**Министерство науки и высшего образования Российской Федерации**

**ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ**

**«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИТМО»**

**(Университет ИТМО)**

Факультет  **Инфокоммуникационных технологий**

Образовательная программа **Интеллектуальные системы в гуманитарной сфере**

Направление подготовки **45.03.04 Интеллектуальные системы в гуманитарной сфере**

О Т Ч Е Т

**лабораторной работе 3**

на тему: “Быстрая сортировка, сортировки за линейное время”

Обучающийся (или несколько) ФИО, № группы

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Работа выполнена с оценкой **\_\_\_\_**

Преподаватель:

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(подпись)

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1. Улучшение Quick-Sort\*

import random

def partition(array, start, stop):

b\_array, c\_start, d\_start = array[start], start, start

for i in range(start + 1, stop):

if array[i] < b\_array:

c\_start += 1

array[c\_start], array[i] = array[i], array[c\_start]

d\_start += 1

if c\_start != d\_start:

array[d\_start], array[i] = array[i], array[d\_start]

elif array[i] == b\_array:

d\_start += 1

array[d\_start], array[i] = array[i], array[d\_start]

array[start], array[c\_start] = array[c\_start], array[start]

return c\_start, d\_start

def randomized\_quicksort(array, start, stop):

if start < stop:

key = random.randint(start, stop - 1)

array[start], array[key] = array[key], array[start]

pivot1, pivot2 = partition(array, start, stop)

randomized\_quicksort(array, start, pivot1)

randomized\_quicksort(array, pivot2 + 1, stop)

return array

if \_\_name\_\_ == "\_\_main\_\_":

list = []

for i in range(10):

array = random.randint(1, 100)

list.append(array)

print('Неотсортированный массив:', \*list)

randomized\_quicksort(list, 0, len(list))

print(' Отсортированный массив:', \*list)

5. Индекс Хирша\*

import random

def partition(array, start, stop):

b\_array, c\_start, d\_start = array[start], start, start

for i in range(start + 1, stop):

if array[i] < b\_array:

c\_start += 1

array[c\_start], array[i] = array[i], array[c\_start]

d\_start += 1

if c\_start != d\_start:

array[d\_start], array[i] = array[i], array[d\_start]

elif array[i] == b\_array:

d\_start += 1

array[d\_start], array[i] = array[i], array[d\_start]

array[start], array[c\_start] = array[c\_start], array[start]

return c\_start, d\_start

def randomized\_quicksort(array, start, stop):

if start < stop:

key = random.randint(start, stop - 1)

array[start], array[key] = array[key], array[start]

pivot1, pivot2 = partition(array, start, stop)

randomized\_quicksort(array, start, pivot1)

randomized\_quicksort(array, pivot2 + 1, stop)

return array

list = []

for i in range(10):

b = random.randint(1, 10)

list.append(b)

randomized\_quicksort(list, 0, len(list))

index\_list = []

for i in range(len(list)):

key = 0

if list[i] != 0:

for c in range(len(list[i:])):

if list[c] >= list[i] and len(list[i:]) >= list[i]:

key = 1

else:

pass

if key == 1:

index\_list.append(list[i])

else:

pass

index = index\_list[len(index\_list) - 1]

print('Индекс Хирша =', index)

8. К ближайших точек к началу координат\*

import random

def randomized\_quicksort(array, start, stop):

if start < stop:

key = random.randint(start, stop)

array[start], array[key] = array[key], array[start]

pivot = partition(array, start, stop)

randomized\_quicksort(array, start, pivot - 1)

randomized\_quicksort(array, pivot + 1, stop)

return array

def partition(array, start, stop):

b\_array = array[start]

c\_start = start

for i in range(start + 1, stop + 1):

if array[i] <= b\_array:

c\_start += 1

array[c\_start], array[i] = array[i], array[c\_start]

array[start], array[c\_start] = array[c\_start], array[start]

return c\_start

with open('input.txt', 'r') as f:

n, k = map(int, f.readline().split())

x = [[]] \* n

for i in range(n):

x[i] = [int(j) for j in f.readline().split()]

a = {}

for i in range(n):

a[float(((x[i][0] \*\* 2) + (x[i][1] \*\* 2)) \*\* 0.5)] = x[i]

list = [float(key) for key in a]

randomized\_quicksort(list, 0, len(list) - 1)

with open('output.txt', 'w') as f:

for i in range(k-1):

f.write(str(a[list[i]]))

f.write(',')

f.write(str(a[list[k - 1]]))

3. Сортировка пугалом

import random

def randomized\_quicksort(array, start, stop):

if start < stop:

key = random.randint(start, stop)

array[start], array[key] = array[key], array[start]

pivot = partition(array, start, stop)

randomized\_quicksort(array, start, pivot - 1)

randomized\_quicksort(array, pivot + 1, stop)

return array

def partition(array, start, stop):

b\_array, c\_start = array[start][0], start

for i in range(start + 1, stop + 1):

if array[i][0] <= b\_array:

c\_start += 1

array[c\_start], array[i] = array[i], array[c\_start]

array[start], array[c\_start] = array[c\_start], array[start]

return c\_start

def game(array):

if array == 1:

return 'YES'

for i in range(n):

b = 0

c = 0

while c < len(a[list[i][0]]):

if abs(i - a[list[i][0]][c]) % array == 0:

b += 1

a[list[i][0]].pop(c)

c += 1

if (b == 0):

return 'NO'

return 'YES'

with open('input.txt') as f:

n, k = map(int, f.readline().split())

list = [int(x) for x in f.readline().split()]

a = {}

for i in range(n):

list[i] = [int(list[i]), i]

a[list[i][0]] = a.get(list[i][0], [])

a[list[i][0]].append(list[i][1])

randomized\_quicksort(list, 0, len(list) - 1)

with open('output.txt', 'w') as f:

f.write(game(k))

4. Точки и отрезки

import random

def randomized\_quicksort(array, start, stop):

if start < stop:

key = random.randint(start, stop)

array[start], array[key] = array[key], array[start]

pivot = partition(array, start, stop)

randomized\_quicksort(array, start, pivot - 1)

randomized\_quicksort(array, pivot + 1, stop)

return array

def partition(array, start, stop):

b\_array = array[start]

c\_start = start

for i in range(start + 1, stop + 1):

if array[i] <= b\_array:

c\_start += 1

array[c\_start], array[i] = array[i], array[c\_start]

array[start], array[c\_start] = array[c\_start], array[start]

return c\_start

with open('input.txt') as f:

s, p = map(int, f.readline().split())

a\_start, a\_end = [], []

for i in range(s):

ai, bi = map(int, f.readline().split())

a\_start.append(ai)

a\_end.append(bi)

points = list(map(int, f.readline().split()))

randomized\_quicksort(a\_start, 0, len(a\_start) - 1)

randomized\_quicksort(a\_end, 0, len(a\_end) - 1)

answer = ''

for point in points:

count = 0

for i in range(s):

if point >= a\_start[i]:

count += 1

if point > a\_end[i]:

count -= 1

answer += str(count)

answer += ' '

with open('output.txt', 'w') as f:

f.write(answer)