Extended GCD

$ax + by = c$ x, y are integers

if $\gcd(x, y) \mid c$ then only solution possible.

solution for $ax_1 + by_1 = g \rightarrow \gcd(x, y)$

solution for original eq^n $\Rightarrow$ $x = x_1 \times \frac{c}{g}$, $y = y_1 \times \frac{c}{g}$

extended GCD :-

```
int gcd( int a, int b, int &x , int &y)
{     if ( b == 0 )
      {  x = 1
         y = 0
         return a; }
      int x1 , y1 ;
      int d = gcd( b, a % b , x1, y1 ) ;

      x = y1
      y = x1 - y1 * (a / b) ;
      return d                     }
```

proof :-

this eqn $\rightarrow$ $bx' + (a \% b)\, y' = g$

$$bx' + \left(a - \left\lfloor \frac{a}{b} \right\rfloor b\right) y' = g$$

$$ay' + b\left(x' - \left\lfloor \frac{a}{b} \right\rfloor y'\right) = g$$

same as

$$ax + by = g$$

0 Flips : [3, 2, 4, 1, 5] at ith step Flips[i] − 1 th bit is flipped.

Binary "00000" $\xrightarrow[\text{step 1}]{}$ ③ "00100" $\xrightarrow[\text{St 2.}]{}$ ② "01100"

count how many times 0 to i in Binary is all 1 while filling Binary according to steps in flip.

i = 0 1 2 3

3 2 4 1 5

$\underbrace{3\ 2\ 4\ 1}_{\text{sum} = 10}$

idx 3/4 $\frac{4 \times (4+1)}{2} = 10$

sum = 15

idx 4/5 $\frac{5 \times 5 + 1}{2} = 15$