factor (b)

(1) for i = 1 to b do
     if (b mod i = 0) then F = F ∪ { i }

$$\Longrightarrow O(b) \text{ time}$$

Example: b = 20, F = {1, 2, 4, 5, 10, 20}

(2) for i = 1 to $b^{1/2}$ do
     if (b mod i = 0) then F = F ∪ { i, b div i }

$$\Longrightarrow O(b^{1/2}) \text{ time}$$

Printing the binary representation of a number

$$a : \underbrace{1\ 0\ 1\ 1}_{a \text{ div } 2}\ \underset{\uparrow}{0}$$

a mod 2

PrintBinary (a: integer)
  LastBit := a mod 2

  if (a div 2) > 0 then
    PrintBinary (a div 2)

  write (LastBit)
end;

a : 1 0 1 **1** LastBit $\Longrightarrow$ 1

a div 2 $\Downarrow$ a mod 2 $\Uparrow$

1 0 **1** LastBit $\Longrightarrow$ 1

a div 2 $\Downarrow$ a mod 2 $\Uparrow$

1 **0** LastBit $\Longrightarrow$ 0

a div 2 $\Downarrow$ a mod 2 $\Uparrow$

1 LastBit $\Longrightarrow$ 1

a mod 2

a div 2 = 0
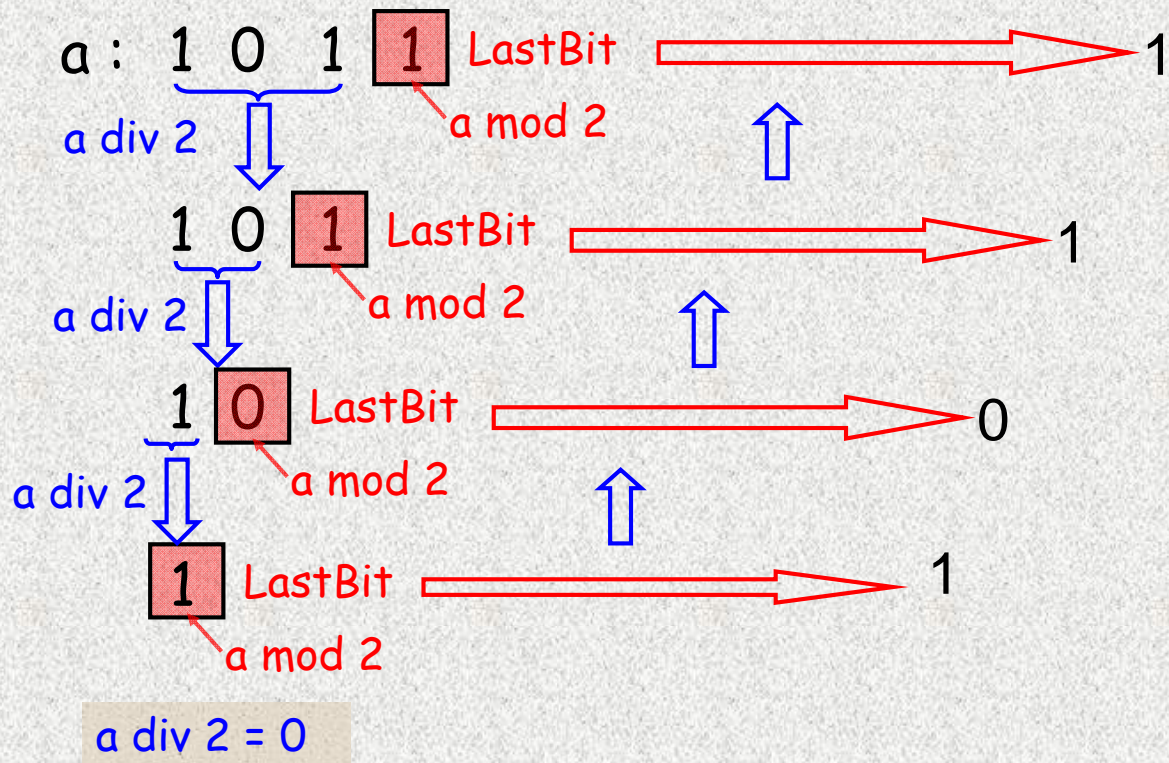
Computation of X^a

$n = \lfloor \lg a \rfloor + 1$

Example:

Step 1: compute

X^1	X^2	X^4	X^8	$\cdots$	$X^{2^{n-1}}$

$a = 25_d$

Step 2: compute

a_0	a_1	a_2	a_3	$\cdots$	a_{n-1}

$n = \lfloor \lg 25 \rfloor + 1 = 5$

X^1	X^2	X^4	X^8	X^{16}

1	0	0	1	1

Step 3: $s := 1$

     for i = 0 to n-1 do

         if $a_i = 1$ then $s := s * X^{2^i}$

$s := 1$
$s := s * X^1$
$s := s * X^8$
$s := s * X^{16}$

$\Longrightarrow$ O(n) = O(lg a) time