DBMS LAB

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1.

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from typing import Set, List, Tuple

def compute_closure(attributes: Set[str], functional_dependencies: List[Tuple[Set[str], Set[str]]]) -> Set[str]:
    closure = attributes.copy()
    changed = True

    while changed:
        changed = False

        for dependency in functional_dependencies:
            lhs, rhs = dependency

            if lhs.issubset(closure) and not rhs.issubset(closure):
                closure.update(rhs)
                changed = True

    return closure

# Function to verify if a functional dependency is logically implied by a set of given dependencies
def is_implied(dependency: Tuple[Set[str], Set[str]], functional_dependencies: List[Tuple[Set[str], Set[str]]]) -> bool:
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    closure = compute_closure(dependency[0], functional_dependencies)
    return dependency[1].issubset(closure)

# Function to check if a relation is in a certain normal form based on the given dependencies
def is_in_normal_form(functional_dependencies: List[Tuple[Set[str], Set[str]]], relation: str, normal_form: str) -> bool:
    for dependency in functional_dependencies:
        lhs, rhs = dependency

        if normal_form == "1NF":
            if len(lhs) > 1 or len(rhs) > 1:
                return False
        elif normal_form == "2NF":
            if not lhs.issubset(rhs) and not is_implied(dependency, functional_dependencies):
                return False
        elif normal_form == "3NF":
            if not is_implied(dependency, functional_dependencies):
                return False

    return True

# Function to parse input data and extract relations and functional dependencies
def parse_input(input_data: str) -> Tuple[str, List[Tuple[Set[str], Set[str]]]]:
    lines = input_data.strip().split('\n')
    relation = lines[0].split('(')[1].strip(')')

    functional_dependencies = []
    for line in lines[1:]:
        lhs_str, rhs_str = line.split('->')
        lhs = set(lhs_str.strip('{}').split(','))
        rhs = set(rhs_str.strip().strip('{}').split(','))
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        functional_dependencies.append((lhs, rhs))

    return relation, functional_dependencies

# Function to display the computed results
def display_output(closure: Set[str], functional_dependencies: List[Tuple[Set[str], Set[str]]], relation: str, normal_form: str) -> None:
    print(f"Closure of {relation}: {closure}")

    for dependency in functional_dependencies:
        lhs, rhs = dependency
        implied = "implied" if is_implied(dependency, functional_dependencies) else "not implied"
        print(f"{{{lhs}}} -> {{{rhs}}} is {implied} by the given set of functional dependencies.")

    print(f"Relation {relation} is {'in' if is_in_normal_form(functional_dependencies, relation, normal_form) else 'not in'} {normal_form}.")

def main():
    input_data = """R (Attributes: A, B, C)
    {A} -> {B}
    {B, C} -> {A}
    {A, C} -> {B}"""

    relation, functional_dependencies = parse_input(input_data)
    attributes = set(relation.split(', '))
    closure = compute_closure(attributes, functional_dependencies)
    normal_form = "3NF"  # Change the normal form here

    display_output(closure, functional_dependencies, relation, normal_form)

if __name__ == "__main__":
    main()
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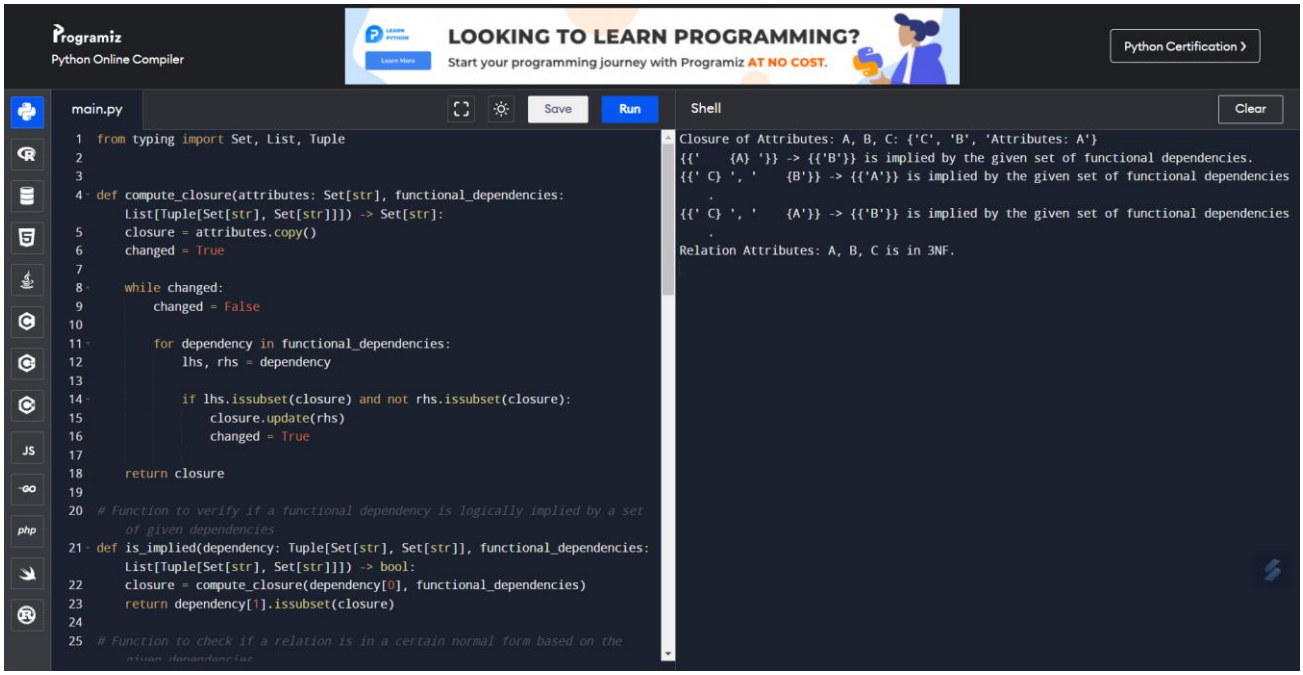
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Function to check if a relation is in a certain normal form based on the
Closure of Attributes: A, B, C: {'C', 'B', 'Attributes: A'}
{{' {A} '}} -> {{'B'}} is implied by the given set of functional dependencies.
{{' C} ', ' {B'}} -> {{'A'}} is implied by the given set of functional dependencies
.
{{' C} ', ' {A'}} -> {{'B'}} is implied by the given set of functional dependencies
.
Relation Attributes: A, B, C is in 3NF.