

# Unification Algorithm

```
def unify(ψ1, ψ2):  
    if is_variable_or_constant(ψ1) or is_variable_or_constant(ψ2):  
        if ψ1 == ψ2:  
            return {}  
        elif is_variable(ψ1):  
            if occurs_in(ψ1, ψ2):  
                return "FAILURE"  
            else:  
                return {ψ1: ψ2}  
        elif is_variable(ψ2):  
            if occurs_in(ψ2, ψ1):  
                return "FAILURE"  
            else:  
                return {ψ2: ψ1}  
        else:  
            return "FAILURE"  
  
    if predicate_symbol(ψ1) != predicate_symbol(ψ2):  
        return "FAILURE"  
  
    if len(ψ1['args']) != len(ψ2['args']):  
        return "FAILURE"  
  
    SUBST = {}  
  
    for i in range(len(ψ1['args'])):  
        S = unify(ψ1['args'][i], ψ2['args'][i])  
        if S == "FAILURE":  
            return "FAILURE"  
        if S:
```

```
psi1 = apply_substitution(S, psi1)
psi2 = apply_substitution(S, psi2)
SUBST.update(S)
```

```
return SUBST
```

```
def is_variable_or_constant(x):
    return isinstance(x, str) and (x.islower() or x.isalpha())
```

```
def is_variable(x):
    return isinstance(x, str) and x.islower()
```

```
def occurs_in(var, expr):
    if var == expr:
        return True
    if isinstance(expr, dict):
        return any(occurs_in(var, arg) for arg in expr.get('args', []))
    return False
```

```
def predicate_symbol(expr):
    if isinstance(expr, dict) and 'pred' in expr:
        return expr['pred']
    return None
```

```
def apply_substitution(subst, expr):
    if isinstance(expr, str):
        return subst.get(expr, expr)
    elif isinstance(expr, dict):
        return {
            'pred': expr['pred'],
```

```
        'args': [apply_substitution(subst, arg) for arg in expr.get('args', [])]
    }
    return expr
```

```
psi1 = {'pred': 'P', 'args': ['x', 'y']}
psi2 = {'pred': 'P', 'args': ['a', 'b']}
result = unify(psi1, psi2)
print(result)
```

## Output:

```
⇒ {'x': 'a', 'y': 'b'}
```