Problem 1:
Section 2.3 Problem 6 (Fifth edition, Section 1.8, Problem 6).

Problem 2:
Section 2.3 Problem 10 (Fifth edition, Section 1.8, Problem 10).

Problem 3:
Prove or disprove that if \( a, b, \) and \( c \) are positive integers and \( a | bc \) then \( a | b \) or \( a | c \).

Problem 4:
Section 3.4 Problem 16 (Fifth edition, Section 2.4, Problem 36).

Problem 5:
How many zeros are there at the end of \( 100! \). Determine this without computing \( 100! \).

Problem 6:
Prove that if \( n \) is an odd positive integer, then \( n^2 \equiv 1 \pmod{8} \).

Problem 7:
For each \( a \in \{1, \ldots, 10\} \) determine the smallest \( k \geq 1 \) such that \( a^k \mod{11} = 1 \).

Problem 8:
Use Fermat’s Little Theorem to compute \( 3^{302} \mod{5} \), \( 3^{302} \mod{7} \) and \( 3^{302} \mod{11} \).

Problem 9:
Prove that if \( p \) is prime, and \( x^2 \equiv 1 \pmod{p} \) then \( x \equiv 1 \pmod{p} \) or \( x \equiv (p-1) \pmod{p} \).

Extra Credit 10:
Let \( p \) be an odd prime. A number \( a \in \{1, \ldots, p-1\} \) is a quadratic residue if the equation \( x^2 \equiv a \pmod{p} \) has a solution for \( x \). Show that there are exactly \((p-1)/2\) quadratic residues modulo \( p \).