# ARTIFICIAL INTELLIGENCE

## EXPERIMENT NO: 7

## IMPLEMENTATION OF UNIFICATION AND RESOLUTION

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## AIM:

To implement Unification and Resolution using python.

## ALGORITHM:

1. If Ψ1 or Ψ2 is a variable or constant, then:
   a) If Ψ1 or Ψ2 are identical, then return NULL.
   b) Else if Ψ1 is a variable:
      - Then if Ψ1 occurs in Ψ2, then return False
      - Else return (Ψ2/Ψ1)
   c) Else if Ψ2 is a variable:
      - thenifΨ2occursinΨ1,thenreturnFalse
      - Else return(Ψ1/Ψ2)
   d) Else return False
2. If the initial Predicate symbol in Ψ1 and Ψ2 are not same, then return False.
3. If Ψ1 and Ψ2 have a different number of arguments, then return False.
4. Create Substitution list.
5. For i=1 to the number of elements in Ψ1.
   a) Call Unify function with the ith element of Ψ1 and with element of Ψ2, and put the result into S.
   b) If S = False then returns False.
   c) If S ≠ Null then append to Substitution list.
6. Return Substitution list.

## SOURCE CODE:

```
def get_index_comma(string):
    index_list = list()
    par_count = 0
    for i in range(len(string)):
        if string[i] == ',' and par_count == 0:
            index_list.append(i)
        elif string[i] == '(':
            par_count += 1
        elif string[i] == ')':
```

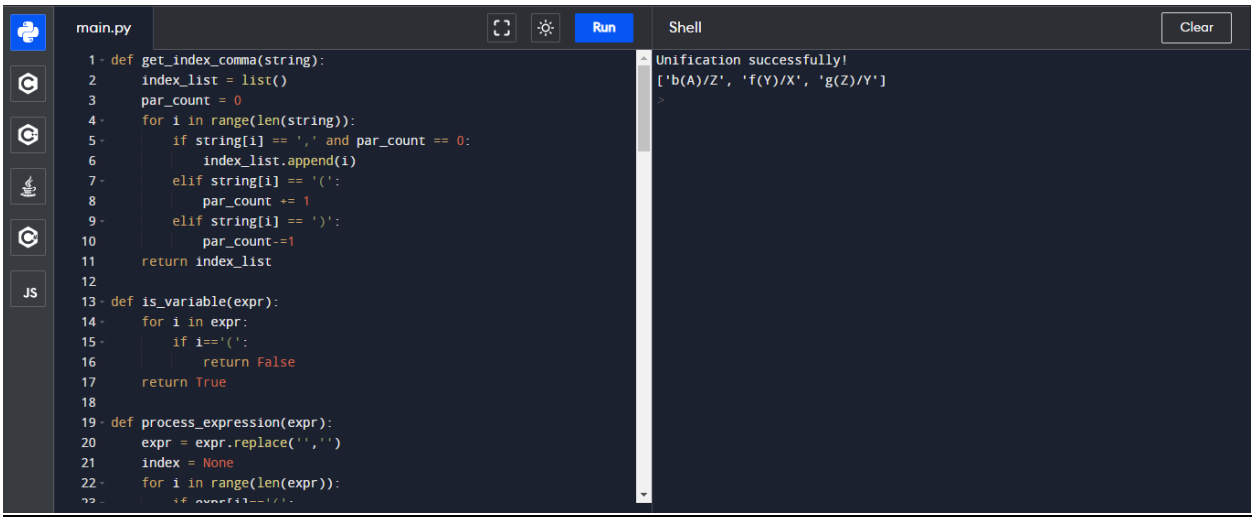
```
            par_count-=1
    return index_list

def is_variable(expr):
    for i in expr:
        if i=='(':
            return False
    return True

def process_expression(expr):
    expr = expr.replace('','')
    index = None
    for i in range(len(expr)):
        if expr[i]=='(':
            index=i
            break
    predicate_symbol = expr[:index]
    expr = expr.replace(predicate_symbol,'')
    expr = expr[1:len(expr)-1]
    arg_list = list()
    indices = get_index_comma(expr)
    if len(indices) == 0:
        arg_list.append(expr)
    else:
        arg_list.append(expr[:indices[0]])
        for i,j in zip(indices,indices[1:]):
            arg_list.append(expr[i+1:j])
        arg_list.append(expr[indices[len(indices)-1]+1:])
    return predicate_symbol,arg_list
def get_arg_list(expr):
    _,arg_list = process_expression(expr)
```

```
    flag = True
    while flag:
        flag = False
        for i in arg_list:
            if not is_variable(i):
                flag = True
                _,tmp = process_expression(i)
                for j in tmp:
                    if j not in arg_list:
                        arg_list.append(j)
                arg_list.remove(i)
    return arg_list

def check_occurs(var,expr):
    arg_list = get_arg_list(expr)
    if var in arg_list:
        return True
    return False

def unify(expr1,expr2):
    if is_variable(expr1) and is_variable(expr2):
        if expr1==expr2:
            return 'Null'
        else:
            return False
    elif is_variable(expr1) and not is_variable(expr2):
        if  check_occurs(expr1, expr2):
            return False
        else:
            tmp = str(expr2) + '/'+str(expr1)
            return tmp
```

```
    elif not is_variable(expr1) and is_variable(expr2):
        if check_occurs(expr2,expr1):
            return False
        else:
            tmp = str(expr1) + '/' + str(expr2)
            return tmp
    else:
        predicate_symbol_1,arg_list_1 = process_expression(expr1)
        predicate_symbol_2,arg_list_2 = process_expression(expr2)
        if predicate_symbol_1 != predicate_symbol_2:
            return False
        elif len(arg_list_1) != len(arg_list_2):
            return False
        else:
            sub_list = list()
            for i in range(len(arg_list_1)):
                tmp = unify(arg_list_1[i],arg_list_2[i])
                if not tmp:
                    return False
                elif tmp == 'Null':
                    pass
                else:
                    if type(tmp)==list:
                        for j in tmp:
                            sub_list.append(j)
                    else:
                        sub_list.append(tmp)
            return sub_list

if __name__=='__main__':
    f1 = 'p(b(A),X,f(g(Z)))'
```

```
f2 = 'p(Z,f(Y),f(Y))'
result = unify(f1,f2)
if not result:
    print('Unification failed!')
else:
    print('Unification successfully!')
    print(result)
```

## OUTPUT:




## RESULT:

Hence, the Unification and Resolution algorithm is implemented successfully.