1. Use the Laws of Logic to show: \( r \rightarrow (\neg q \rightarrow \neg p) \equiv p \rightarrow (r \rightarrow q) \)

2. Negate: There exists an Integer, \( n \), such that \( n \) is prime and \( n \) is even.

3. Find the Contrapositive form of: All cars with fancy stereos are expensive.

4. Find the Big-O of the algorithm with complexity:
\[
(4x^5 + 8x^2 + 2)(5x^2 + 3) + (6x^4 + 2x^2 + 1)(12x^2).
\]

5. What is the probability that a binary string of length 8 will have no more than two 1’s?

6. How many ways can I fill a cooler with cans of soda if the cooler holds 50 cans, I have 6 different types of soda, and I want at least 5 of each type in the cooler?

7. Graph the relation \( R = \{(a,b) \mid a, b \in \{1, 2, 3, 4, 5, 6, 7\} \text{ and } b = [(a^2 + 2) \text{ mod } 4]\}\).

8. Find the \( M_R \circ M_R \) of the relation on \( \{1, 2, 3, 4\} \):
   \[
   R = \{(1,3), (1,4), (2,2), (2,4), (3,1), (3,2), (3,3), (4,1), (4,2), (4,3)\}
   \]

9. Let \( f = \{(1,4), (2,1), (3,3), (4,5), (5,2)\} \), \( g = \{(1,2), (2,4), (3,1), (4,3), (5,5)\} \), and \( h = \{(1,5), (2,3), (3,1), (4,2), (5,4)\} \). Find \( h \circ g \circ f \).

10. Find the Disjunctive Normal Form of the Boolean Expression that describes a 3-way light switch controlling a lightbulb that includes the case of being ON when all three switches are ON.

11. Find the next 5 terms of \( s_n = 4s_{n-1} - 3s_{n-2} \) when \( s_0 = (-1) \) and \( s_1 = 0 \).

12. How many ways can I line up 4 Pennies, 3 Nickels, 6 Dimes, 2 Quarters, and 3 Half-dollars, if all the coins are from 1990? (e.g. PNPNDDQPDHDDQHHDP)

13. Graph an example of a Reflexive and Symmetric relation on the set \( \{1, 2, 3, 4\} \).

14. Graph an example of an Onto function that is NOT One-To-One.

15. Prove one of the following theorems by Induction:
   Theorem: For all Integers \( n \geq 0 \) and \( a \neq 0, 1 \), 
   \[
   \sum_{i=0}^{n} a^i = \frac{a^{n+1} - 1}{a - 1}.
   \]
   Theorem: Every integer greater than 1 is divisible by a prime number.

16. Prove one of the following theorems by Contradiction:
   Theorem: \( \sqrt{2} \) is irrational.
   Theorem: The sum of a rational and an irrational number is irrational.

17. Prove one of the following theorems:
   Theorem: If \( f(x) = 5x + 7 \), then \( R = \{(x, y) \mid x, y \in \mathbb{R} \text{ and } f(x) = f(y)\} \) is an Equivalence Relation.
   Theorem: If \( f(x) = 5x + 7 \), then \( f \) is a Bijection from \( \mathbb{R} \) to \( \mathbb{R} \).