CS 355: Program 2

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We declare that we have completed this assignment in accordance with the UAB Academic Integrity Code and the UAB CS Honor Code. We have read the UAB Academic Integrity Code and understand that any breach of the Code may result in severe penalties. We also declare that the following percentage distribution faithfully represents individual group members' contributions to the completion of the assignment

Vaishak Menon, 50% contribution, Partial Code Work and Partial Report Work, VM, 04/03/2023

Josh Patton, 50% contribution, Partial Code Work and Partial Report Work, JP, 04/03/2023

Report

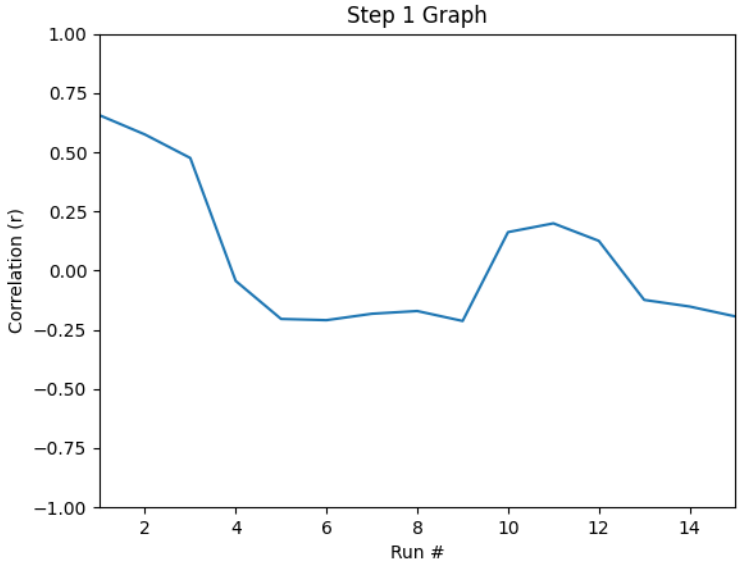
1. Functionality:

   The code has 3 main functions: shuffleDecks, calculateCorrelations, and plotR. The calculateCorrelations function will create an array of size n based on the given bounds. It will then call shuffleDecks to get the properly shuffled array and then compute the correlation coefficient on every shuffle done. After the shuffling is complete, we call plotR to plot the correlation for each run.

First Run

1. Plot r with respect to the times of shuffling. After how many shuffles are the cards in the most random order? (That is, when is r at a minimum value?)

   The cards are in the most random order at shuffle 5 and 10



2. Do the cards return to their original order? After how many runs?

   Based on the correlations we collected, the cards do not return to the original order.

3. Is a total of 15 runs enough to return to the original order?

   15 runs were not enough to return to the original order.

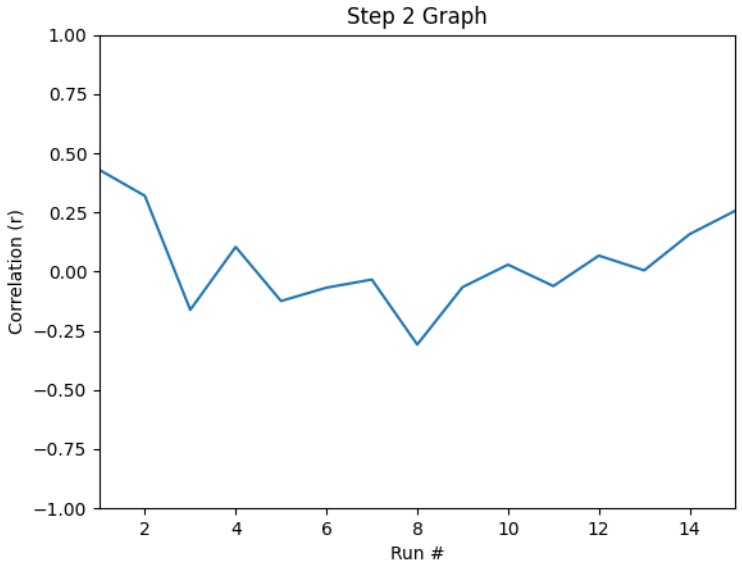
4. If not, does it appear that the cards will return to their original order in a relatively small number of shuffles?

   It does not currently look like it will return, but there is the possiblity of them returning to the same order over a larger number of shuffles.

Second Run

1. Plot r with respect to the times of shuffling. After how many shuffles are the cards in the most random order? (That is, when is r at a minimum value?)

   The cards are in the most random order at shuffle 8, which is the lowest point for this graph.



2. Do the cards return to their original order? After how many runs?

   Based on the correlations we collected, the cards do not return to the original order.

3. Is a total of 15 runs enough to return to the original order?

   15 runs were not enough to return to the original order.

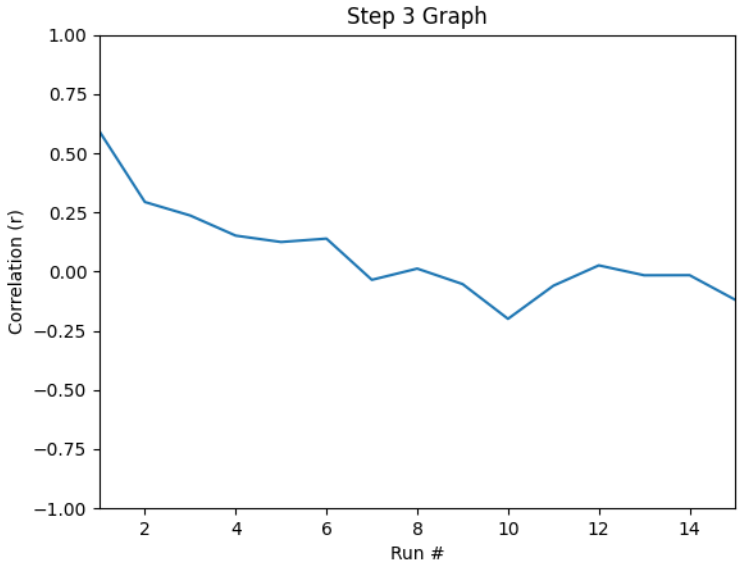
4. If not, does it appear that the cards will return to their original order in a relatively small number of shuffles?

   For this specific test case, it looks like the order is rebounding back to the original, there may be a chance that it goes back, but this would require more testing.

Third Run

1. Plot r with respect to the times of shuffling. After how many shuffles are the cards in the most random order? (That is, when is r at a minimum value?)

   The cards are in the most random order at shuffle 10, which is the lowest point for this graph.



2. Do the cards return to their original order? After how many runs?

   Based on the correlations we collected, the cards do not return to the original order.

3. Is a total of 15 runs enough to return to the original order?

   It is not enough to get back to the original order within 15 runs.

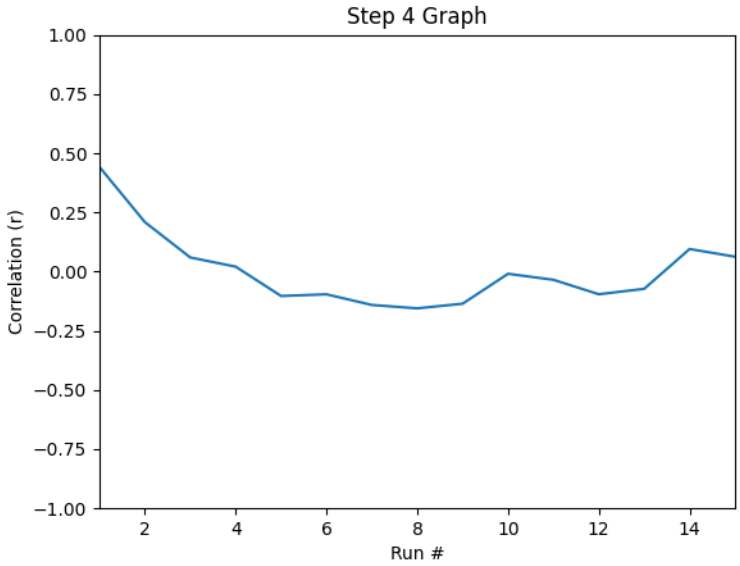
4. If not, does it appear that the cards will return to their original order in a relatively small number of shuffles?

   It does not currently look like it will return, but there is the possiblity of them returning to the same order over a larger number of shuffles.

Fourth Run

1. Plot r with respect to the times of shuffling. After how many shuffles are the cards in the most random order? (That is, when is r at a minimum value?)

   The cards are in the most random order at shuffle 8 or 9, which is the lowest point for this graph.



2. Do the cards return to their original order? After how many runs?

   Based on the correlations we collected, the cards do not return to the original order.

3. Is a total of 15 runs enough to return to the original order?

   It does not reach the original order within 15 runs.

4. If not, does it appear that the cards will return to their original order in a relatively small number of shuffles?

   Based on the graph, it does not seem probable that the order will return to the original order, but without testing many more cases it will not be possible to tell.