CPSC 535 Advanced Algorithms
Project 2: Its a small world

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Problem Statement:
In this project you will design and implement one algorithm related to strings. You will design the algorithm, describe the algorithm using clear pseudocode, and implement it using C/C++/C#/Java/Python, compile, test it, and submit BOTH the report (as a PDF file) and the files. The execution should take less than one hour for each input example.

We assume that the name of each actor is a string, thus a cast is a set of strings, ordered in alphabetical order. But it does not matter whether they are listed alphabetically or not, but for simplicity, let's list them in alphabetical order.

The input will be a positive integer $n > 2$, and a list of n casts from which the first two sets are more significant, CAST[0] and CAST[1]. If the two casts CAST[0] and CAST[1] have at least one string in common, then the shortest connection is 1. If the two casts CAST[0] and CAST[1] do not have any string in common, then look for another cast in the list of n casts, let's called it tempCast, such that CAST[0] and tempCast have a string in common, and CAST[1] and tempCast have a string common, then the shortest connection is 2. Else the shortest connection is greater than 2 or there is no connection.

Summary:

1. Take the input n which represents the number of casts.
2. For loop to get the casts from the user alternatively we can took input from a text file
3. We are storing the casts as a list of n sets, it is important that all casts are stored as sets so that we can use the set properties and get our output
4. Checking for shortest connection 1
5. If set1 = {'a', 'b', 'c'} is one set of actors and set2 = {'c', 'd', 'e'} is the other set than set1 - set2 = {'a', 'b'} and
6. Hence, the length of set1 - set2 < length set 1 and with that we can check for shortest connection 1 in this case i.e. 'c'.
7. Checking for connection 2
8. If length of set1 - set2 is not less than set1 meaning if no common element in the sets, we will iterate over the other sets and check
9. if length of set1 - seti is less than length of set1 and if it is less meaning something is common in between them than we will check if same is true

10. For length of set2 - seti is less than length of set2, if yes than we have a shortest connection of 2 at cast i
11. Else shortest connection is more than 2 or no connection.

Solution:

Pseudocode:

```
n = int(input("Enter the number of casts: "))
casts = []
for i in range(n):
    casts.append(set(input(f"Enter the cast of Movie {i + 1} (Names should be comma seperated):
").split(", ")))

if(len(casts[0] - casts[1]) < len(casts[0])):
    print(f'Shortest Connection is {1}, actor = "{casts[0] - (casts[0] - casts[1])}"')
    exit(0)

for i in range(2, n):
    if(len(casts[0] - casts[i]) < len(casts[0])):
        tempCast = casts[i]
        if(len(casts[1] - tempCast) < len(casts[1])):
            print(f'Shortest Connection is {2}, cast = {tempCast}')
            exit(0)
else:
    print("Shortest Connection > 2 or No Connection")
    exit(0)
```

Time Complexity:- O(N)

Space Complexity:- O(N) / O(1) Depending on condition.

Input example 1: Shortest Connection 1

```
Enter the number of casts: 3
Enter the cast of Movie 1 (Names should be comma seperated): Carrie-Anne Moss, Gloria Foster, Hugo Weaving, Joe Pantolian
o,Keanu Reeves, Laurence Fishburne, Marcus Chong
Enter the cast of Movie 2 (Names should be comma seperated): Andre Braugher, Beau Garrett, Chris Evans, Doug Jones, Ioan
Gruffudd, Jessica Alba, Julian McMahon, Kerry Washington, Laurence Fishburne, Michael Chiklis
Enter the cast of Movie 3 (Names should be comma seperated): Ewan McGregor, Ian McDiarmid, Jake Lloyd, Liam Neeson, Natal
ie Portman
Shortest Connection is 1, actor = "{'Laurence Fishburne'}"
```

Input example 2: Shortest Connection 2

```
Enter the number of casts: 7
Enter the cast of Movie 1 (Names should be comma seperated): Carrie-Anne Moss, Gloria Foster, Hugo Weaving, Joe
 Pantoliano, Keanu Reeves, Laurence Fishburne, Marcus Chong
Enter the cast of Movie 2 (Names should be comma seperated): Andrew Borba, Anne Hathaway, Bill Irwin, Casey Aff
leck, Collette Wolfe, David Oyelowo, Francis X. McCarthy, Jessica Chastain, John Lithgow, Matthew McConaughey,
Michael Caine, Wes Bentley, William Devane
Enter the cast of Movie 3 (Names should be comma seperated): Geoffrey Rush, Jack Davenport, Johnny Depp, Jonath
an Pryce, Keira Knightley, Orlando Bloom
Enter the cast of Movie 4 (Names should be comma seperated): Angela Bassett, Chadwick Boseman, Danai Gurira, Da
niel Kaluuya, Forest Whitaker, Letitia Wright, Lupita Nyongo, Martin Freeman, Michael B. Jordan, Sterling K. Br
own, Winston Duke
Enter the cast of Movie 5 (Names should be comma seperated): Abraham Attah, Asa Butterfield, Anne Hathaway, Chl
oe Grace Moretz, Daniel Radcliffe, Jeff Goldblum, Keanu Reeves, Tom Holland
Enter the cast of Movie 6 (Names should be comma seperated): Andre Braugher, Beau Garrett, Chris Evans, Doug Jo
nes, Ioan Gruffudd, Jessica Alba, Julian McMahon, Kerry Washington, Laurence Fishburne, Michael Chiklis
Enter the cast of Movie 7 (Names should be comma seperated): Ewan McGregor, Ian McDiarmid, Jake Lloyd, Liam Nee
son, Natalie Portman
Shortest Connection is 2, cast = {'Tom Holland', 'Anne Hathaway', 'Abraham Attah', 'Daniel Radcliffe', 'Jeff Go
ldblum', 'Chloe Grace Moretz', 'Keanu Reeves', 'Asa Butterfield'}
```

Input example 3: Shortest Connection >2 or No Connection

```
Enter the number of casts: 3
Enter the cast of Movie 1 (Names should be comma seperated): Carrie-Anne Moss, Gloria Foster, Hugo Weaving, Joe
 Pantoliano,Keanu Reeves, Laurence Fishburne, Marcus Chong
Enter the cast of Movie 2 (Names should be comma seperated): Andre Braugher, Beau Garrett, Chris Evans, Doug Jo
nes, Ioan Gruffudd, Jessica Alba, Julian McMahon
Enter the cast of Movie 3 (Names should be comma seperated): Ewan McGregor, Ian McDiarmid, Jake Lloyd, Liam Nee
son, Natalie Portman
Shortest Connection > 2 or No Connection
```