

Program 6

Knowledge Base - Entailment

Algorithm: $(A \models B) \rightarrow \text{FBT2Q}$

1. Knowledge Base Function
 - Define proposition symbols
 - Knowledge base using logical statements
 - If p then q $p \rightarrow q$
 - If q then p $q \rightarrow p$
 - not p $\neg p$
2. Query Entails Function
 - Takes knowledge base & query as input
 - Checks if KB entails query
 - ↓
 - By checking if there exists any satisfying assignment where conjunction of the KB & negation of query is satisfiable

→ If there is no satisfiable assignment, it returns 'True'

from symbols, infer symbols, And, Not, Implies, Satisfiable

```

def create_knowledge_base():
    p = symbols('P')
    q = symbols('Q')
    r = symbols('R')

    knowledge_base = And(
        Implies(p, q),
        Implies(q, r),
        Not(r)
    )

    return knowledge_base

def query_entails(knowledge_base, query):
    entailment = Satisfiable(And(knowledge_base, Not(query)))
    return not entailment

KB = create_knowledge_base()
query = symbols('P')
result = query_entails(KB, query)

```

```

print("Knowledge Base", kb)
print("Query", query)
print("Query entails Knowledge Base:", result)

```

Output:

Knowledge Base: $\neg r$ & $(\text{Implies}(p, q))$ & $\text{Implies}(q, r)$

Query: p

Query entails Knowledge Base: False

p	q	r	$p \rightarrow q$	$q \rightarrow r$	$\neg r$	$kb \wedge \neg q$
T	T	T	T	T	F	F
T	T	F	T	F	T	F
T	F	T	F	T	F	F
T	F	F	F	T	T	F
F	T	T	T	T	F	F
F	T	F	T	F	T	F
F	F	T	T	T	F	F
F	F	F	T	T	T	F

[Satisfiable]

Thus, not entailing

Ex:-
 $p \rightarrow$ It is sunny
 $q \rightarrow$ I go for a picnic
 $r \rightarrow$ I carry an umbrella
 $p \rightarrow q$ If it is sunny, I go for a picnic
 $q \rightarrow r$ If I go for picnic, I carry an umbrella
 $\neg r$ I'm not carry an umbrella

Query \rightarrow Is it sunny? (No)

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Knowledge Base: $\sim r \ \& \ (\text{Implies}(p, q)) \ \& \ (\text{Implies}(q, r))$

Query: p

Query entails Knowledge Base: False