Matthew DiGiacomo, Dylan Jervis, Yashwanth Dahanayake

CS 260 Programming Assignment 3

March 16, 2015

**Problems 1 and 2 Report**

Problems 1 and 2 had to deal with implementing, with the Dictionary ADT, open hash tables and closed hash tables. For testing our code, we used the text file “Alice in Wonderland” as provided on the course website.

Problem 1 was to determine the average number of probes required to make either a deletion or an insertion for open hash tables. The results of our tests are shown below in Table 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **B** | **Insert Total Probes** | **Delete Total Probes** | **Insert Average Probes** | **Delete Average Probes** |
| 1 | 85182903 | 89749809 | 2822.86926697 | 2486.97098759 |
| 250 | 370874 | 354549 | 12.2903632025 | 10.3333916237 |
| 500 | 197411 | 178054 | 6.54198700954 | 5.57394189832 |
| 750 | 132108 | 116625 | 4.37791622481 | 3.70050133266 |
| 1000 | 108861 | 84298 | 3.60753579003 | 3.00516915618 |
| 1250 | 100875 | 74059 | 3.34288838812 | 2.53314406896 |
| 1500 | 78721 | 58611 | 2.60872879109 | 2.25496306556 |
| 1750 | 74531 | 51440 | 2.46987672322 | 2.00272532607 |
| 2000 | 72315 | 46447 | 2.39644088017 | 1.9908701243 |
| 2250 | 59252 | 36705 | 1.96354718982 | 1.80910838385 |
| 2500 | 64694 | 35551 | 2.14388918346 | 1.70173759035 |
| 2750 | 59473 | 32954 | 1.97087089077 | 1.62575234336 |
| 3000 | 54585 | 31027 | 1.8088878579 | 1.52152805022 |
| 3250 | 57631 | 30673 | 1.90982900318 | 1.56999539336 |
| 3500 | 51873 | 27345 | 1.71901511135 | 1.43731931669 |
| 3750 | 49325 | 27350 | 1.6345771474 | 1.44525470302 |
| 4000 | 52278 | 25636 | 1.73243637328 | 1.4238267148 |
| 4250 | 46724 | 22667 | 1.54838282078 | 1.35560074158 |
| 4500 | 45270 | 22177 | 1.50019883351 | 1.34863780102 |
| 4750 | 47160 | 23324 | 1.56283138918 | 1.33968983343 |
| 5000 | 46325 | 18900 | 1.53516039236 | 1.27944760357 |
| 5250 | 44251 | 20304 | 1.46643027572 | 1.21203438395 |
| 5500 | 43998 | 20132 | 1.45804612937 | 1.27224469161 |
| 5750 | 41806 | 17413 | 1.38540562036 | 1.21735178971 |
| 6000 | 43213 | 18502 | 1.43203207847 | 1.24399919317 |
| 6250 | 43030 | 19479 | 1.42596765642 | 1.25719633406 |
| 6500 | 41869 | 17020 | 1.38749337222 | 1.17850713198 |
| 6750 | 39501 | 15217 | 1.30902041357 | 1.19988960732 |
| 7000 | 39729 | 15391 | 1.31657608696 | 1.16793140082 |
| 7250 | 47020 | 15940 | 1.55819194062 | 1.14453938393 |
| 7500 | 40456 | 14795 | 1.34066808059 | 1.17401999683 |
| 7750 | 40029 | 16200 | 1.32651776246 | 1.18093016475 |
| 8000 | 42967 | 17215 | 1.42387990456 | 1.21764040175 |
| 8250 | 39874 | 14917 | 1.32138123012 | 1.12589629406 |
| 8500 | 39589 | 14626 | 1.31193663839 | 1.11717079132 |
| 8750 | 38097 | 12398 | 1.26249337222 | 1.11623300621 |
| 9000 | 37258 | 13182 | 1.23468981972 | 1.12158597805 |
| 9250 | 41438 | 12762 | 1.37321049841 | 1.12065331928 |
| 9500 | 39011 | 14576 | 1.29278234358 | 1.21103356597 |
| 9750 | 38682 | 14760 | 1.28187963945 | 1.14135477884 |
| 10000 | 39054 | 12412 | 1.29420731707 | 1.11119068935 |
| 10250 | 36220 | 11764 | 1.20029162248 | 1.12628051699 |
| 10500 | 36358 | 11551 | 1.20486479321 | 1.09789943922 |
| 10750 | 39010 | 14729 | 1.29274920467 | 1.12935132648 |
| 11000 | 35758 | 11914 | 1.18498144221 | 1.08555808656 |
| 11250 | 36326 | 10789 | 1.20380434783 | 1.0965545279 |
| 11500 | 36250 | 12026 | 1.20128579003 | 1.07260078487 |
| 11750 | 37949 | 12937 | 1.2575888123 | 1.08677755376 |
| 12000 | 36712 | 12605 | 1.21659597031 | 1.07901044342 |
| 12250 | 35662 | 11924 | 1.18180010604 | 1.05859375 |
| 12500 | 36486 | 10834 | 1.20910657476 | 1.07246089883 |
| 12750 | 35065 | 11154 | 1.16201617179 | 1.0765370138 |
| 13000 | 35487 | 10318 | 1.17600079533 | 1.07289175419 |
| 13250 | 37766 | 9736 | 1.25152439024 | 1.05219928672 |
| 13500 | 35063 | 10956 | 1.16194989396 | 1.07972799842 |
| 13750 | 37340 | 11525 | 1.23740721103 | 1.06604384423 |
| 14000 | 34626 | 10414 | 1.14746818664 | 1.06657107743 |
| 14250 | 35173 | 12312 | 1.16559517497 | 1.04961636829 |
| 14500 | 38943 | 11923 | 1.29052889714 | 1.06894387664 |
| 14750 | 34147 | 9975 | 1.13159464475 | 1.07431340872 |
| 15000 | 35340 | 10186 | 1.17112937434 | 1.05162089614 |

Table 1 – Open Hashing Results

Problem 2 had to deal with closed hashing with linear resolution and showing that the number of probes to make a deletion or insertion met the guidelines. The results of our tests are shown below in Table 2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **B** | **Insert Total Probes** | **Delete Total Probes** | **Insert Average Probes** | **Delete Average Probes** |
| 1 | 30174 | 0 | 0.872534844717 | 0.0 |
| 1000 | 12767845 | 12626 | 369.204933202 | 0.365103232896 |
| 2000 | 14261813 | 7899 | 412.405673472 | 0.228413625586 |
| 3000 | 14034777 | 5249 | 405.840523972 | 0.151784165173 |
| 4000 | 11295085 | 4778 | 326.61745995 | 0.138164362963 |
| 5000 | 6209139 | 3768 | 179.548291018 | 0.108958417674 |
| 6000 | 241348 | 2298 | 6.97900641952 | 0.0664507547279 |
| 7000 | 32741 | 1384 | 0.946764212596 | 0.0400208200798 |
| 8000 | 19917 | 1186 | 0.575935457753 | 0.034295298132 |
| 9000 | 10662 | 780 | 0.308310681858 | 0.0225550864612 |
| 10000 | 11142 | 791 | 0.322190735064 | 0.0228731710138 |
| 11000 | 6770 | 556 | 0.195766583772 | 0.016077728298 |
| 12000 | 5295 | 457 | 0.153114336938 | 0.013214967324 |
| 13000 | 5377 | 435 | 0.155485512694 | 0.0125787982187 |
| 14000 | 4342 | 268 | 0.125556647967 | 0.00774969637384 |
| 15000 | 4102 | 406 | 0.118616621364 | 0.0117402116708 |
| 16000 | 3662 | 281 | 0.105893239257 | 0.00812561448152 |
| 17000 | 3120 | 320 | 0.0902203458447 | 0.00925336880458 |
| 18000 | 2862 | 196 | 0.082759817246 | 0.00566768839281 |
| 19000 | 2565 | 178 | 0.0741715343242 | 0.00514718639755 |
| 20000 | 2828 | 272 | 0.0817766468105 | 0.00786536348389 |
| 21000 | 2586 | 177 | 0.074778786652 | 0.00511826962003 |
| 22000 | 2168 | 137 | 0.062691573651 | 0.00396159851946 |
| 23000 | 2518 | 170 | 0.072812445781 | 0.00491585217743 |
| 24000 | 1972 | 111 | 0.0570238852582 | 0.00320976230409 |
| 25000 | 2294 | 252 | 0.0663350876178 | 0.00728702793361 |
| 26000 | 1768 | 101 | 0.0511248626453 | 0.00292059452895 |
| 27000 | 1576 | 88 | 0.0455728413626 | 0.00254467642126 |
| 28000 | 1822 | 62 | 0.0526863686311 | 0.00179284020589 |
| 29000 | 1548 | 62 | 0.0447631715922 | 0.00179284020589 |
| 30000 | 1577 | 81 | 0.0456017581401 | 0.00234225897866 |
| 31000 | 1308 | 37 | 0.0378231449887 | 0.00106992076803 |
| 32000 | 1619 | 65 | 0.0468162627957 | 0.00187959053843 |
| 33000 | 1316 | 71 | 0.0380544792088 | 0.00205309120352 |
| 34000 | 1272 | 50 | 0.0367821409982 | 0.00144583887572 |

Table 2 – Closed Hashing Results