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LAB Practice 8 - Functions

Please modify the defined lines, by changing the expression for the relation and the domain and co-domain sets.

Please verify and explain the results.

```
In [ ]: def cartesian_product(X, Y):  
        return [(x, y) for x in X for y in Y]  
  
        def relation_R(x, y):  
            return y == 2*x      ## PLEASE MODIFY THIS EXPRESSION, use other relations (example: y == 2*x)  
  
        def subset_complying_with_relation(cartesian_prod):  
            return [(x, y) for (x, y) in cartesian_prod if relation_R(x, y)]  
  
        def is_function(subset_R, X):  
            return len(set(x for (x, y) in subset_R)) == len(X)  
  
        def is_one_to_one(subset_R, X):  
            if not is_function(subset_R, X):  
                return False  
            y_values = [y for (x, y) in subset_R]  
            return len(y_values) == len(set(y_values))  
  
        def is_onto(subset_R, X, Y):  
            if not is_function(subset_R, X):  
                return False  
            y_values_in_R = set(y for (x, y) in subset_R)  
            return y_values_in_R == Y  
  
        def is_bijection(subset_R, X, Y):  
            return is_function(subset_R, X) and is_one_to_one(subset_R, X) and is_onto(subset_R, X, Y)  
  
        def print_sets_info(X, Y, subset_R):
```

```
domain = X
codomain = Y
range_R = set(y for (x, y) in subset_R)

print(f"Domain: {domain}")
print(f"Codomain: {codomain}")
print(f"Range: {range_R}")

# Define sets X and Y
#X = {1, 2, 3}          ## PLEASE MODIFY THE SET
#Y = {4, 5, 6}          ## PLEASE MODIFY THE SET
X = set(range(-2,2))    ## Example - PLEASE MODIFY THE SET
Y = set(range(-5,5))    ## Example - PLEASE MODIFY THE SET

# Compute the Cartesian product and the subset that complies with R
cartesian_prod = cartesian_product(X, Y)
subset_R = subset_complying_with_relation(cartesian_prod)

# Perform tests
function_test = is_function(subset_R, X)
one_to_one_test = is_one_to_one(subset_R, X)
onto_test = is_onto(subset_R, X, Y)
bijection_test = is_bijection(subset_R, X, Y)

# Output results
print(f"Cartesian Product:\n{cartesian_prod}\n")
print(f"Subset that complies with R: {subset_R}\n")
print(f"Is R a function? {function_test} -- Please verify and explain why ?\n")
print(f"Is R one-to-one? {one_to_one_test} -- Please verify and explain why ?\n")
print(f"Is R onto? {onto_test} -- Please verify and explain why ?\n")
print(f"Is R a one-to-one correspondence? {bijection_test} -- Please verify and explain why ?\n")

# Print sets information
print_sets_info(X, Y, subset_R)
```

Cartesian Product:

$[(0, 0), (0, 1), (0, 2), (0, 3), (0, 4), (0, -1), (0, -5), (0, -4), (0, -3), (0, -2), (1, 0), (1, 1), (1, 2), (1, 3), (1, 4), (1, -1), (1, -5), (1, -4), (1, -3), (1, -2), (-2, 0), (-2, 1), (-2, 2), (-2, 3), (-2, 4), (-2, -1), (-2, -5), (-2, -4), (-2, -3), (-2, -2), (-1, 0), (-1, 1), (-1, 2), (-1, 3), (-1, 4), (-1, -1), (-1, -5), (-1, -4), (-1, -3), (-1, -2)]$

Subset that complies with R: $[(0, 0), (1, 2), (-1, -2)]$

Is R a function? False -- Please verify and explain why ?

Is R one-to-one? False -- Please verify and explain why ?

Is R onto? False -- Please verify and explain why ?

Is R a one-to-one correspondence? False -- Please verify and explain why ?

Domain: $\{0, 1, -2, -1\}$

Codomain: $\{0, 1, 2, 3, 4, -1, -5, -4, -3, -2\}$

Range: $\{0, 2, -2\}$