Report for Assignment 3

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1 TwoStackQueue

The first method I will consider is the isEmpty() method. isEmpty() simply checks to see if the in and out are empty stacks using the isEmpty() method from the book. enqueue() pushes an item to the in stack, this will take the same amount of stackoperations reguardless of how many items are in the stack. dequeue() checks to see if the out stack isEmpty(), if so then it copies the in stack to the out one, otherwise it simply pops the out stack.

2 Doubling Ratio

My doubling ratio test is based on the one in the book. In each trial the following happens: I push k items to each of the stacks and record how long that takes. I then add the ratio of the runtimes in avgRatio[], then I double k. My ratio is defined as arrayTime/listTime I do this until NUMDOUBLES is reached, NUMDOUBLES describes how many times I will double k during the experiment. I run this for NUMTESTS. NUMDOUBLES is 5 by default, and NUMTESTS is 100, k starts at 60,000. I found that if k is much lower than this value the run times cannot be divided, because they result in a number that cannot be stored as a double (either NaN or infinity). I am getting times that suggest that the array is about two times as fast as the list. This is because the list has more memory allocation going on, each time it pushes, it has to create a new node. The array only has to resize periodically, and everytime it does, it doubles. Here is the table:

3 Birthday Problem

I tested the birthday problem by creating a boolean array called validate. This array is initialized to the size of NUMTESTS, which is by default 1000. The program will then read in a number from the command line, and send that number to the testHyp() method. This method starts by finding the value of

Test #	Ratio of Runtimes (arrayTime/listTime)	
0	0.5480859010270775	
1	2.562254901960784	
2	0.4085989010989011	
3	0.32216775599128544	
4	0.43729480164158685	
5	0.48874125874125873	
6	0.4177317290552585	
7	0.384099718111346	
8	0.4665441176470588	
9	0.2831541218637993	
10	0.4454248366013071	
11	0.35375816993464054	
12	0.49800950683303624	
13	0.38709150326797387	
14	0.38905228758169935	
15	0.44523172905525843	
16	0.4903409090909091	
17	0.4131565656565657	
18	0.3813153917693559	
19	0.46912878787878787	
20	0.45773172905525844	
21	0.38322332090840067	
22	0.45514705882352935	
23	0.3795454545454545	
24	0.4165441176470588	
25	0.6260984848484848	
26	0.4636140819964349	
27	0.32351587301587303	
28	0.46912878787878787	
29	0.45773172905525844	
30	0.37201744334097275	
31	0.44523172905525843	
32	0.4583036244800951	
33	0.44523172905525843	
34	0.4260398098633392	
35	0.36148989898989903	
36	0.41842948717948725	
37	0.42300950683303623	
38	0.32372848200312987	
39	0.4665441176470588	
40	0.4721590909090909	
41	0.393659281894576	
42	0.39285714285	
43	0.6583333333333333	
44	0.4714285714285714	
45	0.3198214285714286	
46	0.39285714285714285	
47	0.7047619047619047	
48	0.6082010582010582	
49	0.32564205457463885	
50	0.5397783251231527	

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$\begin{array}{c} 85 \\ 86 \\ 87 \\ 88 \\ 88 \\ 88 \\ 90 \\ 90 \\ 90 \\ 90 \\ 92 \\ 93 \\ 94 \\ 96 \\ \end{array} \qquad \begin{array}{c} 0.42142857142857143 \\ 0.3490427098674521 \\ 0.40036945812807884 \\ 0.43805418719211825 \\ 0.3869047619047619 \\ 0.3167027417027417 \\ 0.43965517241379304 \\ 0.598111658456486 \\ 0.598571428571429 \\ 0.4428571428571429 \\ 0.4428571428571429 \\ 0.31785714285714284 \\ 0.4391534391534392 \\ \end{array}$		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		0.42142857142857143
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95 96 3 0.31785714285714284 0.4391534391534392	93	0.5078571428571429
96 0.4391534391534392	94	0.4428571428571429
96 0.4391534391	95	0.31785714285714284
97 0.40572407045009784	96	³ 0.4391534391534392
1 0.200, 2 20, 0 2000, 0 2	97	0.40572407045009784
98 0.5428571428571429	98	0.5428571428571429
99 0.5669047619047619		
The average ratio of the running times 0.4636541373217238	The average ratio of the running time	es 0.4636541373217238

 $\sqrt{N/2}$ where N is the value inputted. I then create an array of length $\sqrt{N/2}$, and I use StdRandom.uniform(N) to generate values for that array from 1 to N. I then take that array and test to see if it has any duplicate values, if it does then I return True, else False. This boolean is then stored into my validate array which I then analyse() the analysis simply prints the number of true and false values stored in validate.

4 Path Compression

To produce a path of length 4. You must submit 5 sites such that you can trace from one to the other. For Example (2,3),(3,7),(7,4),(5,8),(8,10). These inputs would produce a path of length 4.