LAB-6: Propositonal

Logic

CODE:

```
import itertools
# FuncOon to evaluate if a sentence is true in the given model
def pl_true(sentence, model):
  # Extract truth values for the variables from the model
  A = model.get('A', False)
  B = model.get('B', False)
  C = model.get('C', False)
  if sentence == "A or B":
    return A or B
  elif sentence == "(A or C) and (B or not C)":
    return (A or C) and (B or not C)
  return False
#TT-ENTAILS? funcOon: returns true if KB entails alpha
def \Sigma_entails(kb, alpha):
  symbols = ['A', 'B', 'C'] # List of all proposiθonal symbols
  return \Sigma_check_all(kb, alpha, symbols, \{\})
# TT-CHECK-ALL funcOon: recursively checks all possible models
def \Sigma_check_all(kb, alpha, symbols, model):
  if not symbols: # If there are no more symbols to assign
    if pl_true(kb, model):
       return pl_true(alpha, model) # Return true if both KB and \alpha are true in the model
    else:
```

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return True # If KB is false, return true (trivially saOsfied)
  else:
    p = symbols[0] # Get the first symbol
    rest = symbols[1:] # Remaining symbols
    # Create two new models: one where p is true and one where p is false
    model_true = model.copy()
    model_false = model.copy()
    model_true[p] = True
    model_false[p] = False
    # Recursively check both models
    return (Σ_check_all(kb, alpha, rest, model_true) and
         Σ_check_all(kb, alpha, rest, model_false))
# Knowledge base and alpha (proposi⊖on) in string format
kb = "(A or C) and (B or not C)"
alpha = "A or B"
# Check if KB entails alpha
result = \Sigma_entails(kb, alpha)
print(f"KB entails \alpha: {result}\n")
# FuncOon to generate and print both the full truth table and the entailment table
def generate_truth_tables():
  print("Full Truth Table:")
  print(f"{'A':<10}{'B':<10}{'C':<10}{'A \lor C':<10}{'B \lor ¬C':<10}{'KB':<10}{'a (A \lor B)':<10}")
  full_table = []
```

```
for A, B, C in itertools.product([False, True], repeat=3):
                 A_or_C = A or C
                  B_or_not_C = B or not C
                 KB = (A \text{ or } C) \text{ and } (B \text{ or not } C)
                 alpha = A or B
                 full_table.append((A, B, C, A_or_C, B_or_not_C, KB, alpha))
                  p rint(f" {str(A):<10 }{str(B):<10 }{str(C):<10 }{str(A_o r_C):<10 }{str(B_or_not_C):<10 }{str(KB
):<10}{str(alpha):<10}")
         print("\nEntailment Table (Only rows where KB and \alpha are true):")
         print(f"\{'A':<10\}'B':<10\}'C':<10\}'A \lor C':<10\}'B \lor \neg C':<10\}'KB':<10\}'\alpha \ (A \lor B)':<10\}''
         for row in full_table:
                 A, B, C, A_{or} C, B_{or} not C, KB, alpha = row
                 if KB and alpha:
                          print(f"{str(A):<10}{str(B):<10}{str(C):<10}{str(A_or_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_not_C):<10}{str(B_or_n
KB):<10\{str(alpha):<10\}")
generate_truth_tables()
```

OUTPUT:

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\rightarrow KB entails \alpha: True
    Full Truth Table:
    Α
               В
                                    AVC
                                               BV-C
                                                          KB
                                                                    α (AVB)
    False
               False
                         False
                                    False
                                               True
                                                          False
                                                                    False
    False
               False
                          True
                                    True
                                               False
                                                          False
                                                                    False
    False
               True
                          False
                                    False
                                               True
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    False
               True
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                                     True
                                               True
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    True
               False
                          False
                                    True
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               False
                          True
                                    True
                                               False
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                                                                    True
    True
    True
                          False
                                    True
                                                          True
               True
                                               True
                                                                     True
    True
               True
                          True
                                    True
                                                          True
                                                                     True
                                               True
    Entailment Table (Only rows where KB and \alpha are true):
                                                                     a (AVB)
                                    AVC
                                               True
    False
               True
                          True
                                    True
                                                          True
                                                                     True
               False
                          False
                                    True
                                               True
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                                                                     True
                          False
    True
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               True
                          True
                                                          True
                                                                     True
    True
                                     True
                                               True
```