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Some of the answers were arrived at while working in group with:

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Problem 11.1

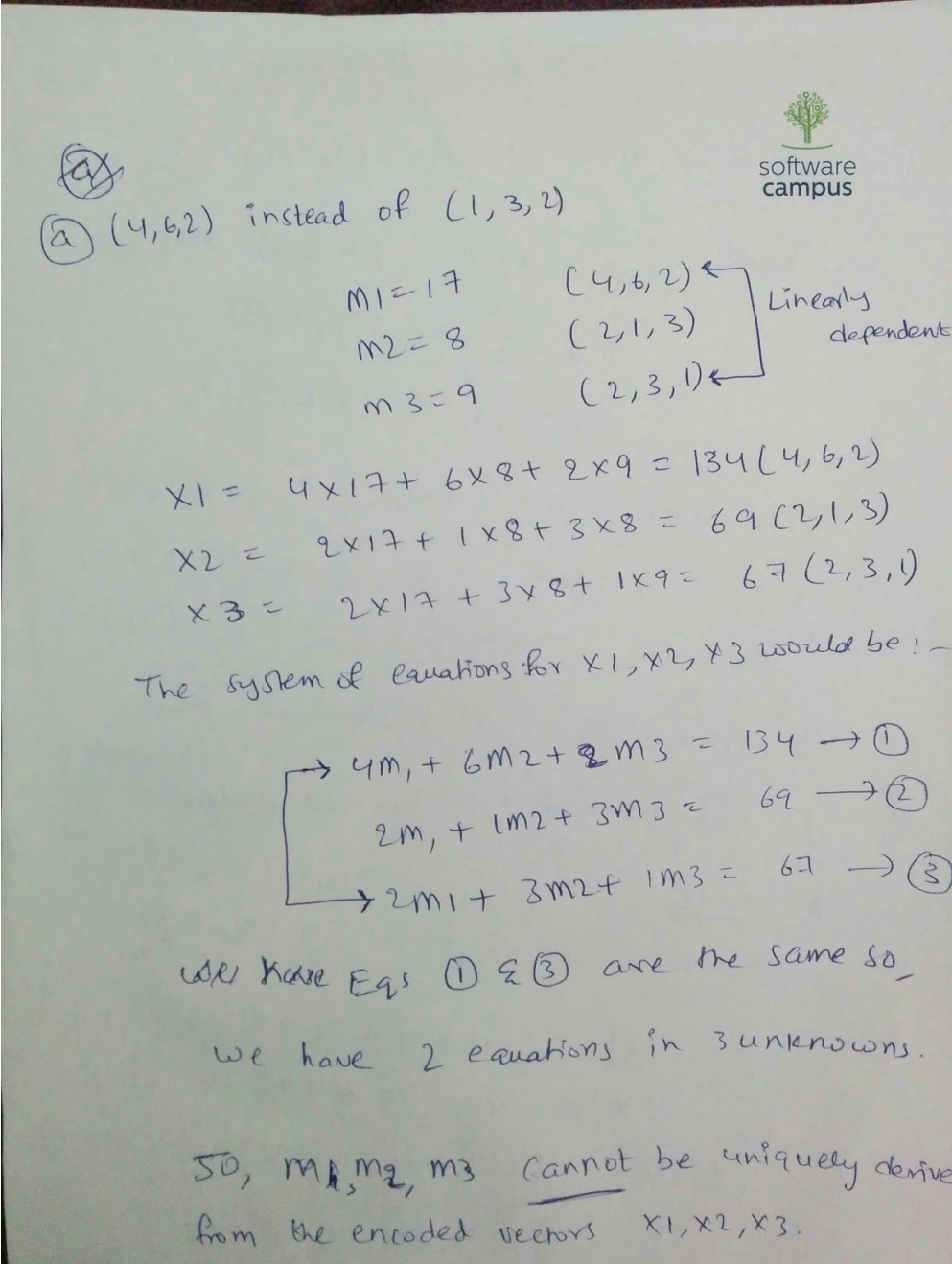
A. Time taken : 40 ms (Node N3 would be a bottleneck)
Number of message exchanged between nodes : 8

B. Time taken : 30 ms
Number of message exchanged between nodes : 7

Continued

C. Assuming every other coefficients are as chosen in the lecture.

a. Written solution



~~(a)~~
(a) $(4, 6, 2)$ instead of $(1, 3, 2)$

$m_1 = 17$
 $m_2 = 8$
 $m_3 = 9$

$(4, 6, 2)$
 $(2, 1, 3)$
 $(2, 3, 1)$

Linearly dependent

$x_1 = 4 \times 17 + 6 \times 8 + 2 \times 9 = 134$
 $x_2 = 2 \times 17 + 1 \times 8 + 3 \times 9 = 69$
 $x_3 = 2 \times 17 + 3 \times 8 + 1 \times 9 = 67$

The system of equations for x_1, x_2, x_3 would be:-

$4m_1 + 6m_2 + 2m_3 = 134 \rightarrow (1)$
 $2m_1 + 1m_2 + 3m_3 = 69 \rightarrow (2)$
 $2m_1 + 3m_2 + 1m_3 = 67 \rightarrow (3)$

As we have Eqs (1) & (3) are the same so,
we have 2 equations in 3 unknowns.

So, m_1, m_2, m_3 cannot be uniquely derived from the encoded vectors x_1, x_2, x_3 .

b. Written solution

(b) $(4, 6, 3)$ instead of $(1, 3, 2)$

we have,

$m_1 = 17$	$(4, 6, 3)$
$m_2 = 8$	$(2, 1, 3)$
$m_3 = 9$	$(2, 3, 1)$

$x_1 = 4 \times 17 + 6 \times 8 + 3 \times 9 = 143 (4, 6, 3)$

$x_2 = \text{same} = 69 (2, 1, 3)$

$x_3 = \text{same} = 67 (2, 3, 1)$

→ system eqs are independent, Hence Solvable
if re-modularity is also independent.

At Peer 2,

$(5, 4)$	$143 (4, 6, 3)$
$(1, 1)$	$69 (2, 1, 3)$

$x_1' = 143 \times 5 + 69 \times 4 = 991$

$x_2' = 143 \times 1 + 69 \times 1 = 212$

coeff $i' = (1+4) \times 4, (5+4) \times 4, (5+4) \times 3$

$= (36, 36, 27)$

coeff $i'' = (1+1) \times 2, (1+1) \times 1, (1+1) \times 3$

$= (4, 2, 6)$


At Peer 3,

$67 (2, 3, 1)$

$991 (36, 54, 27)$

$212 (4, 2, 6)$

Indep. equations so, Solvable


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D. Written solution

(d) At Node 1:

$$m_1 = 6$$

$$m_2 = 2$$

$$m_3 = 7$$

$$(2, 1, 5)$$

$$(1, 2, 3)$$

$$(3, 1, 1)$$

$$X_1 = 6 \times 2 + 2 \times 1 + 7 \times 5 = 49$$

$$X_2 = 1 \times 6 + 2 \times 2 + 3 \times 7 = 31$$

$$X_3 = 3 \times 6 + 1 \times 2 + 1 \times 7 = 27$$

Encoded Values from N1: $X_1 = 49 (2, 1, 5)$
~~Values from~~

$$X_2 = 31 (1, 2, 3)$$

$$X_3 = 27 (3, 1, 1)$$

At Node 2:-

~~Co. effs~~

$$(7, 3)$$

$$(1, 2)$$

X^s

$$49 (2, 1, 5)$$

$$31 (1, 2, 3)$$

$$|X_1| = 7 \times 49 + 3 \times 31 = 436$$

$$|X_2| = 1 \times 49 + 2 \times 31 = 111$$

re-encoded Coeffs: $(20, 10, 56)$
 $(3, 6, 4)$

$$X_1' = 436 (20, 10, 50)$$

$$X_2' = 111 (3, 6, 9)$$



→ Info exchanged between nodes:

$$N1 \rightarrow N2: \begin{aligned} X_1 &= 49 (2, 1, 5) \\ X_2 &= 31 (1, 2, 3) \end{aligned}$$

$$N1 \rightarrow N3: X_3 = 27 (3, 1, 1)$$

$$N2 \rightarrow N3: \begin{aligned} X_1' &= 436 (20, 10, 50) \\ X_2' &= 111 (3, 6, 9) \end{aligned}$$