Theory :- Understanding Relations R_1 and R_2 -
on set $A = \{1, 2, 3, 4\}$

In this thoery, we will explore the two relations R_1 and R_2 on the set $A = \{1, 2, 3, 4\}$ These relations involve order dend pairs (a, b) based on certain conditions. Let's examine each relation separately :

1. Relation R_1 :- Here $R_1 = \{(a, b) \mid a \text{ divides } b\}$

Relation R_1 involves ordered pairs (a, b) where 'a' divides 'b'. For the set $A = \{1, 2, 3, 4\}$, the relation R_1 can be defined as follows :

$R_1 = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 4), (3, 3),$
$(4, 4)\}$

2. Relation R_2 :- Here $R_2 = \{(a, b) \mid a \leq b\}$

Relation R_2 involves ordered pairs (a, b) where 'a' is less than on equal to 'b'. For the set the Relation R_2 is :-

$R_2 = \{(1, 1)(1, 2)(1, 3)(1, 4)(2, 2)(2, 3)(2, 4)(3, 3)(3, 4)(4, 4)\}$

Here a python program is written below:-

with open("input.txt","p") as Myfile:
s = list (map(int, Myfile.readlines()))

// we open- a file ~~iput~~ "input.txt" in read
mode and assign the file object in a
variable Myfile.
// In the next line we have used Myfile.readlines()
method which reads all lines from the
file and map() is used to convert
string into any data type, we converted
the string into integer and stored it
in a list s.

print ("s" = s)   // printing the set

R_1, R_2 = set(), set()   // declaring two 4 sets

for a in s: // using two for loop
    for b in s: we checked if(b%a==0)
        if b%a ==0:   b is divisible by a, then
            R_1.add ((a,b))   we added pair in list
        if a<=b   set R_1 and we
            R_2.add ((a,b))   added the pair in
                set R_2 for the condition
                (if a is less than or equal to b)

```
print("Relation R₁:", R₁)    // we printed
print("Relation R₂:", R₂)    the two relations
                             R₁ and R₂ as a
                             form of set.
```

$print(\text{"Relation } R_1 \text{:"}, R_1)$ // we printed

$print(\text{"Relation } R_2 \text{:"}, R_2)$ the two relations R_1 and R_2 as a form of set.

Theory :- In this problem, we are given two sets, A and B and we are asked to find the relation R from set A to set B based on specefiq condition. The relation R will contain pairs (a, b) where 'a' belongs to set A, 'b' belongs to set B and 'a' is greater than 'b'. In other words, the relation R will consist of all elements from set A that are greater than elements from set B.

The relation R is defined as follows : $R = \{(a, b) \mid a \in A, b \in B, a > b\}$. By comparing each element from set A with set B to check if 'a' is greater than 'b', then we will form the pair (a, b) of a set.

After forming the relation we need to assign the value of a pair (a, b) as 1 has a index of a matrix. $M_{(2, 1)}$ means the index on row 2 and column 1 will have a value of 1 and other index will remain 0.

Here a program is implemented in python below to find the relation and the matrix :-

for
def creat_relation_matrix(): // defining the main function
matrix = [[0 for b in range(d)] for a in range(d)]

for a in A:
    for b in B:
        if (a,b) in R:
            matrix [a-1][b-1] = 1

return matrix

// The above function will retun a 2D matrix.
inside it, we first declared 2D array of size d
(here d is the max size of list A or list B),
we used 2 for loop and checked if the pair
(a,b) is present in the relation of list R.
if it is present, we will assign the in pair value
as index of matrix and index value as 1 and
remaining index value will be 0.
A = list (map(int, input().split())) // taking input
B = list (map(int, input().split()))   of set A and B
d = max(len (A), len(B)) // since we want to
                              get a square matrix

R = [(a,b) for a in A for b in B if a>b]

// a pair of list is created if each
element of A is greater than elements of B.

```
print ("The Relation R₁:", R)  // printing the list R

Matrix = create-relation-matrix()
                                  // calling the
                                  // function will
print (" The matrix is:")         return a 2D
                                  matrix and
for a in matrix                   store it in
    for b in a:                   matrix variable
        print (b, end=' ')
    print ()
// using two for loop to print every
element of the matrix with space
using end=' '.
```

Input
---
1 2 3 4
1 2 3

Output

The Relation R: [(2,1),(3,1)
(3,2),(4,1),(4,2),(4,3)]
The matrix is:

```
0 0 0 0
1 0 0 0
1 1 0 0
1 1 1 0
```