Cups and Saucer Arrangement

How to Run:

You are supposed to run `visual-pyqt.py` to get a graphical display of the arrangements. Navigate to the folder containing the scripts and run:

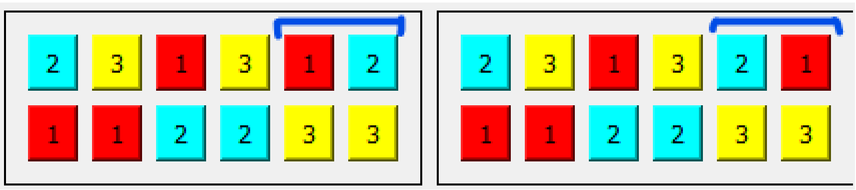
`python visual-pyqt.py` [for windows/mac]
`python3 visual-pyqt.py` [for linux]

There are certain assumptions put into place in order to construct the algorithms. While running the script, it prompts the user to enter a number corresponding to the specific assumption to be used.

Warning: Using Assumption 3 might lead to lag in device, it is not recommended to use Assumption 3 with `visual-pyqt` or `visualize`. Use `arrange.py` instead as it uses CLI instead of GUI.

Assumptions:

- **Assumption Case 1:**
  The saucers are fixed in place (their order does not matter), however, the arrangement of cups on top of them do. For example:
  These are treated as two separate arrangements.

- **Assumption Case 2:**
  The cups are saucers are considered to be identical, visual changes in order of placement of cups on top of saucers does not matter. For example: In the above picture, both are considered the same.

- **Assumption Case 3:**
  Every kind of permutation of cups and saucers is allowed unless they seem same visually.

Program Structure:

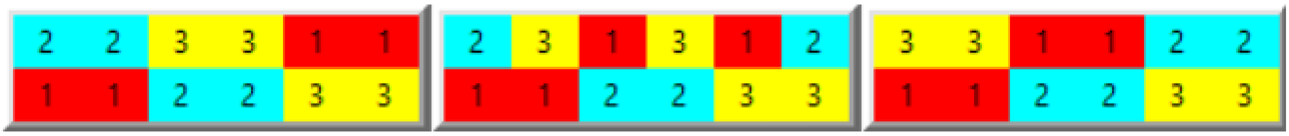
- `arrange.py` : This forms the core of the whole process. It returns arrays corresponding to the arrangement of cups and saucers that `visual-pyqt.py` uses to represent the cups and saucers. You can also run it separately. It will print list of all cup arrangements as a 2D list along with the length of that list, i.e, the total number of arrangements.

- `visual-pyqt.py`: This is used to make a graphical representation of cup and saucer placements. It uses a series of rectangular boxes arranged in two rows to represent the entities. The top row represents cups and the bottom represents saucers.

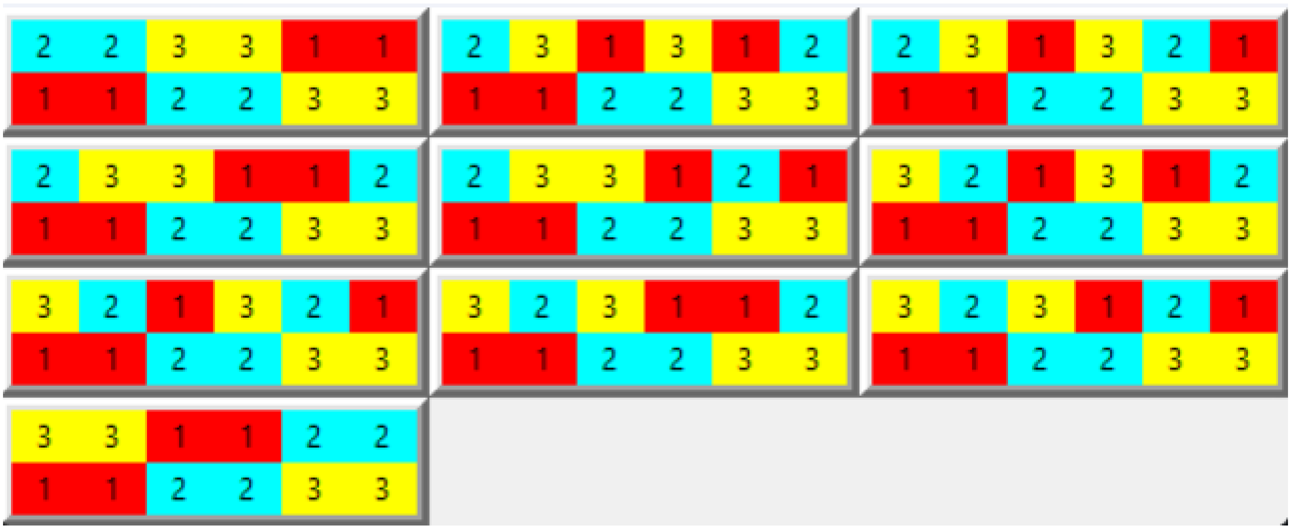
- `visualize.py`: Same as `visual-pyqt.py` but uses Tkinter instead of PyQt. PyQt tends to produce a better and faster result, so please use that instead.

Getting Same Results using Maths:

- Imagine saucers are fixed in place and order of arrangement of cups do not matter if saucers are of same color. In that case (`assumption2`), it can be shown that only 3 possible arrangements exist:



- Now, Let's say we do want to make order of cups on top of same saucers different. Only the second case (in above picture) will get affected by this. On interchanging position of cups (2,3) <-> (3,2); (1,3) <-> (3,1); and (1,2) <-> (2,1), we get a total of `2*2*2 + 2` arrangements. This forms the basis of `assumption1`.



- Finally, let's say we need to consider permutations of both cups and saucers. In that case we start by forming `(cup, saucer)` pair from `assumption2` case and start arranging them. Total ways: 900