Hat Assignment

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**introduction**

A hat is a generic data structure that can be used to retrieve random elements. For instance, it can be used to draw names. Hat has a method draw that is used to randomly delete items from the Hat.

First of all, a class Hat was implemented with it’s various methods. these methods include: add(), isEmpty(), size() and draw(). A test client was also implemented to test these methods.

**Data collection and analysis**

Data is collected in a formal and structured way. The data collected in this experiment will be used to determine the worst time complexity of thee algorithm and validate with the theoretical complexity.

**isEmpty() Method**

This method is used to check if an instance of a Hat is empty or has inputs in the array. Given that this method only returns true if the array is empty, this give a constant time complexity.

**size() Method**

Initially, an instance of a Hat is populated by using the add() method to add inputs. The input becomes the independent variable. The time complexity of the size() was experimentally measured by checking the time it takes to return the size of the array, which is the number of input in the array.

input time

1000 0ms

2000 0ms

**add() Method**

This method is used to populate/add input to the array. This method takes a generic data and adds it to the array. Since the method only add an input to the array. Its theoretical time complexity is O(1). To measure the experimental time complexity, the double ratio experiment was used. The initial input is doubled each time for 5 consecutive times. The time taken to add the input to the array is noted below in a table.

Input time

1000 10ns

2000 10ns

4000 10ns

8000 10ns

16000 10ns

**draw() Method**

The draw method was implemented to draw an item from a hat. It goes through the array, select and delete a random item from the array and return it. The first line of this method takes a random item from the array and assign it to a variable. A for loop is then used to loop through the array, an if statement is then used to compare the random item chosen to all the items in the array. If there a match, it deletes this item from the array and return it.

To test the draw method. inside the client two lines of code are used to select two random people (people is an instance of a hat created in the test client and populated with strings using the add method) from the array and assigned a chore.

**Graph of the experimental time complexity**