

# **CPSC 535 Advanced Algorithms**

## **Project 2: It's a small world**

**Instructor: Prof. Doina Bein**

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**Janhvi Guha**  
**[885186973]**  
**jguha@csu.fullerton.edu**

**Divyansh Mohan Rao**  
**[885191403]**  
**divyanshrao@csu.fullerton.edu**

## Summary

This project has been implemented using python 3.8.2. We installed python from <https://www.python.org/downloads/>. We used visual studio code as our IDE. The code is expecting an input cast text file, each input should be of the format- the first line should be the number of casts, followed by comma-separated names of the cast in each new line. The expected output is if there is the shortest connection between cast0 and cast1 or if not if then give the mutual actors list number.

## Pseudocode

For each input,

- check if cast[0] and cast[1] have any same actor,

  - return shortest path=1 and same actor(s) name(s)

- else check for each input i, in range (2, number of casts).

  - check if there is an intersection between i<sup>th</sup> cast, cast 0 and ith cast, cast 1

    - return shortest path = 2 and cast list

- return shortest path > 2 or no connection

## How to execute code

To execute code, we need to navigate to the code directory, which in this case is *Users/JanhviGuha/Desktop/project2*, and then execute the code in the terminal using the command *python3 smallWorldCast.py* and then provide all the required inputs in order to get output.

## Code

```
def getConnections(cast):
    try:
        # check if the first two casts have any actors in common
        if set(cast[0]) & set(cast[1]):
            intersect = set(cast[0]) & set(cast[1])
            outputtext = ""
            if len(intersect) == 1:
                outputtext = "actor"
            else:
                outputtext = "cast"
            # if so return the intersection
            return f'Shortest Connection = 1, {outputtext} = {set(cast[0]) & set(cast[1])}'
        else:
            # else for each remaining cast i, check if there is any intersection between cast 0 and i and
            # cast 1 and i
            for i in cast:
                if set(cast[0]) & set(i) and set(cast[1]) & set(i):
                    return f'Shortest connection = 2, cast = {set(i)}'
            return f'shortest connection > 2 or no connection'
    except:
        return "Something went wrong please try again by refining the inputs accoring to the constraints"

if __name__ == "__main__":
    # please provide input in the input cast text file, each input should be of the following format,
    # first line should be the number of casts , followed by comma separeted names of the cast in
    # each new line
    file = open('inputcast.txt')
    while True:
        # read the number of casts for first example
        numberOfCasts = file.readline()
        cast = []
        if numberOfCasts:
            # create a 2D array for storing each casts
            cast = [[] * int(numberOfCasts)]
            for i in range(int(numberOfCasts)):
                # read new cast on new line and separte them based on comma ","
                cast[i] = list(map(str.strip, file.readline().lstrip().split(',')))
            # for each input example call the getConnection function and print the resuly
```

```
    print(getConnections(cast))  
else:  
    break
```

## Time Complexity

The time complexity of this algorithm is asymptotically  $O(n+m)$  where  $n$  is the number of casts and  $m$  is the number of actors in the cast. For taking the input, the for loop in the `__main__` function will run for the number of casts for each input, and then the for loop in the `getConnection` function will run for  $n$  times in the worse case.

## Space complexity

The space complexity of this algorithm will be number of casts( $n$ ) \* number of actors in the cast ( $m$ ), i.e.,  $O(nm)$

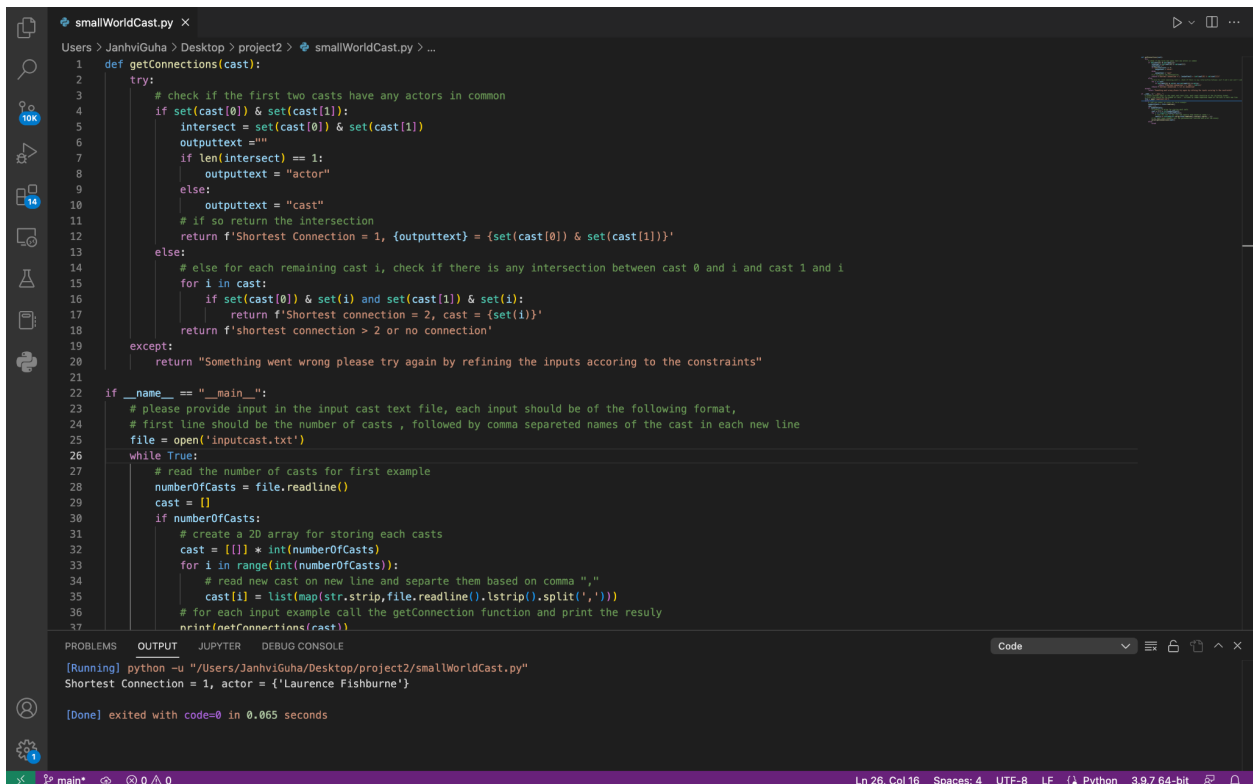
# Test Cases

## Case 1:

### Input:

```
6
Carrie-Anne Moss, Gloria Foster, Hugo Weaving, Joe Pantoliano, Keanu Reeves, Laurence Fishburne, Marcus
Chong
Andre Braugher, Beau Garrett, Chris Evans, Doug Jones, Ioan Gruffudd, Jessica Alba, Julian McMahon,
Kerry Washington, Laurence Fishburne, Michael Chiklis
Ewan McGregor, Ian McDiarmid, Jake Lloyd, Liam Neeson, Natalie Portman
Geoffrey Rush, Jack Davenport, Johnny Depp, Jonathan Pryce, Keira Knightley, Orlando Bloom
Angela Bassett, Chadwick Boseman, Danai Gurira, Daniel Kaluuya, Forest Whitaker, Letitia Wright,
Lupita Nyong'o, Martin Freeman, Michael B. Jordan, Sterling K. Brown, Winston Duke
Andrew Borba, Anne Hathaway, Bill Irwin, Casey Affleck, Collette Wolfe, David Oyelowo, Francis X.
McCarthy, Jessica Chastain, John Lithgow, Matthew McConaughey, Michael Caine, Wes Bentley, William
Devane
```

### Output:



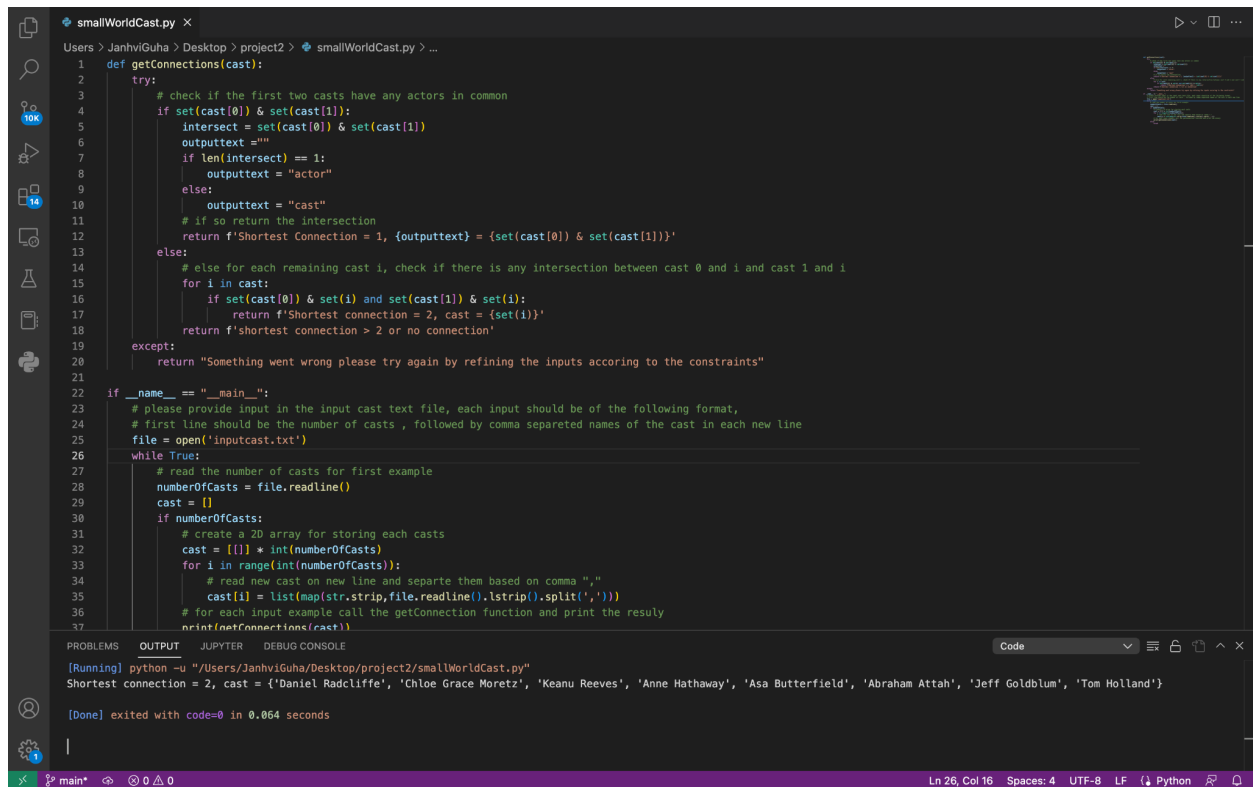
```
smallWorldCast.py X
Users > JanhviGuha > Desktop > project2 > smallWorldCast.py > ...
1 def getConnection(cast):
2     try:
3         # check if the first two casts have any actors in common
4         if set(cast[0]) & set(cast[1]):
5             intersect = set(cast[0]) & set(cast[1])
6             outputtext = ""
7             if len(intersect) == 1:
8                 outputtext = "actor"
9             else:
10                outputtext = "cast"
11            # if so return the intersection
12            return f'Shortest Connection = 1, {outputtext} = {set(cast[0]) & set(cast[1])}'
13        else:
14            # else for each remaining cast i, check if there is any intersection between cast 0 and i and cast 1 and i
15            for i in cast:
16                if set(cast[0]) & set(i) and set(cast[1]) & set(i):
17                    return f'Shortest connection = 2, cast = {set(i)}'
18            return f'shortest connection > 2 or no connection'
19    except:
20        return "Something went wrong please try again by refining the inputs according to the constraints"
21
22 if __name__ == "__main__":
23     # please provide input in the input cast text file, each input should be of the following format,
24     # first line should be the number of casts , followed by comma separated names of the cast in each new line
25     file = open('inputcast.txt')
26     while True:
27         # read the number of casts for first example
28         numberOfCasts = file.readline()
29         cast = []
30         if numberOfCasts:
31             # create a 2D array for storing each casts
32             cast = [[]] * int(numberOfCasts)
33             for i in range(int(numberOfCasts)):
34                 # read new cast on new line and separate them based on comma ","
35                 cast[i] = list(map(str.strip, file.readline().lstrip().split(',')))
36             # for each input example call the getConnection function and print the result
37             print(getConnection(cast))
38
39 PROBLEMS OUTPUT JUPYTER DEBUG CONSOLE
40 [Running] python -u "/Users/JanhviGuha/Desktop/project2/smallWorldCast.py"
41 Shortest Connection = 1, actor = {'Laurence Fishburne'}
42
43 [Done] exited with code=0 in 0.065 seconds
44
45 main* 0 0 0 Ln 26, Col 16 Spaces: 4 UTF-8 LF Python 3.9.7 64-bit
```

## Case 2:

### Input:

```
7
Carrie-Anne Moss, Gloria Foster, Hugo Weaving, Joe Pantoliano, Keanu Reeves, Laurence Fishburne,
Marcus Chong
Andrew Borba, Anne Hathaway, Bill Irwin, Casey Affleck, Collette Wolfe, David Oyelowo, Francis X.
McCarthy, Jessica Chastain, John Lithgow, Matthew McConaughey, Michael Caine, Wes Bentley, William
Devane
Geoffrey Rush, Jack Davenport, Johnny Depp, Jonathan Pryce, Keira Knightley, Orlando Bloom
Angela Bassett, Chadwick Boseman, Danaï Gurira, Daniel Kaluuya, Forest Whitaker, Letitia Wright,
Lupita Nyong'o, Martin Freeman, Michael B. Jordan, Sterling K. Brown, Winston Duke
Abraham Attah, Asa Butterfield, Anne Hathaway, Chloe Grace Moretz, Daniel Radcliffe, Jeff Goldblum,
Keanu Reeves, Tom Holland
Andre Braugher, Beau Garrett, Chris Evans, Doug Jones, Ioan Gruffudd, Jessica Alba, Julian McMahon,
Kerry Washington, Laurence Fishburne, Michael Chiklis
Ewan McGregor, Ian McDiarmid, Jake Lloyd, Liam Neeson, Natalie Portman
```

### Output:



The screenshot shows a Jupyter Notebook interface with a file named `smallWorldCast.py`. The code defines a function `getConnections(cast)` that takes a list of cast members and returns the shortest connection between them. The function uses a recursive approach to find the shortest path between two sets of cast members. The output of the script is displayed in the `OUTPUT` pane, showing the shortest connection between the first two casts and the resulting cast list.

```
def getConnections(cast):
    try:
        # check if the first two casts have any actors in common
        if set(cast[0]) & set(cast[1]):
            intersect = set(cast[0]) & set(cast[1])
            outputtext = ""
            if len(intersect) == 1:
                outputtext = "actor"
            else:
                outputtext = "cast"
            # if so return the intersection
            return f'Shortest Connection = 1, {outputtext} = {set(cast[0]) & set(cast[1])}'
        else:
            # else for each remaining cast i, check if there is any intersection between cast 0 and i and cast 1 and i
            for i in cast:
                if set(cast[0]) & set(i) and set(cast[1]) & set(i):
                    return f'Shortest connection = 2, cast = {set(i)}'
            return f'Shortest connection > 2 or no connection'
    except:
        return "Something went wrong please try again by refining the inputs according to the constraints"
```

OUTPUT

```
[Running] python -u "/Users/JanhviGuha/Desktop/project2/smallWorldCast.py"
Shortest connection = 2, cast = {'Daniel Radcliffe', 'Chloe Grace Moretz', 'Keanu Reeves', 'Anne Hathaway', 'Asa Butterfield', 'Abraham Attah', 'Jeff Goldblum', 'Tom Holland'}

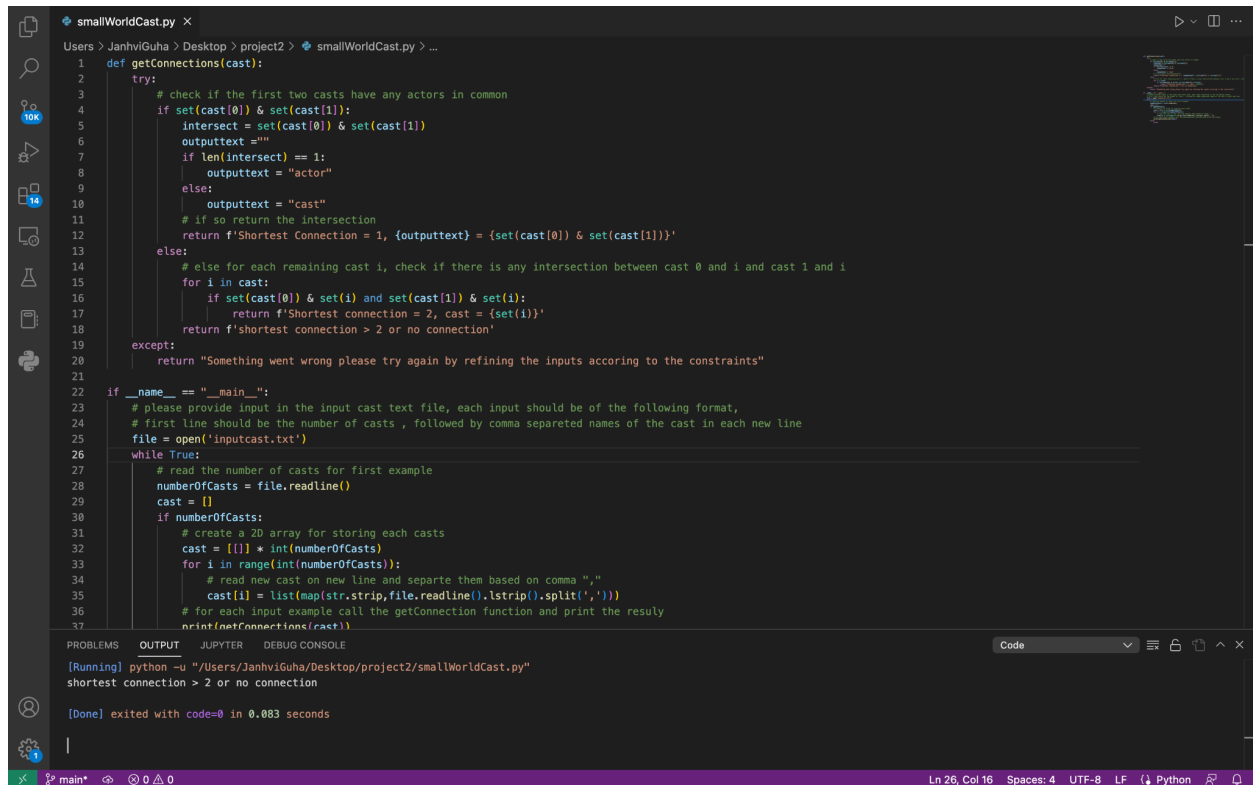
[Done] exited with code=0 in 0.064 seconds
```

### Case 3:

#### Input:

```
7
Ewan McGregor, Ian McDiarmid, Jake Lloyd, Liam Neeson, Natalie Portman
Andrew Borba, Anne Hathaway, Bill Irwin, Casey Affleck, Collette Wolfe, David Oyelowo, Francis X.
McCarthy, Jessica Chastain, John Lithgow, Matthew McConaughey, Michael Caine, Wes Bentley, William
Devane
Geoffrey Rush, Jack Davenport, Johnny Depp, Jonathan Pryce, Keira Knightley, Orlando Bloom
Angela Bassett, Chadwick Boseman, Danai Gurira, Daniel Kaluuya, Forest Whitaker, Letitia Wright,
Lupita Nyong'o, Martin Freeman, Michael B. Jordan, Sterling K. Brown, Winston Duke
Abraham Attah, Asa Butterfield, Anne Hathaway, Chloe Grace Moretz, Daniel Radcliffe, Jeff Goldblum,
Keanu Reeves, Tom Holland
Andre Braugher, Beau Garrett, Chris Evans, Doug Jones, Ioan Gruffudd, Jessica Alba, Julian McMahon,
Kerry Washington, Laurence Fishburne, Michael Chiklis
Carrie-Anne Moss, Gloria Foster, Hugo Weaving, Joe Pantoliano, Keanu Reeves, Laurence Fishburne,
Marcus Chong
```

#### Output:



The screenshot displays a Jupyter Notebook environment with a file named `smallWorldCast.py`. The code defines a function `getConnections(cast)` that checks for common actors between different casts. The main block of the script reads an input file, processes the data, and prints the result of the `getConnections` function.

```
1 def getConnections(cast):
2     try:
3         # check if the first two casts have any actors in common
4         if set(cast[0]) & set(cast[1]):
5             intersect = set(cast[0]) & set(cast[1])
6             outputtext = ""
7             if len(intersect) == 1:
8                 outputtext = "actor"
9             else:
10                outputtext = "cast"
11            # if so return the intersection
12            return f'Shortest Connection = 1, {outputtext} = {set(cast[0]) & set(cast[1])}'
13        else:
14            # else for each remaining cast i, check if there is any intersection between cast 0 and i and cast 1 and i
15            for i in cast:
16                if set(cast[0]) & set(i) and set(cast[1]) & set(i):
17                    return f'Shortest connection = 2, cast = {set(i)}'
18            return f'Shortest connection > 2 or no connection'
19    except:
20        return "Something went wrong please try again by refining the inputs according to the constraints"
21
22 if __name__ == "__main__":
23     # please provide input in the input cast text file, each input should be of the following format,
24     # first line should be the number of casts , followed by comma separated names of the cast in each new line
25     file = open('inputcast.txt')
26     while True:
27         # read the number of casts for first example
28         numberOfCasts = file.readline()
29         cast = []
30         if numberOfCasts:
31             # create a 2D array for storing each casts
32             cast = [[]] * int(numberOfCasts)
33             for i in range(int(numberOfCasts)):
34                 # read new cast on new line and separate them based on comma ","
35                 cast[i] = list(map(str.strip, file.readline().lstrip().split(',')))
36             # for each input example call the getConnection function and print the result
37             print(getConnections(cast))
38
39 PROBLEMS OUTPUT JUPYTER DEBUG CONSOLE
40 [Running] python -u "/Users/JanhviGuha/Desktop/project2/smallWorldCast.py"
41 shortest connection > 2 or no connection
42 [Done] exited with code=0 in 0.083 seconds
```