CCCS 314 – Design and Analysis of Algorithms

LAB 2

[PLO K2, CLO 2.2]

Topic: Brute Force Algorithms

1. Brute Force: String Matching
2. Brute Force: Closest-Pair Problem
3. Validation of String-Matching Code
4. Validation of Closest-Pair Problem's Code

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Exercise 1: (Brute Force: String Matching)

PART A: The brute force algorithm for string matching is given below:

ALGORITHM *BruteForceStringMatch*$(T[0..n-1], P[0..m-1])$

```
//Implements brute-force string matching
//Input: An array T[0..n − 1] of n characters representing a text and
//       an array P[0..m − 1] of m characters representing a pattern
//Output: The index of the first character in the text that starts a
//       matching substring or −1 if the search is unsuccessful
for i ← 0 to n − m do
    j ← 0
    while j < m and P[j] = T[i + j] do
        j ← j + 1
    if j = m return i
return −1
```

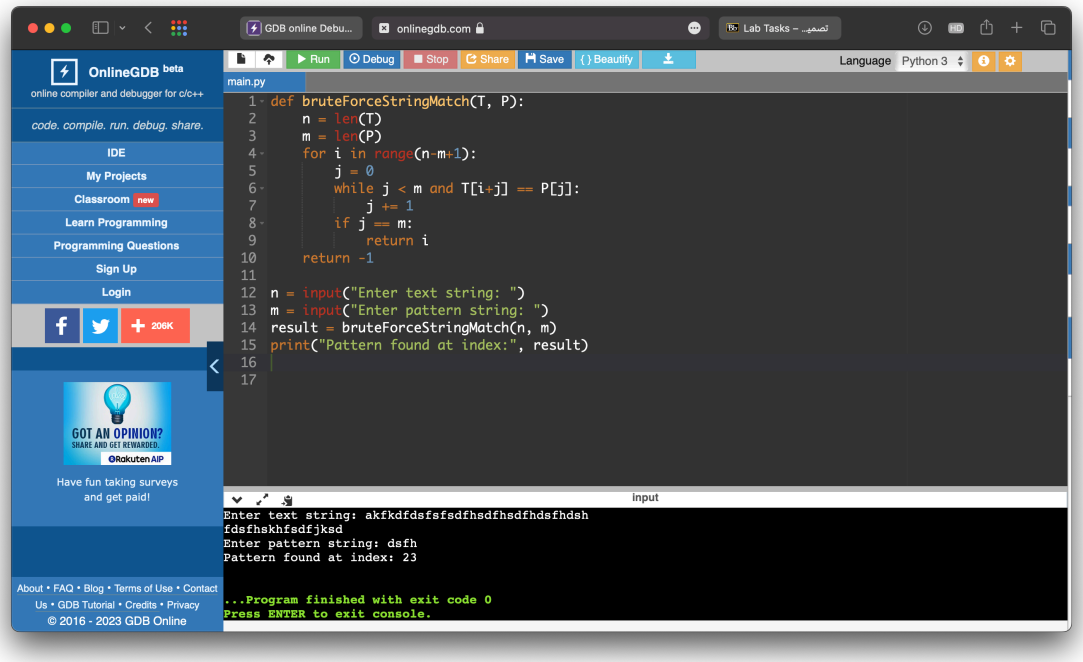
Write a code to implement this algorithm in the language of your choice. Paste your complete code here:

```
def bruteForceStringMatch(T, P):
    n = len(T)
    m = len(P)
    for i in range(n-m+1):

j=0
while j < m and T[i+j] == P[j]:
```

```
j += 1 if j == m:

return i

return -1

n = input("Enter text string: ")
m = input("Enter pattern string: ")
result = bruteForceStringMatch(n, m)
print("Pattern found at index:", result)
```

PART B: Run your code for the following inputs:
T = akfkdfdsfsfsdfhsdfhsdfhdsfhdshfdsfhskhfsdfjksd
P = dsfh

Write the output of your code below and attach its output as screenshot.



Exercise 2: (Brute Force: Closest Pair)

PART A: The brute force algorithm for finding closest pair of points in 2D space is given below:

ALGORITHM *BruteForceClosestPair*(P)

//Finds distance between two closest points in the plane by brute force
//Input: A list P of n $(n \geq 2)$ points $p_1(x_1, y_1), \ldots, p_n(x_n, y_n)$
//Output: The distance between the closest pair of points
$d \leftarrow \infty$
for $i \leftarrow 1$ **to** $n - 1$ **do**
  for $j \leftarrow i + 1$ **to** n **do**
    $d \leftarrow \min(d, sqrt((x_i - x_j)^2 + (y_i - y_j)^2))$ //*sqrt* is square root
return d

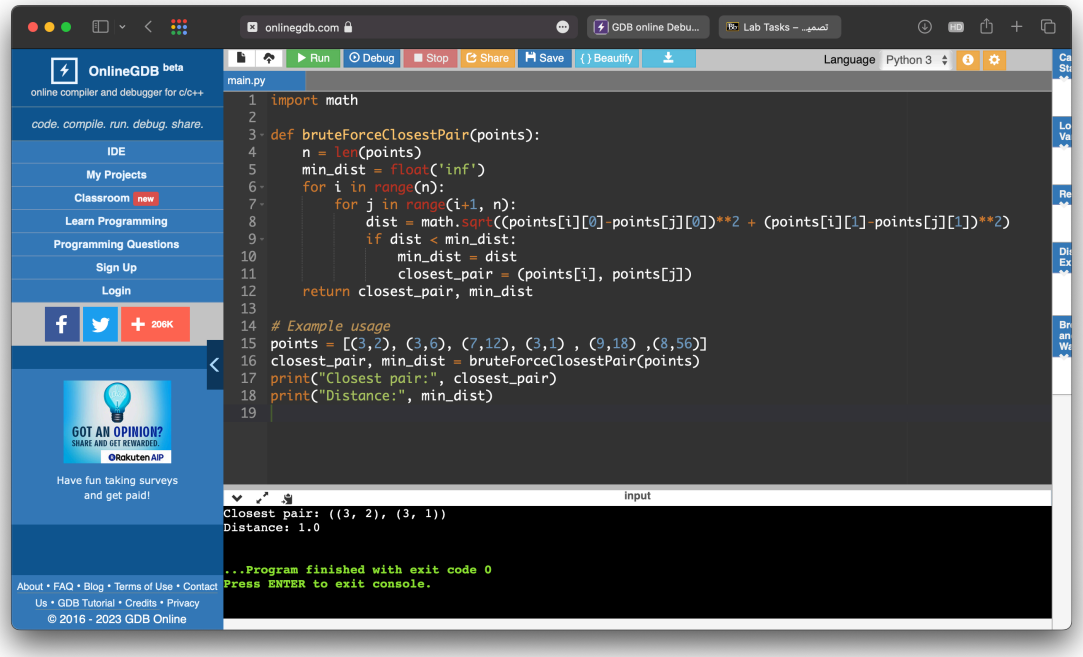
Write a code to implement this algorithm in the language of your choice. Paste your complete code here:

```
import math

def bruteForceClosestPair(points):
    n = len(points)
    min_dist = float('inf')
    for i in range(n):

for j in range(i+1, n):
dist = math.sqrt((points[i][0]-points[j][0])**2 +

(points[i][1]-points[j][1])**2)
            if dist < min_dist:
min_dist = dist
                closest_pair = (points[i], points[j])
    return closest_pair, min_dist

# Example usage
points = [(1,2), (3,4), (5,6), (7,8)]
closest_pair, min_dist = bruteForceClosestPair(points)
print("Closest pair:", closest_pair) print("Distance:",
min_dist)
```

PART B: Run your code for the following inputs:
p = [(3, 2), (3, 6), (7, 12), (3, 1), (9, 18), (8, 56)];
Write the output of your code below and attach its output as screenshot.

the closest points are:
?

and their distance is:
?



Exercise 3 and 4:
You will run the above codes on given inputs and write your answers in the provided space on blackboard.