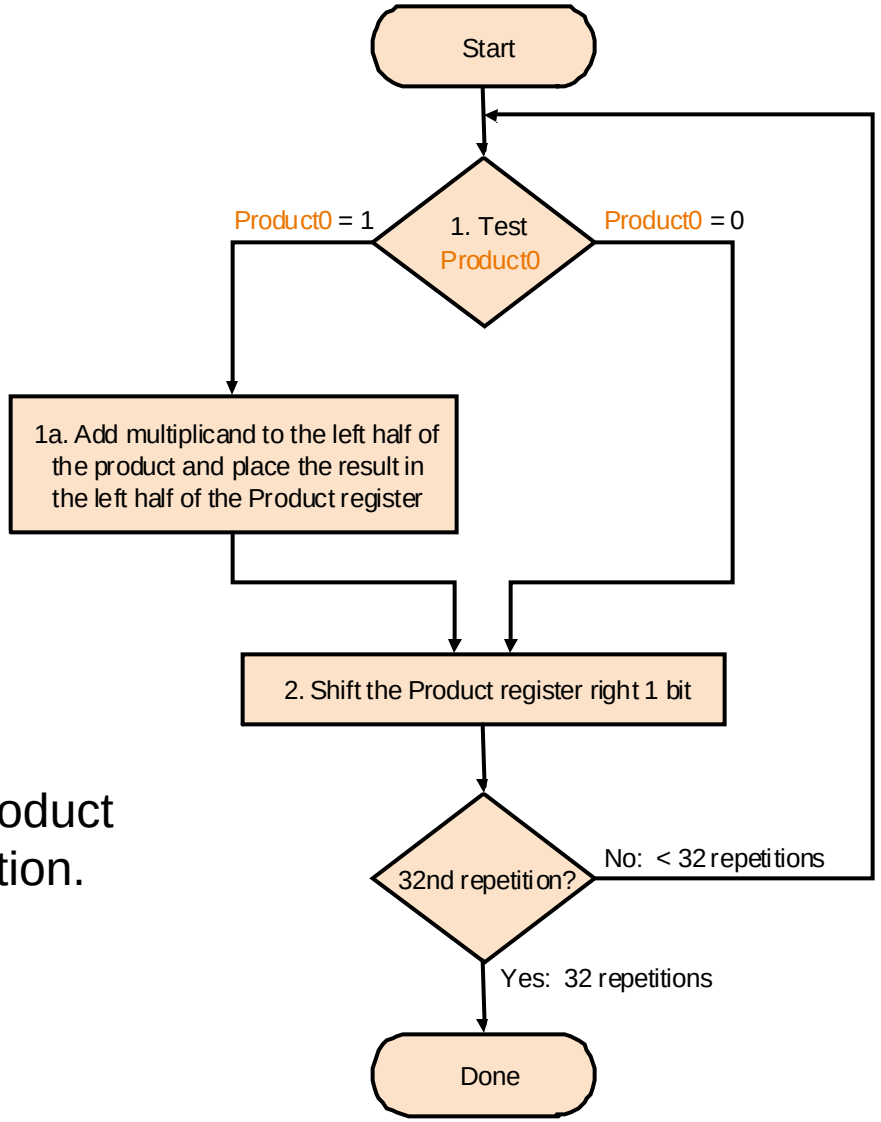


Example for second version

Iteration	Step	Multiplier	Multiplicand	Product
0	Initial	0011	0010	0000 0000
1	Test true shift right	0011 0001	0010	0010 0000 0001 0000
2	Test true shift right	0001 0000	0010	0011 0000 0001 1000
3	Test false shift right	0000 0000	0010	0001 1000 0000 1100
4	Test false shift right	0000 0000	0010	0000 1100 0000 0110

Final Version



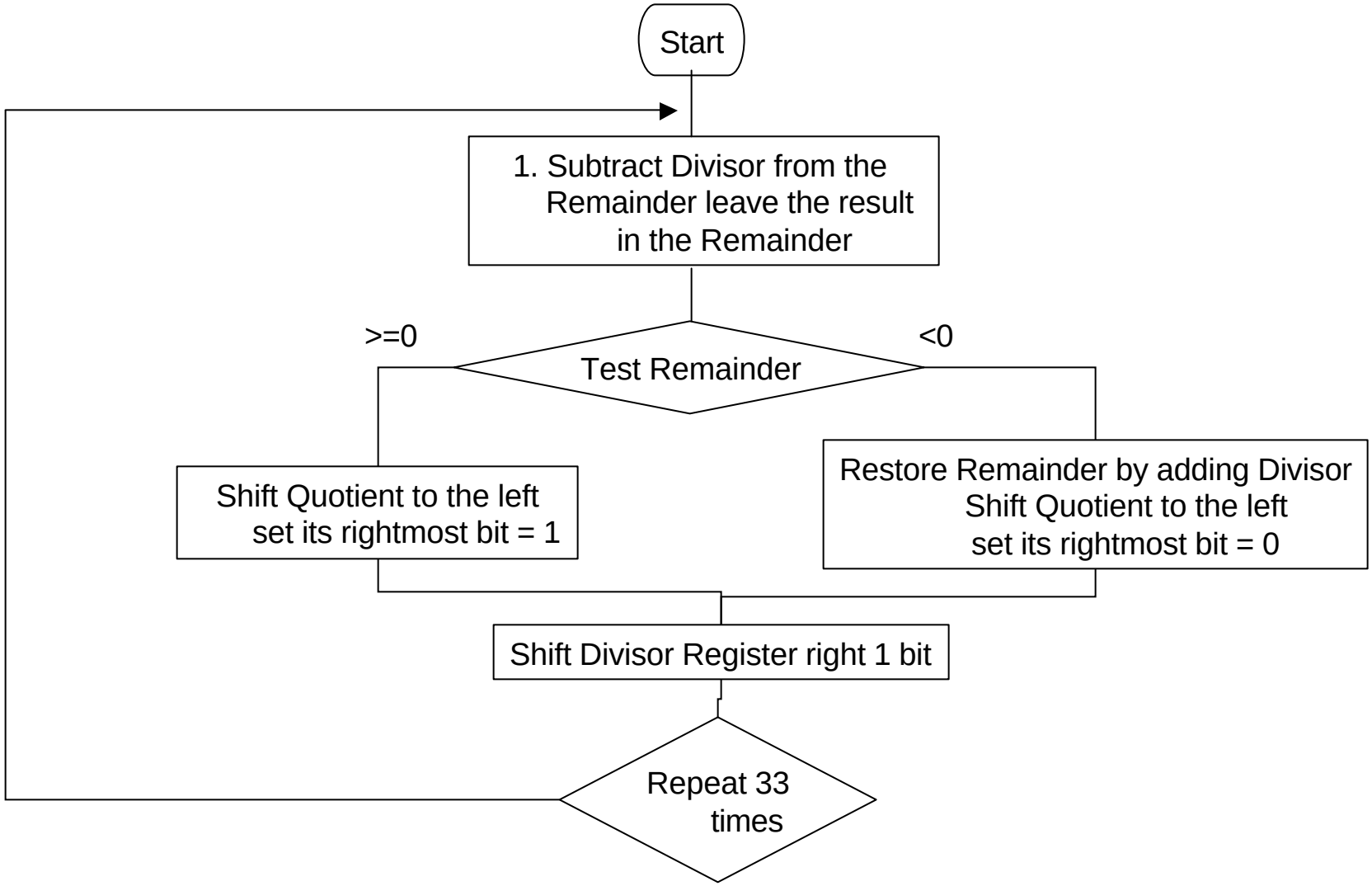


The trick is to use the lower half of the product to hold the multiplier during the operation.

What about the sign?

- Positive numbers are easy.
- How about negative numbers?

Division


Start
1. Subtract Divisor from the Remainder leave the result in the Remainder
Test Remainder
>=0
<0
Shift Quotient to the left set its rightmost bit = 1
Restore Remainder by adding Divisor Shift Quotient to the left set its rightmost bit = 0
Shift Divisor Register right 1 bit
Repeat 33 times