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An alternative method to solve a system of one-variable linear congruences with prime moduli

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We consider a system of linear congruences of a single variable with specific conditions and construct a new faster method to solve that system without using the Chinese remainder theorem . The concerned system of congruences is $\boldsymbol{a_i x \equiv b_i \, mod(m_i)}$, for $\boldsymbol{0 < a_i, b_i < m_i}$ **for all** $\boldsymbol{i = 1, 2, 3, \dots, n}$ with all $\boldsymbol{m_i}$ values are prime. This system can be reduced to a single linear congruence of the same variable and it has a unique solution. The single congruence is

$\boldsymbol{(a_1 M_1 + a_2 M_2 + \cdots + a_n M_n)x \equiv (b_1 M_1 + b_2 M_2 + \cdots + b_n M_n)}$ (mod M) where $\boldsymbol{M = m_1 \times m_2 \times \dots \times m_n}$ and $\boldsymbol{M_i = \frac{M}{m_i}}$ for all $\boldsymbol{i = 1, 2, 3, \dots, n}$.

The unique solution of the single congruence is the solution of the above system.

Keywords: Chinese remainder theorem, linear congruence and prime modulo

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