Assignment 2

(1)

$x \equiv 2 \pmod 3$

$x \equiv 3 \pmod 5$

$x \equiv 2 \pmod 7$

$$x \equiv \underset{(\bmod 3)}{35} + \underset{(\bmod 5)}{21} + \underset{(\bmod 7)}{15}$$

Applying mod 3

$x \equiv (35 + 0 + 0) \bmod 3$

$= 2 \bmod 3$

Applying mod 5

$\equiv (0 + 21 + 0) \bmod 5$

$= 21 \bmod 5 = 1 \bmod 5$

So, we need to multiply 21 by 3.

Applying mod 7

$= (0 + 0 + 15) \bmod 7$

$= 1 \bmod 7 = 2 \bmod 7$

(Multiply 15 by 2)

$\equiv (35 + 21 \cdot 3 + 15 \cdot 2)$

$= 128 \bmod (245)$

Ans

Q4)

$30 = 2 \cdot 3 \cdot 5$

$gcd(2,3,5) = 1$

Using Chinese Remainder Theorem

for each $k = 0, \dots 29 \mod (30)$

$\exists$ unique (a, b, c) s.t

$k \equiv b \pmod 3$ &

$k \equiv c \pmod 5$

So, $N = 2! \cdot 3! \cdot 5! = 1440$ and

440 is Ans

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(2) $x^2 \equiv 1 \pmod 3$
$x \equiv 2 \pmod 4$

$\Rightarrow$ $x^2 \equiv 4 \pmod 4$

$x^2 = 1 + 4$

$\Rightarrow$ $x^2 \equiv 5 \pmod 3$
$\equiv 2 \pmod 3$
$\equiv 1 \pmod 3$ (Divide eqn by 2)

$x^2 \equiv 5 \bmod 4 \equiv 1 \bmod 4$
$\equiv 4 \bmod 4$ (Multiply 1 by 4)

$\Rightarrow x^2 = \frac{1}{2} + \frac{4}{2} = 1+2$
$= 4 \cdot 1 + 2 = 4 + 2 = 6 \bmod (12)$

$x \equiv 2 \bmod (12)$
& $x \equiv 3 \bmod (12)$