Midterm test

90 minutes

1 Exercise 1 (4 points)

Given a sequence of positive integers $a_1, a_2, \ldots, a_n$ where $1 \leq a_i \leq 10,000$ and $1 \leq n \leq 10,000$, and a given positive integer x (where $1 \leq x \leq 20,000$), find the pair (a_i, a_j) that satisfy the following conditions:

- $a_i + a_j = x$
- $a_i \times a_j$ is largest
- $1 \leq i < j \leq n$

Input:
The input is read from the text file `input_1.txt`:

- The first line contains the integer n and x.
- The second line contains n integers $a_1, a_2, \ldots, a_n$.

For example:

```
10 13
3 2 8 5 9 2 3 6 4 7
```

Output:
Write to the text file `output_1.txt` two integers:

- The pair a_i and a_j. If multiple pairs satisfy the condition, print only one pair (any).
- If it does not exist, output `-1`.

For example:

```
6 7
```

Explaining:
There are 3 pairs satisfying $a_i + a_j = 13$: (8, 5), (9, 4), and (6, 7), among which (6, 7) has the largest product.

2 Exercise 2 (3 points)

Given a matrix of size $m \times n$, sort its elements along the diagonals from top-left to bottom-right. The Figure 1 below is an example.

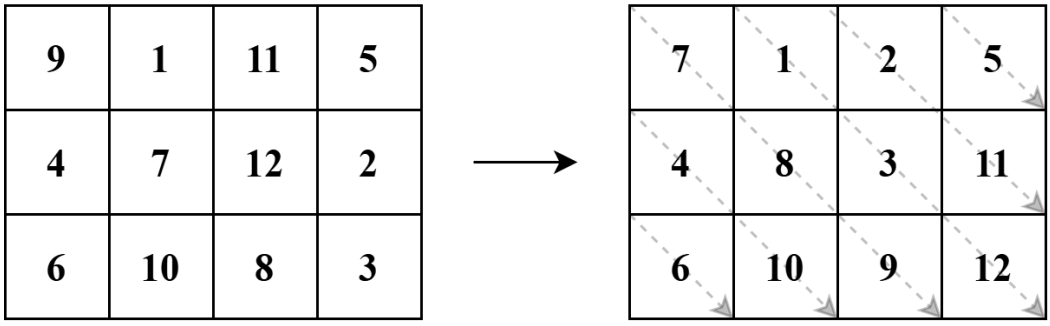

Figure 1: Sort along the diagonals from top-left to bottom-right.

Input:
The input is read from the text file `input_2.txt`:

- The first line contains two integers m and n, representing the number of rows and columns of the matrix.
- The next m lines each contain n integers, representing the elements of the matrix.

For example:

```
3  4
9  1  11  5
4  7  12  2
6  10 8   3
```

Output:
Write to the text file `output_2.txt` the matrix after sorting. For example:

```
7  1  2  5
4  8  3  11
6  10 9  12
```

3 Exercise 3 (3 points)

Spotify is a digital music streaming service with a library of millions of songs from various artists, allowing users to enjoy music anytime, anywhere. It is the ideal platform for discovering the most popular songs and top-quality artists. Let's use the "Most Streamed Spotify Songs 2024" dataset to address the challenges outlined below.

Dataset description

The input is read from the **provided** text file `MostStreamedSpotifySongs2024.txt`, which has the content as Figure 2:

```
1   Track                                                ,Artist              ,Spotify Streams ,Explicit Track
2   "Taste (feat. Offset)"                               ,"Tyga"              ,     1358105253 ,              1
3   "Stay With Me"                                       ,"Sam Smith"         ,     2086460781 ,              0
4   "All Girls Are The Same"                             ,"Juice WRLD"        ,     1615353665 ,              1
5   "PILLOWTALK"                                         ,"ZAYN"              ,     1320205697 ,              1
6   "Like Crazy"                                         ,"Jimin"             ,     1165398518 ,              0
7   "ROCKSTAR (feat. Roddy Ricch)"                       ,"DaBaby"            ,     1638836101 ,              1
8   "Umbrella"                                           ,"Rihanna"           ,     1535595924 ,              0
9   "Feels (feat. Pharrell Williams, Katy Perry & Big Sean)" ,"Calvin Harris"     ,     1120187276 ,              1
10  "Young, Wild & Free (feat. Bruno Mars)"              ,"Snoop Dogg"        ,     1431126152 ,              1
11  "Dance Monkey"                                       ,"Tones And I"       ,     3071214106 ,              0
12  "Astronaut In The Ocean"                             ,"Masked Wolf"       ,     1251675613 ,              1
13  "This Is What You Came For"                          ,"Calvin Harris"     ,     1746790923 ,              0
14  "Where Are You Now"                                  ,"Lost Frequencies"  ,     1223329465 ,              0
15  "Firestone"                                          ,"Kygo"              ,     1106264600 ,              0
16  "i hate u, i love u (feat. olivia o'brien)"          ,"gnash"             ,     1405772026 ,              1
17  "Look What You Made Me Do"                           ,"Taylor Swift"      ,     1152346128 ,              0
18  "Cruel Summer"                                       ,"Taylor Swift"      ,     2188247133 ,              0
19  "Happy - From Despicable Me 2"                       ,"Pharrell Williams" ,     1379786786 ,              0
20  "XO Tour Llif3"                                      ,"Lil Uzi Vert"      ,     2123458039 ,              1
21  "Ride It"                                            ,"Regard"            ,     1349427877 ,              0
```

Figure 2: Example of Most Streamed Spotify Songs 2024 dataset.

where:

- The first line provides the included information fields:

  `Track`: Name of the song.

  `Artist`: Name of the artist(s) of the song.

  `Spotify Streams`: Total number of streams on Spotify.

  `Explicit Track`: mark track as explicit, `0` is NOT explicit, and `1` is explicit.

- For the next lines, each one is the information of a song, separated by a comma ",".

Requirements

- **Filter non-explicit songs**: Remove all of the explicit songs (with `Explicit Track = 1`). Save the list of filtered songs to a new file named `filtered_songs.txt`.

  Example output:

```
Track                                ,Artist             ,Spotify Streams
"Stay With Me"                       ,"Sam Smith"        ,     2086460781
"Like Crazy"                         ,"Jimin"            ,     1165398518
"Umbrella"                           ,"Rihanna"          ,     1535595924
"Dance Monkey"                       ,"Tones And I"      ,     3071214106
"This Is What You Came For"          ,"Calvin Harris"    ,     1746790923
"Where Are You Now"                  ,"Lost Frequencies" ,     1223329465
"Firestone"                          ,"Kygo"             ,     1106264600
"Look What You Made Me Do"           ,"Taylor Swift"     ,     1152346128
"Cruel Summer"                       ,"Taylor Swift"     ,     2188247133
"Happy - From Despicable Me 2"       ,"Pharrell Williams" ,     1379786786
"Ride It"                            ,"Regard"           ,     1349427877
```

  Figure 3: Example output for `filtered_songs.txt`.

  The following two requirements are working on this filtered list.

- **Top 5 songs by streams**: Find and print to console the top 5 songs with the highest number of streams in 2024, including the song name, artist, and number of streams.

  Example output:

```
Top 5 songs by streams:
1. Dance Monkey                 Tones And I     3071214106 streams.
2. Cruel Summer                 Taylor Swift    2188247133 streams.
3. Stay With Me                 Sam Smith       2086460781 streams.
4. This Is What You Came For    Calvin Harris   1746790923 streams.
5. Umbrella                     Rihanna         1535595924 streams.
```

- **Artist of the year**: Find and print to console the artist with **the most songs**.

  Example output:

```
Artist of the year: Taylor Swift with 2 songs.
```

Any plagiarism, any tricks, or any lie will have a 0 point for the course grade.

The End.