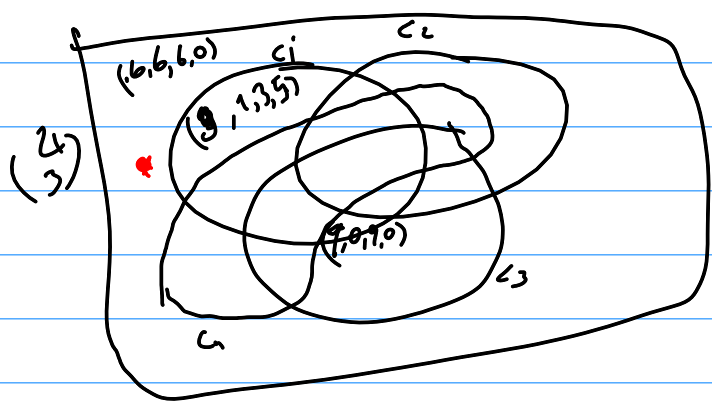
$x_3 \geq 8,\ x_2 \geq 8 \to 10$

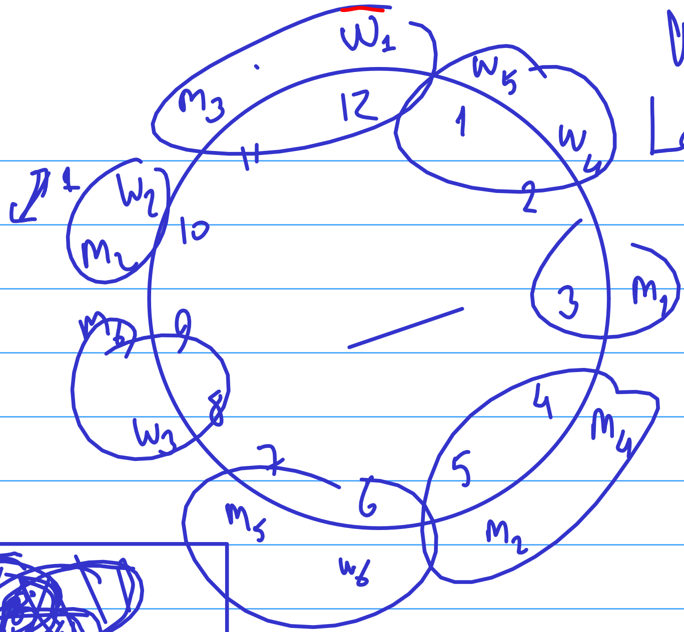
$$\underline{x_1 + x_2 + x_3} + x_4 = \underset{=2}{18} \qquad 0 \leq x_i \leq 7 \qquad i = 1,2,3,4$$

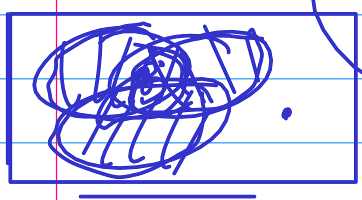
Let $c_i : x_i \geq 8$ then. $\# = \bar{N} = S_0 - S_1 + S_2 - \underset{=0}{S_3} + \underset{=0}{S_4}$

$S_0 = N = \binom{4}{0}\binom{21}{3}$ $\quad S_1 = \sum_i N(c_i) = \binom{4}{1}\binom{13}{3}$ $\quad \ldots S_2 = \binom{4}{2}\binom{5}{3}$

$$\# = \binom{21}{3} - \binom{4}{1}\binom{13}{3} + \binom{4}{2}\binom{5}{3}$$







We can use P.I.E.

Let C_i : W_i & M_i sits next to each other.

Ans: $\bar{N} = S_0 - S_1 + S_2 - S_3 + S_4 - S_5 + S_6$

$= 11! - \binom{6}{1}(2 \cdot 10!) + \binom{6}{2}(2^2 \cdot 9!)$

$- \binom{6}{3}(2^3 \cdot 8!) + \binom{6}{4}(2^4 \cdot 7!) -$

$\binom{6}{5}(2^5) \cdot 6! + \binom{6}{6} 2^6 \cdot 5!$

$=$

RSA $\quad n = p \cdot q \quad \varphi(n) = (p-1)(q-1)$

Euler's totient fun.

$35\cdot(1-\frac{1}{5}-\frac{1}{7}+\frac{1}{35})$

$35(\frac{5-1}{5})(\frac{7-1}{7})$

$\varphi(n)$ is the number of numbers $\leq n$, and coprime with n.

$\varphi(12) = 4 \qquad 1\ \cancel{2}\ \cancel{3}\ \cancel{4}\ 5\ \cancel{6}\ 7\ \cancel{8}\ \cancel{9}\ \cancel{10}\ 11\ \cancel{12}$

$\varphi(35) = 5.7 = 4.6 = 24 \qquad 35 - \frac{35}{5} - \frac{35}{7} + 1$

$1\ 2\ 3\ 4\ \cancel{5}\ 6\ \cancel{7}\ 8\ 9\ \cancel{10}\ 11\ 12\ 13\ \cancel{14}\ \cancel{15}\ \ldots\ \cancel{35}$

$\varphi(n) = ? \qquad n = p_1^{\alpha_1} p_2^{\alpha_2} \cdots p_t^{\alpha_t}$

$2^3 3^5 5^1 = \ldots$

$\varphi(n) = n\left(1-\frac{1}{p_1}\right)\left(1-\frac{1}{p_2}\right)\cdots\left(1-\frac{1}{p_t}\right)$

$\varphi(n) \ldots$

$n = p_1^{\alpha_1} p_2^{\alpha_2} \cdots p_t^{\alpha_t} \qquad (1\ 2\ 3\ \ldots\ \ldots\ \ldots \qquad n \qquad 16 \qquad 45 = 3.3.5$

C_i: div by $p_i \qquad S_1 = N(C_1) + N(C_2) + N(C_3) + \cdots + N(C_t)$

$S_1 = \sum_i N(C_i)$

$\varphi(n) = \bar{N} = S_0 - S_1 + \cdots + (-1)^t S_t$

$= n - \left(\frac{n}{p_1} + \frac{n}{p_2} + \cdots + \frac{n}{p_t}\right) + \left(\frac{n}{p_1 p_2} + \frac{n}{p_1 p_3} + \cdots + \frac{n}{p_{t-1} p_t}\right) - \left(\frac{n}{p_1 p_2 p_3} + \cdots\right) \cdots (-1)^t\left(\frac{n}{p_1 p_2 \cdots p_t}\right)$

$$\boxed{\varphi(n) = n\left(1-\frac{1}{p_1}\right)\left(1-\frac{1}{p_2}\right)\cdots\left(1-\frac{1}{p_t}\right)}$$

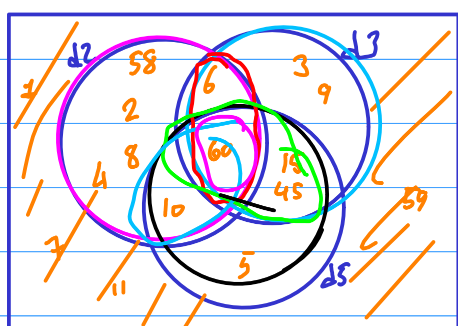
$60 = 2^2 . 3^1 5^1$

$\# = \bar{N} = S_0 - S_1 + S_2 - S_3$

$= 60 - 30 - 20 - 12 + 10 + 4 + 6 - 2$

$= 60(1-\frac{1}{2})(1-\frac{1}{3})(1-\frac{1}{5})$

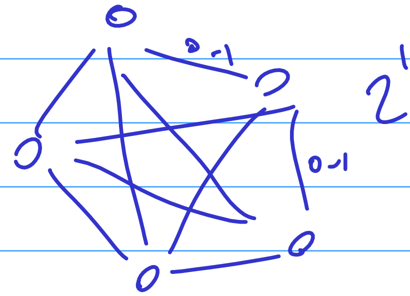
$= 60($

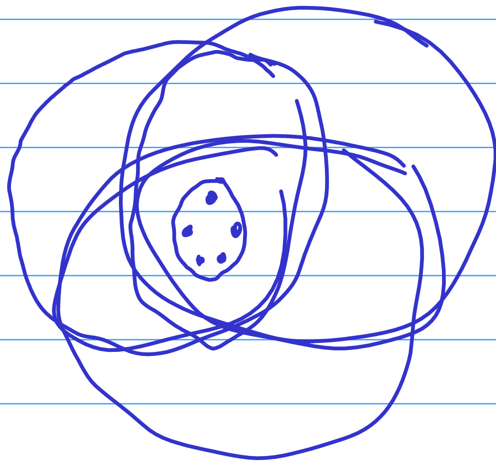


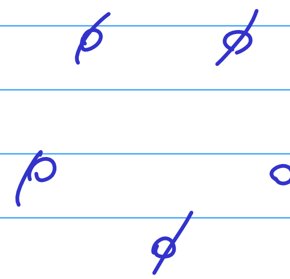
Let c_i : v_i is isolated

Then the answer $= \bar{N} = S_0 - S_1 + S_2 - S_3 + S_4 - S_5$

$$= 2^{\binom{5}{2}} - \binom{5}{1} 2^{\binom{4}{2}} + \binom{5}{2} 2^{\binom{3}{2}} - \binom{5}{3} 2^{\binom{2}{2}} + \binom{5}{4} \cdot 1 - \binom{5}{5} \cdot 1$$





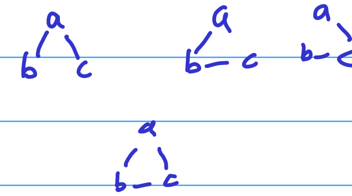


#V=3

$$\bar{N} = S_0 - S_1 + S_2 - S_3$$

$$= \binom{3}{3} 2^{\binom{3}{2}} - \binom{3}{1} 2^{\binom{2}{2}} + \binom{3}{2} 1 - \binom{3}{3} \cdot 1$$

$$= 8 - 3.2 + 3 - 1$$



$$= 4$$