$$\left(3^{2024} + 5^{2023}\right) \times 7^{999} \bmod 10$$

satuan digit

$3^1 = 3$
$3^2 = 9$
$3^3 = 7$
$3^4 = 1$
$3^5 = 3$
$3^6 = \ldots$

Pangkat kelipatan 4 digit kembali ke awal

$3^{2024 \bmod 4} = 3^0 = 1$

$5^{2023} \bmod 10 = 5$

$7^{999 \bmod 4}$

$\left(\cancel{7^{996}} \cdot 7^3\right)^{\cancel{\bmod 4}}$

$(1 \cdot 7^3) \bmod 10 = 3$

$\to \varphi(10)$

$3^n \bmod 10 = 3^{n \bmod 4} \bmod 10$

$\varphi(10) = 4$

Euler totient function

$3^n \bmod K \to K$ bil. bulat

$$((1 + 5) \times 3) \bmod 10 = \underline{\underline{8}}$$

$$\left(3^{2024} + 5^{2023}\right) \times 7^{999} \mod 2024$$

Euler Totient Function – Phi (ϕ)

$\varphi(n)$ = Banyaknya bil. relatif prima n (termasuk 1) → cari banyak x yang memenuhi syg gcd(x, n) = 1 } bukan faktor & bisa dibagi n selain 1

$x \leq n$

$\varphi(10)$

10 Faktornya → {2, 5, 10}

bukan faktor {1, 3, 7, 9}

$$\varphi(n) = n \times \left(1 - \frac{1}{p_1}\right) \times \left(1 - \frac{1}{p_2}\right) \times \dots \times \left(1 - \frac{1}{p_n}\right)$$

p_i → fak. prima di n

$\varphi(10)$

$10 = 2 \cdot 5$

$$\varphi(10) = 10 \times \left(1 - \frac{1}{2}\right) \times \left(1 - \frac{1}{5}\right)$$

$$= \cancel{10} \times \frac{1}{\cancel{2}} \times \frac{4}{\cancel{5}}$$

$$= \underline{\underline{4}}$$

$$a^{p} \bmod n \equiv a^{p \bmod \varphi(n)} \bmod n$$

$\gcd(a, n) = 1$

$22 \times 21 \times 20 \times \ldots \times 1 \mod 2024$

$22! \mod 2024 = 22! \mod (88 \cdot 23)$

$(p-1)! \mod p = p-1$

$22! \to p-1 = 22$

$p = 23$

$88 \left(22 \cdot 88^{-1}\right) \mod 23$

$88 \left(\frac{22}{88}\right) \mod 23$

$88 \left(4^{-1} \mod 23\right)$

$$9^{-1} \bmod 23 \equiv 6 \bmod 23$$

$$\frac{1}{9} \bmod 23 \equiv 6 \bmod 23$$

$$6 \cdot 9 \pmod{23} \equiv 1 \pmod{23}$$

$$6 \bmod 23 \equiv \frac{1}{9} \bmod 23$$

inv $9 \bmod 26$

$$27 \pmod{26} \equiv 1 \pmod{26}$$

$$9 \cdot 3 \pmod{26} \equiv 1 \pmod{26}$$

$$9 \bmod 26 \equiv \frac{1}{3} \pmod{26}$$

$$9 \bmod 26 \equiv 3^{-1} \bmod 26$$

$$3^{-1} \bmod 26 \equiv 9 \bmod 26$$

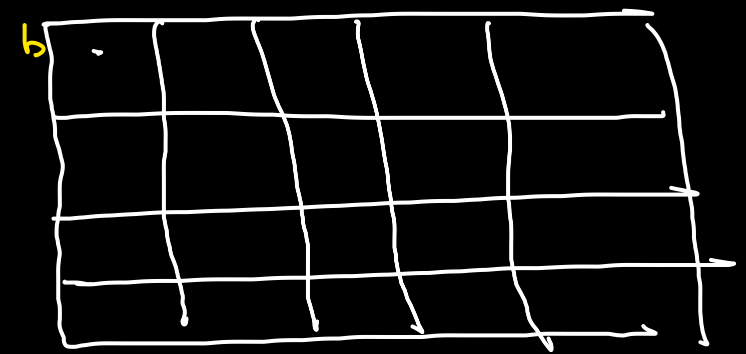
1. Penjumlahan, Pengurangan, Perkalian, Pembagian, Dengan Gaya
2. GCD/ FPB sama KPK (banyak cara representasi program Rekursif, Bisa ga rekursif, Bisa pake modulo gak pake modulo)
3. Kombinatorika
4. DP Grid (max(f(x-1,y), f(x,y - 1)) atau DP lainnya
5. Linear Diophantine (Hasil kembangan FPB Algoritma Euclid)

```
int jeje[12][12];
int tanya(int x, int y) {
  return jeje[x][y];
}
int main() {
  for (int a = 0; a <= 10; a++) {
    jeje[a][0] = 1;
    for (int b = 1; b < a; b++) {
      jeje[a][b] = jeje[a - 1][b] + jeje[a - 1][b - 1];
    }
    jeje[a][a] = 1;
  }
  tanya(10,3)
}
```

5

a = 0, b = 1

jeje[a,b] = $^{a}C_{b}$



b = 0 return 1

tanya(5,3) jeje

$= 10$

tanya(x,y) = $^{x}C_{y}$

tanya(9,3) = 9?

tanya(5,3) = 10?

t(x,y) = j[x][y]

jeje(x,y) = jeje(x-1,y) + jeje(x-1,y-1)

tanya(10,3) = $^{10}C_{3}$

= 120

$$nCr = \frac{n!}{(n-r)!\, r!}$$

$$nCr = \underline{f(n-1, r) + f(n-1, r-1)}$$

$r = 0$ } return 1

$$5C_0 = \frac{\cancel{5!}\ 1}{\cancel{5!}\ \cancel{0!}\ 1}$$

$$= 1$$

$$nC_r \quad r=0 \quad = 1$$

$f(n,r) = f(n-1, r) + f(n-1, r-1)$ { $r=0$ return 1

```
int jeje(int x)
{
if(x == 0) return 0;
if(x & 1) return 1 + jeje(x / 2);
else return jeje(x / 2);
}
int main()
{
cout << jeje(1040);
}
```

→ 0 + jeje(x/2)

Biner

→ gede

jeje (7) =

1 + jeje (7/2)

1 + jeje(3)

1 + jeje (1)

1 + 0

= 1 + 1 + 1

= 3

1 & (a) :

Perintah → Kalau a = true, a = 1

1040 =

$$x \,\&\, 1 \begin{cases} 1, & x \text{ ganjil} \\ 0, & x \text{ genap} \end{cases}$$

Genap = ... $0 \,\&\, 1 = 0$

Ganjil = ... $1 \,\&\, 1 = 1$

7 odd biner :

$7/2 = 3$ sisa 1

$3/2 = 1$ sisa 1

$1/2 = 0$ sisa 1

$0/2 = 0$

8 biner :

$8/2 = 4$ sisa 0

$4/2 = 2$ sisa 0

$2/2 = 1$ sisa 0

$1/2 = 0$ sisa 1

1000 =

jeje(x) $\underline{1 + 1 = 2}$

berapa kali hasilnya ganjil

kalau $x/2$ terus sampai

0

$1040/2 = 520$

$520/2 = 260$

$260/2 = 130$

$130/2 = 65$ $\underline{(+1)}$

$65/2 = 32$

$32/2 = 16$

$16/2 = 8$

$8/2 = 4$

$4/2 = 2$

$2/2 = 1$ $\underline{(+1)}$

$1/2 = 0$ stop

1. Konsep / ide
2. Amanin Pola
3. Kuui