1. Residual Number System (10 points): Show the operation of $8 \times 17$ in a residual number system with moduli $(m_1, m_2, m_3) = (3, 7, 8)$.

2. Residual Number System (15 points): Suppose $(x \% 4, x \% 5, x \% 7) = (1, 2, 3)$, where symbol $\%$ denotes modulus operation. Follow the procedure of Chinese remainder theorem to derive the smallest positive integer $x$ that satisfies this system.

3. Boolean Algebra (10 points): State the definition of Boolean algebra.

4. Boolean Algebra (10 points): Use Boolean algebra (laws and theorems) to prove the De Morgan’s theorem: $(ab)' = a' + b'$.

5. Boolean Algebra (15 points): Use Boolean algebra (laws and theorems) to transform Boolean function, $E(a, b, c) = ab'c + ab + bc'$, into product-of-sums form.

6. Boolean Algebra (15 points): Reduce the following to an expression of a minimal number of literals: $E(a, b, c) = a'b' + b'c + ac + bc + a'bc'$.

7. Recursive Function (15 points): A frog knows 3 jumping styles (A, B, C). Styles A, B jump forward by 1 foot, and style C jumps forward by 2 feet. Let $a_i$ denote the number of ways to jump over a total distance of $i$ feet.
   (a) What is $a_1$, $a_2$, $a_3$?
   (b) Derive the recursive formula of $a_n$.
   (c) Find the solution of the recursion.

8. Recursive Function (10 points): Consider the following homogeneous linear recurrence relation: $a_n = 2ra_{n-1} - r^2a_{n-2}$. Show that $a_n = c_1r^n + c_2nr^n$ satisfies the recurrence relation, where $c_1$, and $c_2$, are constant coefficients.