MGF Notes / Week 10 - Logic Test Review

Topic 1: Symbolic translation of negations, conjunctions, and disjunctions: Basic
Problem 1: Translate the statement "It is sunny and it is not raining" into symbolic form using p for "It is sunny," q for "It is raining," ~ for negation, □ for conjunction, and □ for disjunction.
Problem 2: Convert the statement "The door is open or the light is off" into symbolic form using p for "The door is open" and q for "The light is off."

Topic 2: Symbolic translation of negations, conjunctions, and disjunctions: Advanced
Problem 1: Translate "It is not the case that both the car is new and the engine is faulty" into symbolic form using p for "The car is new" and q for "The engine is faulty."
Problem 2: Convert "Either the game is postponed or it is not sunny and the field is wet" into symbolic form using p for "The game is postponed," q for "It is sunny," and r for "The field is wet."

Topic 3: Introduction to truth tables with negations, conjunctions, or disjunctions
Problem 1: Construct a truth table for the statement p □ ~q, where p and q are propositions. List all possible truth values for p, q, and the expression.
Problem 2: Create a truth table for ~p □ q. Show all combinations of truth values for p, q, and the result.

Topic 4: Introduction to truth tables with conditional statements
Problem 1: Build a truth table for the conditional statement p □ q. Include all possible truth values for p, q, and the implication.
Problem 2: Construct a truth table for ~p □ q. Show the truth values for all combinations of p, q, and the conditional.

Topic 5: Truth tables with conjunctions, disjunctions, and conditional statements
Problem 1: Create a truth table for the statement (p □ q) □ r. List all possible truth values for p, q, r, and the expression.
Problem 2: Build a truth table for p □ (q □ r). Show the truth values for all combinations of p, q, r, and the result.

Topic 6: The converse, inverse, and contrapositive of a conditional statement
Problem 1: For the statement "If it is snowing, then it is cold," write the converse, inverse, and contrapositive. Clearly label each.
Problem 2: Given the statement "If a number is divisible by 4, then it is even," state the converse, inverse, and contrapositive.

Topic 7: Writing the converse, inverse, and contrapositive of a conditional statement and determining their truth values
Problem 1: For the statement "If $x > 7$, then $x > 5$," write the converse, inverse, and contrapositive. If $x = 8$, determine the truth value of each statement.
Problem 2: Given "If a shape is a rectangle, then it has four sides," write the converse, inverse, and contrapositive. Evaluate their truth values when the shape is a square.

Topic 8: Using logic to test a claim: Conjunction or disjunction
Problem 1: Test the claim "The park is open and it is sunny" using logic. If the park is open (true) but it is not sunny (false), is the claim true? Explain.
Problem 2: Evaluate the claim "The movie is playing or the theater is closed." If the movie is not playing (false) and the theater is open (true), determine if the claim holds and justify.

Topic 9: Using logic to test a claim: Conditional statement, basic
Problem 1: Test the claim "If it is Monday, then the library is open." If it is Monday (true) and the library is open (true), is the claim true? Explain.
Problem 2: Evaluate the claim "If a student attends class, then they take notes." If the student attends (true) but does not take notes (false), determine if the claim holds and justify.

Topic 10: Symbolic translation involving three statements
Problem 1: Translate the statement "If it is raining and the wind is strong, then the event is canceled" into symbolic form using p for "It is raining," q for "The wind is strong," and r for "The event is canceled."

strong," and r for "The event is canceled."
Problem 2: Convert "Either the store is closed or it is not busy and the staff is available" into symbolic form using p for "The store is closed," q for "It is busy," and r for "The staff is available."

Topic 11: Using logic to test a claim: Conditional statement, advanced
Problem 1: Test the claim "If a number is divisible by 8, then it is divisible by 4 and 2." If a number is divisible by 8 (true) and divisible by both 4 and 2 (true), is the claim true? Test with a counterexample (e.g., a number not divisible by 8).
Problem 2: Evaluate the claim "If a triangle is right, then it has a 90-degree angle." If a triangle is right (true) and has a 90-degree angle (true), is the claim valid? Check with a non-right triangle.