i) $m=2$,

$a_1, a_2, N \in \mathbb{Z}$ s.t. $N \neq 0$ 이므로

$\gcd(a_1, N) = 1$

$\gcd(a_2, N) = 1$

$\rightarrow \gcd(a_1 a_2, N) = 1 \cdots (1)$ ($\because$ Lemma 48)

So the assertion is true for $m=2$

ii) Assume that the assertion holds for every $m = 2, 3, 4, \cdots, k$ (≥ 2)

iii) Now, consider the case where $m=k+1$.

$m=k$ 일때 식이 성립하므로

$\gcd(a_1 a_2 \cdots a_k, N) = 1$. $\cdots (1)$ ($a_1 a_2 \cdots a_k, N \in \mathbb{Z}$ s.t. $N \neq 0$)

$m=k+1$ 일때, $a_{k+1}, a_1 a_2 \cdots a_k, N \in \mathbb{Z}$ s.t $N \neq 0$ 이므로

$\gcd(a_{k+1}, N) = 1$.

$\gcd(a_1 a_2 \cdots a_k, N) = 1$ ($\because (1)$) $\rightarrow \gcd(a_1 a_2 \cdots a_{k+1}, N) = 1$ ($\because$ Lemma 48)

Thus the assertion is true for $m=k+1$.

IV) Therefore we conclude that the assertion is true for every $m \geq 2$ ▨