OTAGO POLYTECHNIC
Te Kura Matatini ki Otago

Design Pattern Exercise
IN710 Object Oriented System Development

Introduction

In this exercise you reuse your `Card` and `Deck` classes. You will modify `Deck` to use the *Strategy* pattern for shuffling and then measure the effectiveness of different shuffling methods.

1 Shuffling

In your `Deck` class you have a list of `Card`s, and at some point you need to shuffle them. There are a number of ways to do this.

1. by using the `random.shuffle()` function;
2. exchange each card in the deck with one at a randomly selected index;
3. for each evenly numbered card position, exchange it with a randomly chosen odd position;
4. swap two randomly chosen card positions 52 or more times.

You can probably come up with others.

2 Task 1

Implement the various shuffling algorithms as *strategies* that can be plugged into your `Deck` class. Then write a simple program that creates one deck for each strategy and applies the appropriate shuffle.

3 Task 2

Now we want to test teh effectiveness of each shuffling method. To do this, we will shuffle the decks 520 times with each shuffling method and record the results. If a shuffling method is perfect, then every card should occur in every deck postion 10 times.

To record the results, make a Python dictionary using the card values as keys and whose values are lists showing the positions (0 - 51) that a card occupies in each shuffled deck.

We can use a chi-squared test to evaluate the quality of each shuffle. The general chi-squared formula is

$$\chi^2 = \sum_{i=0}^{n} (a_i - e_i)^2 / e_i$$

Where a_i is the observed card position frequency and e_i is the expected frequency (10 in our case).

Write a chi-squared function that takes a results dictionary and ruturns the corresponding value.