

PROBLEM 1. Show there are no integer solutions to the equation

$$x^4 - 125x^3 - 75x^2 + 5x + 15 = 123456789.$$

PROBLEM 2. Does Sunzi's theorem still hold if we drop the requirement that the n_i are relatively prime? Prove your assertion or provide a counterexample.

PROBLEM 3. A group of 17 people stack their books in 11 piles of equal size, each containing more than one book, and an additional pile containing 6 books. They collect the books and this time stack them into 17 equally-sized piles, with no left over. What is the smallest number of books they could have had? [Hint: -3 is the multiplicative inverse of 11 modulo 17.]

PROBLEM 4. Find *all* solutions $x \in \mathbb{Z}$ to the system of congruences

$$x = 2 \pmod{4}$$

$$x = 3 \pmod{5}$$

$$x = 4 \pmod{9}.$$

PROBLEM 5. Find all integers x, y such that

$$2x + 5y = 4 \pmod{11}$$

$$x + 3y = 7 \pmod{11}.$$