Problem 1. (From the book.) Do the following problems:
Chapter 6 Problem Set, pages 48–49: 5-8, 12, 15

Problem 2. Let \( d, n \in \mathbb{N} \) such that \( d \mid n \). Show that for \( a \in \mathbb{N} \), \( (a^d - 1)(a^n - 1) \).
(Hint: Notice that for \( k \in \mathbb{N} \), \( x^k - 1 = (x - 1)p(x) \) for some function \( p(x) \). What is \( p(x) \)?)

Problem 3. Compute the value of \( 2222^{5555} + 5555^{2222} \pmod{7} \).

Problem 4. Recall that a composite number \( n \) is an absolute pseudoprime if \( n \mid a^n - a \) for every \( a \in \mathbb{Z} \) such that \( (a, n) = 1 \).
   i. Prove or disprove that \( n = 2465 \) is an absolute pseudoprime.
   ii. Show that if \( n = (6k + 1)(12k + 1)(18k + 1) \) for some \( k \in \mathbb{N} \) such that all three factors are prime, then \( n \) is an absolute pseudoprime.
   iii. Use the previous part to find the smallest absolute pseudoprime of this form.

Problem 5. Let \( p, q \) be distinct primes and suppose \( a \in \mathbb{Z} \) so that \( a^p \equiv a \pmod{q} \) and \( a^q \equiv a \pmod{p} \). Prove that \( a^{pq} \equiv a \pmod{pq} \).