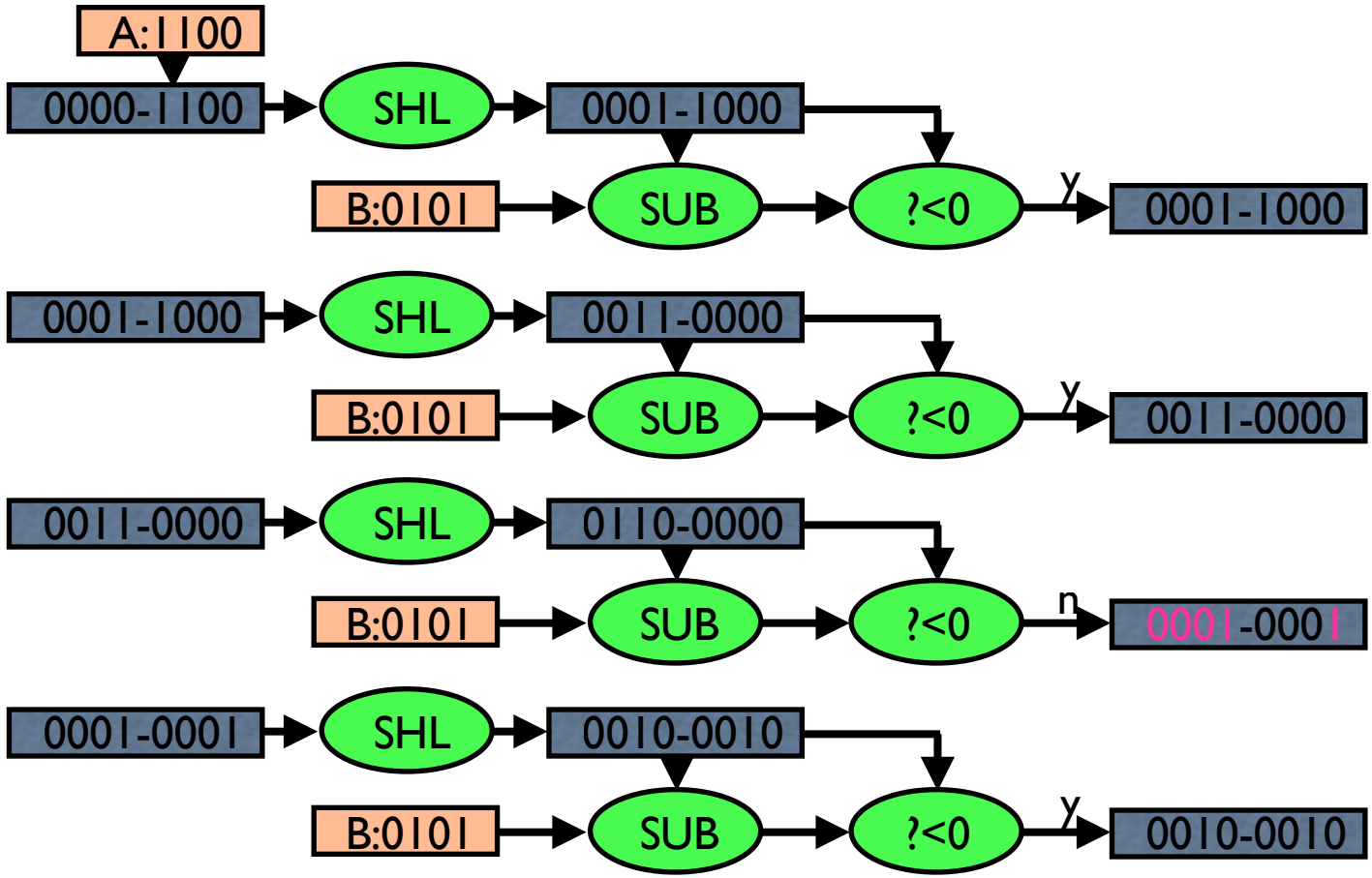
A Large Example: Divider

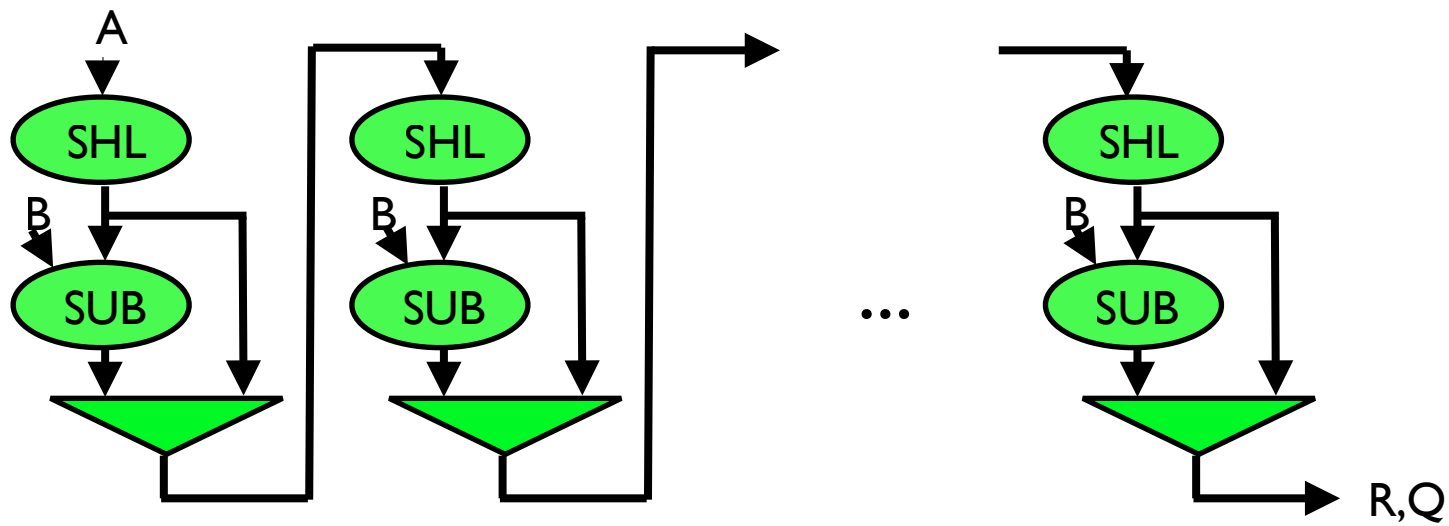
transfer function: $A = (Q \times B) + R$

A, B, R, Q are 8-bit unsigned integers

Shift/Subtract Method



High-level Implementation



Shift: 0 gates, 0 ns
Sub: 165 gates, 450 ns
Mux: 36 gates, 100 ns

Area = 1,608 gates
Delay = 4.4 us
Throughput = 227,272 op/sec

Modeling our Divider in C++

```
void div(unsigned char a, unsigned char b,
         unsigned char &r, unsigned char &q) {
  unsigned short t = a;
  for(int i=0; i<8; i++) {
    t <<= 1;
    int x = (t >> 8) - b;
    if( x < 0 ) continue;
    t = ((t & 0xff) | (x << 8)) | 1;
  }
  r = t >> 8;
  q = t & 0xff;
}
```

Testing our Divider Model

```
int main() {
  unsigned char r, q;
  for(int a=0; a<256; a++)
    for(int b=0; b<256; b++) {
      div((unsigned char)a,
          (unsigned char)b, r, q);
      assert( a == (q * b) + r );
    }
  return 0;
}
```