PROPOSITIONAL LOGIC

1BM22CS260

Code:

```
from itertools import product

def pl_true(sentence, model):
    """Evaluates if a sentence is true in a given
model."""
    if isinstance(sentence, str):
        return model.get(sentence, False)
    elif isinstance(sentence, tuple) and
len(sentence) == 2:  # NOT operation
        operator, operand = sentence
        if operator == "NOT":
            return not pl_true(operand, model)
    elif isinstance(sentence, tuple) and
len(sentence) == 3:
        operator, left, right = sentence
        if operator == "AND":
            return pl_true(left, model) and
pl_true(right, model)
        elif operator == "OR":
            return pl_true(left, model) or
pl_true(right, model)
        elif operator == "IMPLIES":
            return not pl_true(left, model) or
pl_true(right, model)
        elif operator == "IFF":
```

```
            return pl_true(left, model) ==
pl_true(right, model)

def print_truth_table(kb, query, symbols):
    """Generates and prints the truth table for KB
and Query."""
    # Define headers with spaces for alignment
    headers = ["A      ", "B      ", "C      ", "A
∨ C  ", "B ∨ ¬C ", "KB     ", "α      "]
    print(" | ".join(headers))
    print("-" * (len(headers) * 9))  # Separator
line

    # Generate all combinations of truth values
    for values in product([False, True],
repeat=len(symbols)):
        model = dict(zip(symbols, values))

        # Evaluate sub-expressions and main
expressions
        a_or_c = pl_true(("OR", "A", "C"), model)
        b_or_not_c = pl_true(("OR", "B", ("NOT",
"C")), model)
        kb_value = pl_true(("AND", ("OR", "A",
"C"), ("OR", "B", ("NOT", "C"))), model)
        alpha_value = pl_true(("OR", "A", "B"),
model)

        # Print the truth table row
```

```
        row = values + (a_or_c, b_or_not_c,
kb_value, alpha_value)
        row_str = " | ".join(str(v).ljust(7) for v
in row)

        # Highlight rows where both KB and α are
true
        if kb_value and alpha_value:
            print(f"\033[92m{row_str}\033[0m")  #
Green color for rows where KB and α are true
        else:
            print(row_str)

# Define the knowledge base and query
symbols = ["A", "B", "C"]
kb = ("AND", ("OR", "A", "C"), ("OR", "B", ("NOT",
"C")))
query = ("OR", "A", "B")

# Print the truth table
print_truth_table(kb, query, symbols)
```

Output:

```
A       | B       | C       | A ∨ C   | B ∨ ¬C  | KB      | α
--------------------------------------------------------------
False   | False   | False   | False   | True    | False   | False
False   | False   | True    | True    | False   | False   | False
False   | True    | False   | False   | True    | False   | True
False   | True    | True    | True    | True    | True    | True
True    | False   | False   | True    | True    | True    | True
True    | False   | True    | True    | False   | False   | True
True    | True    | False   | True    | True    | True    | True
True    | True    | True    | True    | True    | True    | True
```