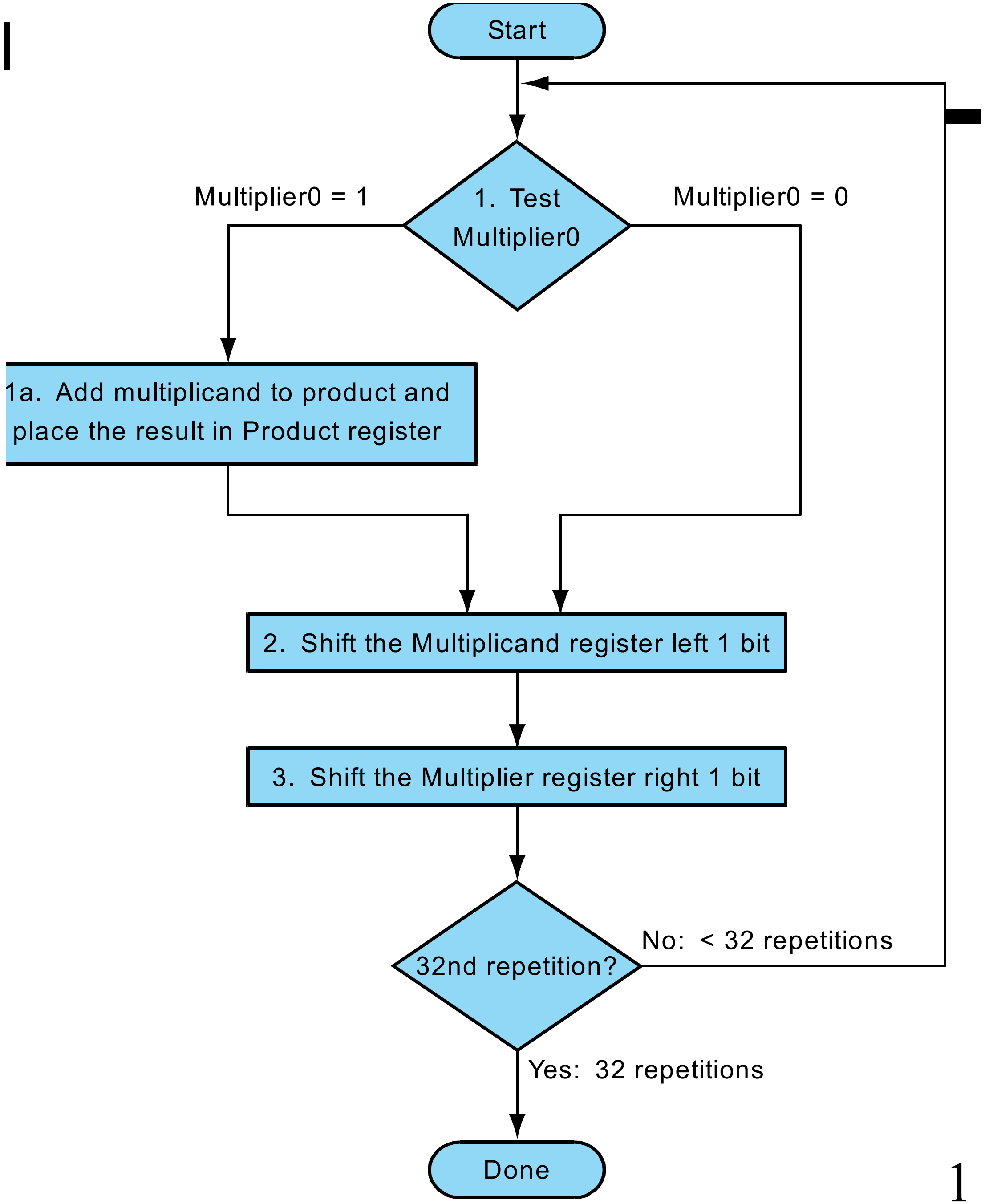
Multiplication Control

We use multiplicand register,
multiplier register,
and product register.
Product register's initial
value is 0.

Multiplier0 is the right most bit
of the multiplier.


Start
Multiplier0 = 1
1. Test Multiplier0
Multiplier0 = 0
1a. Add multiplicand to product and place the result in Product register
2. Shift the Multiplicand register left 1 bit
3. Shift the Multiplier register right 1 bit
32nd repetition?
No: < 32 repetitions
Yes: 32 repetitions
Done

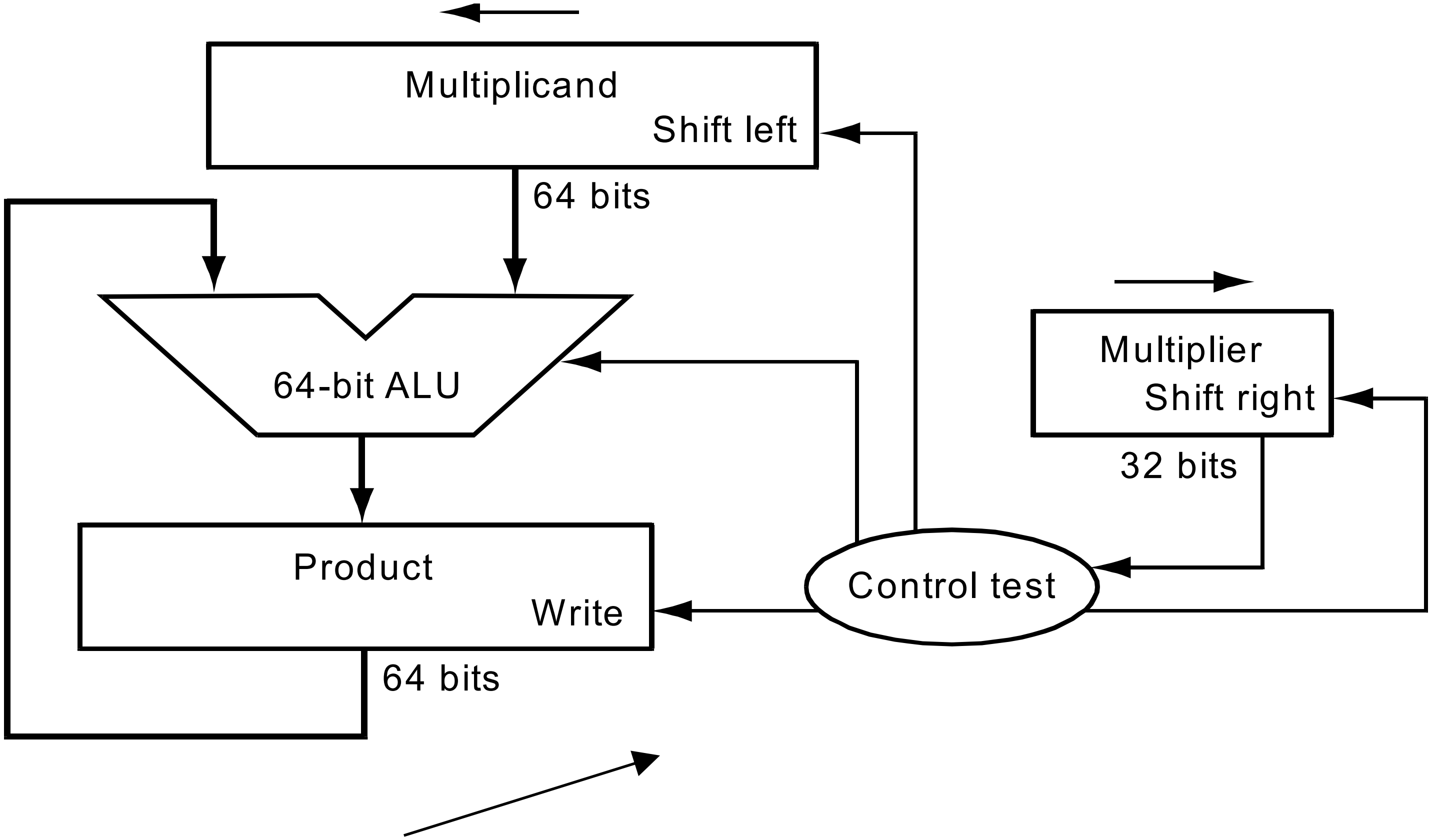
Example: multiply 0110 and 0011 (Assume 4-bit numbers instead of 32-bit numbers)

Iteration	Step	Multiplicand Register value	Multiplier Register value	Product Register value
0	Initial values	0110	0011	0
1st iteration	1a. Prod = Prod+Multiplicand 2.sll Multiplicand by 1 3. srl Multiplier by 1	0 1100	001	0+0110=0110
2nd iteration	1a. Prod = Prod+Multiplicand 2. sll Multplicand by 1 3. srl Multiplier by 1	01 1000	00	0110+01100 = 010010
3rd iteration	2. sll Multplicand by 1 3. srl Multiplier by 1	011 0000	0	010010
4th iteration	2. sll Multplicand by 1 3. srl Multiplier by 1	0110 0000	--	010010

Final Product

Multiplication Hardware

In the previous example, if we use 4-bit multiplicand, we end up 8-bit multiplicand at the end since we kept shifting it 4 times. And the product also ends up in 8 bit. Therefore, if we use 32-bit numbers, then we need 64 bits for multiplicand and product and we need a 64-bit adder to add those two numbers.



Datapath