12-11-24

Lab-07

⇒ Propositional logic

P → Q (if P is true, then Q must be true)

→ Entailment

⇒ P, (P → Q) ⊨ Q

⇒ Given P and P → Q, it logically follows that Q must be true.

Step 1:-

Knowledge Base:

1) Alice is the mother of Bob
2) Bob is the father of Charlie
3) A father is a parent.
4) A mother is a parent.
5) All parents have children.
6) If someone is a parent, their children are siblings
7) Alice is married to David

P → Q = T

1) M(Alice, Bob)
2) F(Bob, Charlie)
3) Father(x) → Parent(x)
4) Mother(x) → Parent(x)
5) Parent(x) → Has Children(x)
6) Parent(x) ∧ Has Children(x) → Sibling(Children(x))
7) Married(Alice, David)

Logical Reasoning:-

Pro 11/11/24

1) From statements 1 and 4:

(M(Alice, Bob)) ∧ (Mother(x) → Parent(x)) → Alice → Parent

2) From statements 2 and 3:

(F(Bob, Charlie)) ∧ (Father(x) → Parent(x)) → Bob → Parent

3) From statement 5:

(Alice, Bob) ⇒ Parent(x) → Has Children(x)

4) From statemat 6:

(Alice, Bob) ⇒ Parent(x) ∧ Has children(x) → Sibling(Children(x))

⇒ Children ⇒ Charlie and Bob

∴ Sibling(Charlie, Bob) can be logically concluded

Lab - 7

Code:

```
class KnowledgeBase:
    def __init__(self):
        self.rules = []
        self.facts = set()

    def add_fact(self, fact):
        self.facts.add(fact)

    def add_rule(self, premise, conclusion):
        self.rules.append((premise, conclusion))

    def infer(self):
        new_inferences = True
        while new_inferences:
            new_inferences = False
            for premise, conclusion in self.rules:
                if all(fact in self.facts for fact in premise):
                    if conclusion not in self.facts:
                        self.facts.add(conclusion)
                        new_inferences = True

    def entails(self, hypothesis):
        return hypothesis in self.facts

kb = KnowledgeBase()

kb.add_fact("Alice is mother of Bob")
kb.add_fact("Bob is father of Charlie")
kb.add_fact("A father is a parent")
kb.add_fact("A mother is a parent")
kb.add_fact("All parents have children")
kb.add_fact("Alice is married to David")
```

```
kb.add_rule(["Bob is father of Charlie", "A father is parent"], "Bob is parent")
kb.add_rule(["Alice is mother of Bob", "A mother is parent"], "Alice is parent")
kb.add_rule(["Bob is parent", "All parents have children"], "Charlie and
            Bob are siblings")

kb.infer()

hypothesis = "Charlie and Bob are siblings."
if kb.entails(hypothesis):
    print(f"the hypothesis '{hypothesis}' is entailed by kb")
else:
    print(f"the hypothesis '{hypothesis}' is not entailed by kb")
```

Output:- The hypothesis 'Charlie and Bob are siblings' is entailed by kb

Jm
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