Propositional logic

```
import itertools
# Function to evaluate an expression
def evaluate_expression(a, b, c, expression):
    # Use eval() to evaluate the logical expression
    return eval(expression)

# Function to generate the truth table and evaluate a logical expression
def truth_table_and_evaluation(kb, query):
    # All possible combinations of truth values for a, b, and c
    truth_values = [True, False]
    combinations = list(itertools.product(truth_values, repeat=3))

    # Reverse the combinations to start from the bottom (False -> True)
    combinations.reverse()

    # Header for the full truth table
    print(f"{'a':<5}   {'b':<5} {'c':<5} {'KB':<20}{'Query':<20}")

    # Evaluate the expressions for each combination
    for combination in combinations:
        a, b, c = combination
```

```
    # Evaluate the knowledge base (KB) and query expressions
    kb_result = evaluate_expression(a, b, c, kb)
    query_result = evaluate_expression(a, b, c, query)

    # Replace True/False with string "True"/"False"
    kb_result_str = "True" if kb_result else "False"
    query_result_str = "True" if query_result else "False"

    # Convert boolean values of a, b, c to "True"/"False"
    a_str = "True" if a else "False"
    b_str = "True" if b else "False"
    c_str = "True" if c else "False"

    # Print the results for the knowledge base and the query
    print(f"{a_str:<5} {b_str:<5} {c_str:<5} {kb_result_str:<20} {query_result_str:<20}")

# Additional output for combinations where both KB and query are true
print("\nCombinations where both KB and Query are True:")
print(f"{'a':<5}   {'b':<5} {'c':<5} {'KB':<20}{'Query':<20}")

# Print only the rows where both KB and Query are True
for combination in combinations:
    a, b, c = combination
```

```
        # Evaluate the knowledge base (KB) and query expressions
        kb_result = evaluate_expression(a, b, c, kb)
        query_result = evaluate_expression(a, b, c, query)

        # If both KB and query are True, print the combination
        if kb_result and query_result:
            a_str = "True" if a else "False"
            b_str = "True" if b else "False"
            c_str = "True" if c else "False"
            kb_result_str = "True" if kb_result else "False"
            query_result_str = "True" if query_result else "False"
            print(f"{a_str:<5} {b_str:<5} {c_str:<5} {kb_result_str:<20} {query_result_str:<20}")

# Define the logical expressions as strings
kb = "(a or c) and (b or not c)"  # Knowledge Base
query = "a or b"  # Query to evaluate

# Generate the truth table and evaluate the knowledge base and query
truth_table_and_evaluation(kb, query)
```

```
a       b     c     KB                  Query
False False False False               False
False False True  False               False
False True  False False               True
False True  True  True                True
True  False False True                True
True  False True  False               True
True  True  False True                True
True  True  True  True                True

Combinations where both KB and Query are True:
a       b     c     KB                  Query
False True  True  True                True
True  False False True                True
True  True  False True                True
True  True  True  True                True
```