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COSC3319.01

8 A.M.

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Lab 4 Grading Option “A part A”

**Discussion**

**C)**

**A)** The theoretical number of probes to find a random item in the hash table when it is 40% full using linear probing is 1.34. The actual number of probes was an average of 15.4 when searching for the first 30 entries and 37.5 when searching for the last 30 entries. The difference in results is mostly due to a bad hashing algorithm. Nearly every item hashed to the same address, causing multiple probes to follow, searching for an empty space linearly.

**B)** The theoretical number of probes to find a random item in the hash table when it is 87% full using linear probing is 4.5. The actual number of probes was an average of 15.4 when searching for the first 30 entries and 97.03 when searching for the last 30 entries. The difference in results, again, is due to a bad hashing algorithm. Nearly every item hashed to the same address, causing multiple probes to follow, searching for an empty space linearly. Given the large amount of entries in the table keeps the program searching long

er for empty positions.

**C)** The theoretical number of probes to find a random item in the hash table when it is 40% full using random probing is 1.28. The actual number of probes was an average of 15.10 when searching for the first 30 entries and 42.17 when searching for the last 30 entries. The difference in results is mostly due to a bad hashing algorithm. Nearly every item hashed to the same address, causing multiple probes to follow. Although random probing for collision handling did improve the probe count slightly, it is still nowhere near a perfect hash function.

**D)** The theoretical number of probes to find a random item in the hash table when it is 87% full using random probing is 2.38. The actual number of probes was an average of 15.10 when searching for the first 30 entries and 172.57 when searching for the last 30 entries. The difference in results, again, is due to a bad hashing algorithm. Nearly every item hashed to the same address, causing multiple probes to follow. Due to the empty space in the table decreasing, the random probing did not help reduce the number of probes.

**E)** The biggest flaw of the provided hash function is that the key is being multiplied by a multiple of the number that is being used to calculate the remainder, leaving only modifications made after the multiplication (the 13th character) to be used in the function. Based on the nature of the data, the 13th character held the same value for the majority of the data, leading to many collisions. A better hash function would simply take out the initial multiplication. Example: From ((“AB” + “FG”)\*256 + “5”) % 128 to ((“AB”+”FG”)+5)%128. This would utilize a distributed sample of the key properly without discarding the majority of it.

After writing a new hash function, the results were as follows: 40% linear required an average of 1.03 and 1.47 when sampling first and last 30 entries respectively. 87% linear required and average of 1.03 and 11.07 probes base on the same sample as before. 40% random needed an average of 1.07 and 1.50 probes while 87% random probing needed 1.10 and 3.17 probes on average.

**A)** **A)** There I no difference in the quality of hashing or number of collisions between a hash able in main memory and a relative file. The only noticeable difference was the performance speed. There was a noticeable delay between file reads and outputting the results for each pass. The table in main memory processed and displayed the results without any delay. The complexity of the code increased a fair amount, but the ability to store a much larger amount of records makes it worth the effort.

**Program.cs**

using System;

using System.IO;

using System.Text;

namespace Hashing

{

class Program

{

static void Main(string[] args)

{

Console.Write("Enter the size of the hashtable: ");

int hashTableSize = Convert.ToInt32(Console.ReadLine());

float expectedResults = -1;

string fileName = "";

do

{

Console.Write("Enter name of input file: ");

fileName = Console.ReadLine();

if (!File.Exists(fileName))

{

Console.WriteLine("File not found");

}

}

while (!File.Exists(fileName));

string[] input = File.ReadAllLines(fileName);

HashNode[] hashtable = new HashNode[hashTableSize];

#region 40% Linear OldHash

Console.WriteLine("\nFilling to 40% capacity with old hash algorithm linear probing");

int entries = 0;

for (int i = 0; i < hashTableSize; i++)

{

hashtable[i] = new HashNode();

}

while (entries < hashTableSize \* 0.4f && entries < input.Length)

{

int ha = GetHashOld(input[entries], hashTableSize);

InsertIntoHashTable(hashtable, input[entries], ha, ProbeMode.Linear);

entries++;

}

PrintHashTable(hashtable);

PrintProbeResults(hashtable, input, 30, entries, ProbeMode.Linear);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Linear);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 87% Linear OldHash

Console.WriteLine("\nFilling to 87% capacity with old hash algorithm linear probing");

entries = 0;

for (int i = 0; i < hashTableSize; i++)

{

hashtable[i] = new HashNode();

}

while (entries < hashTableSize \* 0.87f && entries < input.Length)

{

int ha = GetHashOld(input[entries], hashTableSize);

InsertIntoHashTable(hashtable, input[entries], ha, ProbeMode.Linear);

entries++;

}

PrintHashTable(hashtable);

PrintProbeResults(hashtable, input, 30, entries, ProbeMode.Linear);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Linear);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region Random Collision handling OldHash

#region 40% Random

Console.WriteLine("\nFilling to 40% capacity with old hash algorithm random probing");

for (int i = 0; i < hashTableSize; i++)

{

hashtable[i] = new HashNode();

}

entries = 0;

while (entries < hashTableSize \* 0.4f && entries < input.Length)

{

int ha = GetHashOld(input[entries], hashTableSize);

InsertIntoHashTable(hashtable, input[entries], ha, ProbeMode.Random);

entries++;

}

PrintHashTable(hashtable);

PrintProbeResults(hashtable, input, 30, entries, ProbeMode.Random);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Random);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 87% Random

Console.WriteLine("\nFilling to 87% capacity with old hash algorithm random probing");

// 87%

entries = 0;

for (int i = 0; i < hashTableSize; i++)

{

hashtable[i] = new HashNode();

}

while (entries < hashTableSize \* 0.87f && entries < input.Length)

{

int ha = GetHashOld(input[entries], hashTableSize);

InsertIntoHashTable(hashtable, input[entries], ha, ProbeMode.Random);

entries++;

}

PrintHashTable(hashtable);

PrintProbeResults(hashtable, input, 30, entries, ProbeMode.Random);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Random);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#endregion

#region New Hash Algo

Console.WriteLine("\nNew Hashing Function");

#region 40% Linear

Console.WriteLine("\nFilling to 40% capacity with new hash algorithm linear probing");

for (int i = 0; i < hashTableSize; i++)

{

hashtable[i] = new HashNode();

}

entries = 0;

while (entries < hashTableSize \* 0.4f && entries < input.Length)

{

int ha = GetHash(input[entries], hashTableSize);

InsertIntoHashTable(hashtable, input[entries], ha, ProbeMode.Linear);

entries++;

}

PrintHashTable(hashtable);

PrintProbeResults(hashtable, input, 30, entries, ProbeMode.Linear);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Linear);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 87% Linear

Console.WriteLine("\nFilling to 87% capacity with new hash algorithm linear probing");

// 87% Linear

entries = 0;

for (int i = 0; i < hashTableSize; i++)

{

hashtable[i] = new HashNode();

}

while (entries < hashTableSize \* 0.87f && entries < input.Length)

{

int ha = GetHash(input[entries], hashTableSize);

InsertIntoHashTable(hashtable, input[entries], ha, ProbeMode.Linear);

entries++;

}

PrintHashTable(hashtable);

PrintProbeResults(hashtable, input, 30, entries, ProbeMode.Linear);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Linear);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 40% Random

Console.WriteLine("\nFilling to 40% capacity with new hash algorithm random probing");

for (int i = 0; i < hashTableSize; i++)

{

hashtable[i] = new HashNode();

}

entries = 0;

while (entries < hashTableSize \* 0.4f && entries < input.Length)

{

int ha = GetHash(input[entries], hashTableSize);

InsertIntoHashTable(hashtable, input[entries], ha, ProbeMode.Random);

entries++;

}

PrintHashTable(hashtable);

PrintProbeResults(hashtable, input, 30, entries, ProbeMode.Random);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Random);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 87% Random

Console.WriteLine("\nFilling to 87% capacity with new hash algorithm random probing");

entries = 0;

for (int i = 0; i < hashTableSize; i++)

{

hashtable[i] = new HashNode();

}

while (entries < hashTableSize \* 0.87f && entries < input.Length)

{

int ha = GetHash(input[entries], hashTableSize);

InsertIntoHashTable(hashtable, input[entries], ha, ProbeMode.Random);

entries++;

}

PrintHashTable(hashtable);

PrintProbeResults(hashtable, input, 30, entries, ProbeMode.Random);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Random);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#endregion

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Relative File

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Console.WriteLine("\n\nStarting Relative File Processing");

Console.Write("Enter the new size of the hashtable: ");

hashTableSize = Convert.ToInt32(Console.ReadLine());

string hashTableFileName = "hashtable40LO.txt";

StreamWriter sw = new StreamWriter(hashTableFileName, false);

#region 40% Linear OldHash

Console.WriteLine("\nFilling to 40% capacity with old hash algorithm linear probing");

entries = 0;

for (int i = 0; i < hashTableSize; i++)

{

sw.Write("{0,-50}", i + ",,,");

}

sw.Flush();

sw.Close();

while (entries < hashTableSize \* 0.4f && entries < input.Length)

{

int ha = GetHashOld(input[entries], hashTableSize);

InsertIntoHashTable(hashTableFileName, hashTableSize, input[entries], ha, ProbeMode.Linear);

entries++;

}

PrintHashTable(hashTableFileName, hashTableSize);

PrintProbeResults(hashTableFileName, hashTableSize, input, 30, entries, ProbeMode.Linear);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Linear);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 87% Linear OldHash

Console.WriteLine("\nFilling to 87% capacity with old hash algorithm linear probing");

hashTableFileName = "hashtable87LO.txt";

sw = new StreamWriter(hashTableFileName, false);

entries = 0;

for (int i = 0; i < hashTableSize; i++)

{

sw.Write("{0,-50}", i + ",,,");

}

sw.Flush();

sw.Close();

while (entries < hashTableSize \* 0.87f && entries < input.Length)

{

int ha = GetHashOld(input[entries], hashTableSize);

InsertIntoHashTable(hashTableFileName, hashTableSize, input[entries], ha, ProbeMode.Linear);

entries++;

}

PrintHashTable(hashTableFileName, hashTableSize);

PrintProbeResults(hashTableFileName, hashTableSize, input, 30, entries, ProbeMode.Linear);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Linear);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region Random Collision handling OldHash

#region 40% Random

Console.WriteLine("\nFilling to 40% capacity with old hash algorithm random probing");

hashTableFileName = "hashtable40RO.txt";

sw = new StreamWriter(hashTableFileName, false);

for (int i = 0; i < hashTableSize; i++)

{

sw.Write("{0,-50}", i + ",,,");

}

sw.Flush();

sw.Close();

entries = 0;

while (entries < hashTableSize \* 0.4f && entries < input.Length)

{

int ha = GetHashOld(input[entries], hashTableSize);

InsertIntoHashTable(hashTableFileName, hashTableSize, input[entries], ha, ProbeMode.Random);

entries++;

}

PrintHashTable(hashTableFileName, hashTableSize);

PrintProbeResults(hashTableFileName, hashTableSize, input, 30, entries, ProbeMode.Random);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Random);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 87% Random

Console.WriteLine("\nFilling to 87% capacity with old hash algorithm random probing");

// 87%

entries = 0;

hashTableFileName = "hashtable87RO.txt";

sw = new StreamWriter(hashTableFileName, false);

for (int i = 0; i < hashTableSize; i++)

{

sw.Write("{0,-50}", i + ",,,");

}

sw.Flush();

sw.Close();

while (entries < hashTableSize \* 0.87f && entries < input.Length)

{

int ha = GetHashOld(input[entries], hashTableSize);

InsertIntoHashTable(hashTableFileName, hashTableSize, input[entries], ha, ProbeMode.Random);

entries++;

}

PrintHashTable(hashTableFileName, hashTableSize);

PrintProbeResults(hashTableFileName, hashTableSize, input, 30, entries, ProbeMode.Random);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Random);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#endregion

#region New Hash Algo

Console.WriteLine("\nNew Hashing Function");

#region 40% Linear

Console.WriteLine("\nFilling to 40% capacity with new hash algorithm linear probing");

hashTableFileName = "hashtable40LN.txt";

sw = new StreamWriter(hashTableFileName, false);

for (int i = 0; i < hashTableSize; i++)

{

sw.Write("{0,-50}", i + ",,,");

}

sw.Flush();

sw.Close();

entries = 0;

while (entries < hashTableSize \* 0.4f && entries < input.Length)

{

int ha = GetHash(input[entries], hashTableSize);

InsertIntoHashTable(hashTableFileName, hashTableSize, input[entries], ha, ProbeMode.Linear);

entries++;

}

PrintHashTable(hashTableFileName, hashTableSize);

PrintProbeResults(hashTableFileName, hashTableSize, input, 30, entries, ProbeMode.Linear);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Linear);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 87% Linear

Console.WriteLine("\nFilling to 87% capacity with new hash algorithm linear probing");

// 87% Linear

entries = 0;

hashTableFileName = "hashtable87LN.txt";

sw = new StreamWriter(hashTableFileName, false);

for (int i = 0; i < hashTableSize; i++)

{

sw.Write("{0,-50}", i + ",,,");

}

sw.Flush();

sw.Close();

while (entries < hashTableSize \* 0.87f && entries < input.Length)

{

int ha = GetHash(input[entries], hashTableSize);

InsertIntoHashTable(hashTableFileName, hashTableSize, input[entries], ha, ProbeMode.Linear);

entries++;

}

PrintHashTable(hashTableFileName, hashTableSize);

PrintProbeResults(hashTableFileName, hashTableSize, input, 30, entries, ProbeMode.Linear);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Linear);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 40% Random

Console.WriteLine("\nFilling to 40% capacity with new hash algorithm random probing");

hashTableFileName = "hashtable40RN.txt";

sw = new StreamWriter(hashTableFileName, false);

for (int i = 0; i < hashTableSize; i++)

{

sw.Write("{0,-50}", i + ",,,");

}

sw.Flush();

sw.Close();

entries = 0;

while (entries < hashTableSize \* 0.4f && entries < input.Length)

{

int ha = GetHash(input[entries], hashTableSize);

InsertIntoHashTable(hashTableFileName, hashTableSize, input[entries], ha, ProbeMode.Random);

entries++;

}

PrintHashTable(hashTableFileName, hashTableSize);

PrintProbeResults(hashTableFileName, hashTableSize, input, 30, entries, ProbeMode.Random);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Random);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#region 87% Random

Console.WriteLine("\nFilling to 87% capacity with new hash algorithm random probing");

entries = 0;

hashTableFileName = "hashtable87RN.txt";

sw = new StreamWriter(hashTableFileName, false);

for (int i = 0; i < hashTableSize; i++)

{

sw.Write("{0,-50}", i + ",,,");

}

sw.Flush();

sw.Close();

while (entries < hashTableSize \* 0.87f && entries < input.Length)

{

int ha = GetHash(input[entries], hashTableSize);

InsertIntoHashTable(hashTableFileName, hashTableSize, input[entries], ha, ProbeMode.Random);

entries++;

}

PrintHashTable(hashTableFileName, hashTableSize);

PrintProbeResults(hashTableFileName, hashTableSize, input, 30, entries, ProbeMode.Random);

expectedResults = CalculateExpectedProbes(entries, hashTableSize, ProbeMode.Random);

Console.WriteLine("Theoretical probe count: " + expectedResults);

#endregion

#endregion

Console.Write("Press any key to continue...");

Console.Read();

}

public static int GetHashOld(string key, int tableSize)

{

long temp = ConvertStringToLong(key.Substring(0, 2));

temp = ConvertStringToLong(key.Substring(5, 2));

temp \*= 256;

temp += ConvertStringToLong(key.Substring(12, 1));

temp %= tableSize;

return (char)temp;

}

public static int GetHash(string key, int tableSize)

{

long temp = ConvertStringToLong(key.Substring(0, 4));

temp += ConvertStringToLong(key.Substring(10, 1));

temp %= tableSize;

return (char)temp;

}

public static void InsertIntoHashTable(HashNode[] table, string key, int ha, ProbeMode mode)

{

int originalAddress = ha;

int probes = 0;

if (mode == ProbeMode.Linear)

{

while (!string.IsNullOrEmpty(table[ha].key))

{

ha++;

ha %= table.Length;

probes++;

}

}

else if (mode == ProbeMode.Random)

{

int randomSeed = 1234;

Random rand = new Random(randomSeed);

while (!string.IsNullOrEmpty(table[ha].key))

{

int r = rand.Next(table.Length - 1);

ha = (ha + r) % table.Length;

probes++;

}

}

table[ha].key = key;

table[ha].firstHashAddress = originalAddress;

table[ha].probes = probes + 1;

}

public static void InsertIntoHashTable(string fileName, int hastableSize, string key, int ha, ProbeMode mode, int lineLength = 50)

{

Stream stream = File.Open(fileName, FileMode.Open, FileAccess.ReadWrite);

int originalAddress = ha;

int probes = 0;

if (mode == ProbeMode.Linear)

{

while (!string.IsNullOrEmpty(ReadLineHashInfo(stream, ha, lineLength)[1]))

{

ha++;

ha %= hastableSize;

probes++;

}

}

else if (mode == ProbeMode.Random)

{

int randomSeed = 1234;

Random rand = new Random(randomSeed);

while (!string.IsNullOrEmpty(ReadLineHashInfo(stream, ha, lineLength)[1]))

{

int r = rand.Next(hastableSize - 1);

ha = (ha + r) % hastableSize;

probes++;

}

}

char[] chars = string.Format("{0,-50}", ha + "," + key + "," + originalAddress + "," + (probes + 1)).ToCharArray();

stream.Seek(ha \* lineLength, SeekOrigin.Begin);

byte[] write = Encoding.Default.GetBytes(chars, 0, lineLength);

stream.Write(write, 0, lineLength);

stream.Flush();

stream.Close();

}

public static HashNode ProbeHashTable(HashNode[] table, string key, int ha, ProbeMode mode)

{

if (mode == ProbeMode.Linear)

{

// if key is not what is expected

// then increment address and search there

while (table[ha].key != key)

{

ha++;

ha %= table.Length;

}

}

else if (mode == ProbeMode.Random)

{

int randomSeed = 1234;

Random rand = new Random(randomSeed);

// if key is not what is expected

// then add next random offset to address and search there

while (table[ha].key != key)

{

int r = rand.Next(table.Length - 1);

ha = (ha + r) % table.Length;

}

}

return table[ha];

}

public static string[] ProbeHashTable(string fileName, int hastableSize, string key, int ha, ProbeMode mode, int lineLength = 50)

{

Stream stream = File.Open(fileName, FileMode.Open, FileAccess.ReadWrite);

string[] hash = new string[4];

if (mode == ProbeMode.Linear)

{

// if key is not what is expected

// then increment address and search there

while (!(hash = ReadLineHashInfo(stream, ha, lineLength))[1].Equals(key))

{

ha++;

ha %= hastableSize;

}

}

else if (mode == ProbeMode.Random)

{

int randomSeed = 1234;

Random rand = new Random(randomSeed);

while (!(hash = ReadLineHashInfo(stream, ha, lineLength))[1].Equals(key))

{

int r = rand.Next(hastableSize - 1);

ha = (ha + r) % hastableSize;

}

}

stream.Flush();

stream.Close();

return hash;

}

public static void PrintProbeResults(HashNode[] table, string[] input, int n, int tableEntries, ProbeMode mode)

{

int prb = 0, max = 0, total = 0;

float avg = 0.0f;

int min = 99999;

int cnt = 0;

while (cnt < n)

{

prb = ProbeHashTable(table, input[cnt], GetHashOld(input[cnt], table.Length), mode).probes;

total += prb;

if (prb < min) min = prb;

if (prb > max) max = prb;

cnt++;

}

avg = (float)total / (float)n;

Console.WriteLine("First " + n + " " + mode.ToString() + " Probes: min = " + min + ", max = " + max + ", avg = " + avg.ToString("0.00"));

prb = max = total = 0;

avg = 0.0f;

min = 99999;

cnt = 0;

while (cnt < n)

{

if (cnt >= input.Length) break;

prb = ProbeHashTable(table, input[tableEntries - 1 - cnt], GetHashOld(input[tableEntries - 1 - cnt], table.Length), ProbeMode.Linear).probes;

total += prb;

if (prb < min) min = prb;

if (prb > max) max = prb;

cnt++;

}

avg = (float)total / (float)n;

Console.WriteLine("Last " + n + " " + mode.ToString() + " Probes: min = " + min + ", max = " + max + ", avg = " + avg.ToString("0.00"));

}

public static void PrintProbeResults(string fileName, int hastableSize, string[] input, int n, int tableEntries, ProbeMode mode, int lineLength = 50)

{

int prb = 0, max = 0, total = 0;

float avg = 0.0f;

int min = 99999;

int cnt = 0;

string[] probe;

while (cnt < n)

{

probe = ProbeHashTable(fileName, hastableSize, input[cnt], GetHashOld(input[cnt], hastableSize), mode);

prb = 0;

int.TryParse(probe[3], out prb);

total += prb;

if (prb < min) min = prb;

if (prb > max) max = prb;

cnt++;

}

avg = (float)total / (float)n;

Console.WriteLine("First " + n + " " + mode.ToString() + " Probes: min = " + min + ", max = " + max + ", avg = " + avg.ToString("0.00"));

prb = max = total = 0;

avg = 0.0f;

min = 99999;

cnt = 0;

while (cnt < n)

{

probe = ProbeHashTable(fileName, hastableSize, input[tableEntries - 1 - cnt], GetHashOld(input[tableEntries - 1 - cnt], hastableSize), mode);

prb = 0;

int.TryParse(probe[3], out prb);

total += prb;

if (prb < min) min = prb;

if (prb > max) max = prb;

cnt++;

}

avg = (float)total / (float)n;

Console.WriteLine("Last " + n + " " + mode.ToString() + " Probes: min = " + min + ", max = " + max + ", avg = " + avg.ToString("0.00"));

}

public static float CalculateExpectedProbes(int numKyes, int tableSize, ProbeMode mode)

{

float e = -1;

float a = (float)numKyes / (float)tableSize;

if(mode == ProbeMode.Linear)

{

e = (1 - a / 2) / (1 - a);

}

else if(mode == ProbeMode.Random)

{

e = -(1 / a) \* (float)Math.Log(1 - a);

}

return e;

}

public static void PrintHashTable(HashNode[] table)

{

Console.WriteLine("{0, -8}|{1, -20}|{2, -17}|{3, -10}|", "ADDRESS", "KEY", "ORIGINAL ADDRESS", "PROBES");

for (int i = 0; i < table.Length; i++)

{

Console.WriteLine("{0, -8}|{1}", i, table[i].ToString());

}

}

public static void PrintHashTable(string fileName, int hastableSize, int lineLength = 50)

{

Stream stream = File.Open(fileName, FileMode.Open, FileAccess.Read);

byte[] buffer = new byte[lineLength];

string line = "";

Console.WriteLine("{0, -8}|{1, -20}|{2, -17}|{3, -10}|", "ADDRESS","KEY", "ORIGINAL ADDRESS", "PROBES");

for (int i = 0; i < hastableSize; i++)

{

stream.Seek(i \* lineLength, SeekOrigin.Begin);

stream.Read(buffer, 0, lineLength);

line = Encoding.Default.GetString(buffer);

string[] hashData = line.Split(new char[] { ',' }, StringSplitOptions.None);

string output = "";

if (!string.IsNullOrEmpty(hashData[1]))

output += string.Format("{0, -20}|", hashData[1]);

else

output += string.Format("{0, -20}|", "");

if (!string.IsNullOrEmpty(hashData[2]))

output += string.Format("{0, -17}|", hashData[2]);

else

output += string.Format("{0, -17}|", "");

int probes = 1;

int.TryParse(hashData[3], out probes);

if (int.TryParse(hashData[3], out probes))

output += string.Format("{0, -10}|", probes);

else

output += string.Format("{0, -10}|", "");

Console.WriteLine("{0, -8}|{1}", i, output);

}

stream.Flush();

stream.Close();

}

public static string[] ReadLineHashInfo(Stream stream, int lineNumber, int lineLength = 50)

{

byte[] buffer = new byte[lineLength];

stream.Seek(lineNumber \* lineLength, SeekOrigin.Begin);

stream.Read(buffer, 0, lineLength);

string line = Encoding.Default.GetString(buffer);

string[] hash = line.Split(new char[] { ',' }, StringSplitOptions.None);

return hash;

}

public static long ConvertStringToLong(string str)

{

long result = 0;

str = str.ToUpper();

foreach (char c in str)

{

result \*= 10;

int parse = 0;

if (int.TryParse(c.ToString(), out parse))

result += parse; // already a number

else if (!c.Equals(' '))

result += (int)c - 64; // converts letter to number

}

return result;

}

}

public enum ProbeMode { Linear, Random }

public class HashNode

{

public string key;

public int? firstHashAddress;

public int probes;

public HashNode()

{

key = null;

firstHashAddress = null;

probes = 0;

}

public override string ToString()

{

string output = "";

if (!string.IsNullOrEmpty(key))

output += string.Format("{0, -20}|", key);

else

output += string.Format("{0, -20}|", "");

if (firstHashAddress != null)

output += string.Format("{0, -17}|", firstHashAddress);

else

output += string.Format("{0, -17}|", "");

if (probes != 0)

output += string.Format("{0, -10}|", probes);

else

output += string.Format("{0, -10}|", "");

return output;

}

}

}

Enter the size of the hashtable: 128

Enter name of input file: input.txt

Filling to 40% capacity with old hash algorithm linear probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Aguirrie |0 |1 |

1 |Alcantara |0 |2 |

2 |Bhandari |0 |3 |

3 |1234567890123456 |3 |1 |

4 |Carmona |0 |5 |

5 |Casper |0 |6 |

6 |Cook |0 |7 |

7 |Daniels |0 |8 |

8 |Nienberg |0 |9 |

9 |Paschal |0 |10 |

10 |Red |0 |11 |

11 |Salkowski |0 |12 |

12 |Zulfiqar |0 |13 |

13 |Qamruddin |0 |14 |

14 |Acevedo |0 |15 |

15 |Ajose |0 |16 |

16 |Arauza |0 |17 |

17 |Buck |0 |18 |

18 |Clark |0 |19 |

19 |Crouch |0 |20 |

20 |Davies |0 |21 |

21 |Dugger |0 |22 |

22 |Egbe |0 |23 |

23 |Ellington |0 |24 |

24 |Farral |0 |25 |

25 |Garza |0 |26 |

26 |Gurung |0 |27 |

27 |Joseph |0 |28 |

28 |Kelly |0 |29 |

29 |Corey |0 |30 |

30 |Adam |0 |31 |

31 |Clayton |0 |32 |

32 |Dustin |0 |33 |

33 |Robert |0 |34 |

34 |Kyle |0 |35 |

35 |Scott |0 |36 |

36 |Octavio |0 |37 |

37 |Judy |0 |38 |

38 |Derek |0 |39 |

39 |Jeffrey |0 |40 |

40 |Jordon |0 |41 |

41 |Vinnela |0 |42 |

42 |Lisa |0 |43 |

43 |Todd |0 |44 |

44 |Veronica |0 |45 |

45 |Matthew |0 |46 |

46 |Michael |0 |47 |

47 |Akhila |0 |48 |

48 |John |0 |49 |

49 |Charles |0 |50 |

50 |James |0 |51 |

51 |Chris |0 |52 |

52 | | | |

53 | | | |

54 | | | |

55 | | | |

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First 30 Linear Probes: min = 1, max = 30, avg = 15.40

Last 30 Linear Probes: min = 23, max = 52, avg = 37.50

Theoretical probe count: 1.342105

Filling to 87% capacity with old hash algorithm linear probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Aguirrie |0 |1 |

1 |Alcantara |0 |2 |

2 |Bhandari |0 |3 |

3 |1234567890123456 |3 |1 |

4 |Carmona |0 |5 |

5 |Casper |0 |6 |

6 |Cook |0 |7 |

7 |Daniels |0 |8 |

8 |Nienberg |0 |9 |

9 |Paschal |0 |10 |

10 |Red |0 |11 |

11 |Salkowski |0 |12 |

12 |Zulfiqar |0 |13 |

13 |Qamruddin |0 |14 |

14 |Acevedo |0 |15 |

15 |Ajose |0 |16 |

16 |Arauza |0 |17 |

17 |Buck |0 |18 |

18 |Clark |0 |19 |

19 |Crouch |0 |20 |

20 |Davies |0 |21 |

21 |Dugger |0 |22 |

22 |Egbe |0 |23 |

23 |Ellington |0 |24 |

24 |Farral |0 |25 |

25 |Garza |0 |26 |

26 |Gurung |0 |27 |

27 |Joseph |0 |28 |

28 |Kelly |0 |29 |

29 |Corey |0 |30 |

30 |Adam |0 |31 |

31 |Clayton |0 |32 |

32 |Dustin |0 |33 |

33 |Robert |0 |34 |

34 |Kyle |0 |35 |

35 |Scott |0 |36 |

36 |Octavio |0 |37 |

37 |Judy |0 |38 |

38 |Derek |0 |39 |

39 |Jeffrey |0 |40 |

40 |Jordon |0 |41 |

41 |Vinnela |0 |42 |

42 |Lisa |0 |43 |

43 |Todd |0 |44 |

44 |Veronica |0 |45 |

45 |Matthew |0 |46 |

46 |Michael |0 |47 |

47 |Akhila |0 |48 |

48 |John |0 |49 |

49 |Charles |0 |50 |

50 |James |0 |51 |

51 |Chris |0 |52 |

52 |Wade |0 |53 |

53 |Christopher |0 |54 |

54 |Fernando |0 |55 |

55 |Batbold |0 |56 |

56 |Joel |0 |57 |

57 |Fabulous |0 |58 |

58 |Misogamist |0 |59 |

59 |Maiden |0 |60 |

60 |Eye |0 |61 |

61 |Constriction |0 |62 |

62 |Necromancer |0 |63 |

63 |Syncopate |0 |64 |

64 |Yolk |0 |65 |

65 |Afterwards |0 |66 |

66 |Person |0 |67 |

67 |Northwest |0 |68 |

68 |Irreversible |0 |69 |

69 |Fabricate |0 |70 |

70 |Honor |0 |71 |

71 |Staple |0 |72 |

72 |Under |0 |73 |

73 |Jutty |0 |74 |

74 |Finagle |0 |75 |

75 |Cook |0 |76 |

76 |Rush |0 |77 |

77 |Wine |0 |78 |

78 |Screen |0 |79 |

79 |Perfect |0 |80 |

80 |mole |0 |81 |

81 |parasympathetic |20 |62 |

82 |poison |0 |83 |

83 |brutalize |0 |84 |

84 |cap |0 |85 |

85 |ratiocination |14 |72 |

86 |cauldron |0 |87 |

87 |prepossess |0 |88 |

88 |wince |0 |89 |

89 |orthodontist |0 |90 |

90 |live |0 |91 |

91 |magnetic |0 |92 |

92 |inlet |0 |93 |

93 |constrain |0 |94 |

94 |marsupial |0 |95 |

95 |rationalize |0 |96 |

96 |scat |0 |97 |

97 |toluene |0 |98 |

98 |wet |0 |99 |

99 |sparse |0 |100 |

100 |quandary |0 |101 |

101 |dactyl |0 |102 |

102 |nosegay |0 |103 |

103 |option |0 |104 |

104 |forgetful |0 |105 |

105 |privilege |0 |106 |

106 |sponsor |0 |107 |

107 |exhilarate |0 |108 |

108 |guard |0 |109 |

109 |noggin |0 |110 |

110 |prologue |0 |111 |

111 |seal |0 |112 |

112 | | | |

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First 30 Linear Probes: min = 1, max = 30, avg = 15.40

Last 30 Linear Probes: min = 72, max = 112, avg = 97.03

Theoretical probe count: 4.5

Filling to 40% capacity with old hash algorithm random probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Aguirrie |0 |1 |

1 | | | |

2 | | | |

3 |1234567890123456 |3 |1 |

4 | | | |

5 | | | |

6 |Salkowski |0 |11 |

7 | | | |

8 | | | |

9 |Vinnela |0 |48 |

10 |Akhila |0 |56 |

11 | | | |

12 | | | |

13 | | | |

14 |Paschal |0 |9 |

15 | | | |

16 |Buck |0 |17 |

17 | | | |

18 | | | |

19 | | | |

20 | | | |

21 | | | |

22 | | | |

23 | | | |

24 | | | |

25 | | | |

26 | | | |

27 |Scott |0 |39 |

28 |Charles |0 |58 |

29 | | | |

30 | | | |

31 |Kelly |0 |31 |

32 | | | |

33 |Acevedo |0 |14 |

34 | | | |

35 |Bhandari |0 |3 |

36 | | | |

37 | | | |

38 | | | |

39 | | | |

40 |Judy |0 |42 |

41 |Qamruddin |0 |13 |

42 | | | |

43 | | | |

44 | | | |

45 | | | |

46 |Joseph |0 |30 |

47 | | | |

48 | | | |

49 | | | |

50 |Alcantara |0 |2 |

51 | | | |

52 |Jeffrey |0 |46 |

53 | | | |

54 |Dustin |0 |36 |

55 | | | |

56 | | | |

57 |Arauza |0 |16 |

58 | | | |

59 |Zulfiqar |0 |12 |

60 | | | |

61 |Adam |0 |33 |

62 |Octavio |0 |41 |

63 | | | |

64 |Veronica |0 |53 |

65 | | | |

66 | | | |

67 |Casper |0 |5 |

68 | | | |

69 | | | |

70 |Lisa |0 |50 |

71 | | | |

72 | | | |

73 | | | |

74 | | | |

75 |Carmona |0 |4 |

76 |Nienberg |0 |8 |

77 | | | |

78 |Farral |0 |26 |

79 | | | |

80 |Todd |0 |52 |

81 | | | |

82 | | | |

83 | | | |

84 |Robert |0 |37 |

85 | | | |

86 | | | |

87 | | | |

88 | | | |

89 |Gurung |0 |28 |

90 |Clark |0 |18 |

91 |Ajose |0 |15 |

92 | | | |

93 | | | |

94 |Egbe |0 |22 |

95 |Red |0 |10 |

96 | | | |

97 | | | |

98 | | | |

99 |Crouch |0 |19 |

100 | | | |

101 | | | |

102 |Daniels |0 |7 |

103 |Michael |0 |55 |

104 | | | |

105 |Garza |0 |27 |

106 |James |0 |61 |

107 | | | |

108 | | | |

109 |Davies |0 |20 |

110 |Cook |0 |6 |

111 |Kyle |0 |38 |

112 |John |0 |57 |

113 | | | |

114 |Chris |0 |62 |

115 |Clayton |0 |35 |

116 |Jordon |0 |47 |

117 | | | |

118 | | | |

119 |Matthew |0 |54 |

120 | | | |

121 | | | |

122 | | | |

123 | | | |

124 |Dugger |0 |21 |

125 |Ellington |0 |25 |

126 |Corey |0 |32 |

127 |Derek |0 |44 |

First 30 Random Probes: min = 1, max = 32, avg = 15.10

Last 30 Random Probes: min = 22, max = 62, avg = 42.17

Theoretical probe count: 1.283192

Filling to 87% capacity with old hash algorithm random probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Aguirrie |0 |1 |

1 |cauldron |0 |133 |

2 |Fernando |0 |70 |

3 |1234567890123456 |3 |1 |

4 |nosegay |0 |193 |

5 |Irreversible |0 |93 |

6 |Salkowski |0 |11 |

7 |Joel |0 |75 |

8 |Constriction |0 |84 |

9 |Vinnela |0 |48 |

10 |Akhila |0 |56 |

11 |seal |0 |251 |

12 |Christopher |0 |69 |

13 |sponsor |0 |216 |

14 |Paschal |0 |9 |

15 |privilege |0 |211 |

16 |Buck |0 |17 |

17 |Necromancer |0 |85 |

18 |Northwest |0 |91 |

19 |exhilarate |0 |220 |

20 |parasympathetic |20 |1 |

21 |Yolk |0 |88 |

22 |cap |0 |131 |

23 |forgetful |0 |210 |

24 |magnetic |0 |153 |

25 | | | |

26 | | | |

27 |Scott |0 |39 |

28 |Charles |0 |58 |

29 | | | |

30 | | | |

31 |Kelly |0 |31 |

32 |Syncopate |0 |86 |

33 |Acevedo |0 |14 |

34 | | | |

35 |Bhandari |0 |3 |

36 |Fabricate |0 |99 |

37 | | | |

38 |brutalize |0 |127 |

39 | | | |

40 |Judy |0 |42 |

41 |Qamruddin |0 |13 |

42 |marsupial |0 |156 |

43 |Fabulous |0 |76 |

44 |Cook |0 |109 |

45 |Eye |0 |81 |

46 |Joseph |0 |30 |

47 |Staple |0 |102 |

48 |Finagle |0 |106 |

49 |ratiocination |14 |3 |

50 |Alcantara |0 |2 |

51 | | | |

52 |Jeffrey |0 |46 |

53 |orthodontist |0 |149 |

54 |Dustin |0 |36 |

55 |Person |0 |90 |

56 |dactyl |0 |192 |

57 |Arauza |0 |16 |

58 |live |0 |151 |

59 |Zulfiqar |0 |12 |

60 | | | |

61 |Adam |0 |33 |

62 |Octavio |0 |41 |

63 |noggin |0 |243 |

64 |Veronica |0 |53 |

65 |Under |0 |103 |

66 |Batbold |0 |71 |

67 |Casper |0 |5 |

68 |Wade |0 |64 |

69 |Jutty |0 |105 |

70 |Lisa |0 |50 |

71 |wince |0 |148 |

72 |Misogamist |0 |77 |

73 | | | |

74 | | | |

75 |Carmona |0 |4 |

76 |Nienberg |0 |8 |

77 |constrain |0 |155 |

78 |Farral |0 |26 |

79 |Maiden |0 |79 |

80 |Todd |0 |52 |

81 |Honor |0 |100 |

82 |wet |0 |187 |

83 | | | |

84 |Robert |0 |37 |

85 |option |0 |195 |

86 |poison |0 |123 |

87 | | | |

88 | | | |

89 |Gurung |0 |28 |

90 |Clark |0 |18 |

91 |Ajose |0 |15 |

92 |prologue |0 |244 |

93 |scat |0 |160 |

94 |Egbe |0 |22 |

95 |Red |0 |10 |

96 |prepossess |0 |139 |

97 |rationalize |0 |157 |

98 |Screen |0 |118 |

99 |Crouch |0 |19 |

100 |quandary |0 |190 |

101 |Afterwards |0 |89 |

102 |Daniels |0 |7 |

103 |Michael |0 |55 |

104 |Perfect |0 |119 |

105 |Garza |0 |27 |

106 |James |0 |61 |

107 |Wine |0 |117 |

108 | | | |

109 |Davies |0 |20 |

110 |Cook |0 |6 |

111 |Kyle |0 |38 |

112 |John |0 |57 |

113 |toluene |0 |177 |

114 |Chris |0 |62 |

115 |Clayton |0 |35 |

116 |Jordon |0 |47 |

117 |sparse |0 |188 |

118 | | | |

119 |Matthew |0 |54 |

120 |Rush |0 |110 |

121 |inlet |0 |154 |

122 |guard |0 |221 |

123 |mole |0 |122 |

124 |Dugger |0 |21 |

125 |Ellington |0 |25 |

126 |Corey |0 |32 |

127 |Derek |0 |44 |

First 30 Random Probes: min = 1, max = 32, avg = 15.10

Last 30 Random Probes: min = 3, max = 251, avg = 172.57

Theoretical probe count: 2.376505

New Hashing Function

Filling to 40% capacity with new hash algorithm linear probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 | | | |

1 | | | |

2 | | | |

3 | | | |

4 |Clark |4 |1 |

5 |Judy |5 |1 |

6 | | | |

7 | | | |

8 |Bhandari |8 |1 |

9 |Matthew |8 |2 |

10 |Garza |10 |1 |

11 |Clayton |11 |1 |

12 | | | |

13 |Octavio |13 |1 |

14 |Scott |14 |1 |

15 |Arauza |15 |1 |

16 |Adam |15 |2 |

17 |Vinnela |14 |4 |

18 |Akhila |13 |6 |

19 | | | |

20 | | | |

21 |Chris |21 |1 |

22 | | | |

23 | | | |

24 | | | |

25 |Daniels |25 |1 |

26 |Farral |26 |1 |

27 | | | |

28 | | | |

29 | | | |

30 | | | |

31 |Salkowski |31 |1 |

32 | | | |

33 |Dugger |33 |1 |

34 | | | |

35 |Lisa |35 |1 |

36 |Jordon |36 |1 |

37 |Paschal |37 |1 |

38 |Dustin |38 |1 |

39 |Veronica |39 |1 |

40 |Todd |40 |1 |

41 | | | |

42 | | | |

43 | | | |

44 | | | |

45 |Buck |45 |1 |

46 | | | |

47 |Joseph |47 |1 |

48 | | | |

49 | | | |

50 | | | |

51 | | | |

52 | | | |

53 |Cook |53 |1 |

54 | | | |

55 |Alcantara |55 |1 |

56 | | | |

57 |Ellington |57 |1 |

58 |Kyle |57 |2 |

59 | | | |

60 | | | |

61 | | | |

62 | | | |

63 | | | |

64 | | | |

65 | | | |

66 |Zulfiqar |66 |1 |

67 | | | |

68 | | | |

69 |Robert |69 |1 |

70 |Jeffrey |70 |1 |

71 | | | |

72 | | | |

73 | | | |

74 |John |74 |1 |

75 | | | |

76 | | | |

77 |Corey |77 |1 |

78 |Derek |77 |2 |

79 | | | |

80 | | | |

81 | | | |

82 | | | |

83 |1234567890123456 |83 |1 |

84 | | | |

85 |Gurung |85 |1 |

86 | | | |

87 | | | |

88 | | | |

89 | | | |

90 | | | |

91 | | | |

92 |Acevedo |92 |1 |

93 |Carmona |93 |1 |

94 |Egbe |93 |2 |

95 | | | |

96 |Qamruddin |96 |1 |

97 | | | |

98 | | | |

99 | | | |

100 | | | |

101 | | | |

102 | | | |

103 | | | |

104 | | | |

105 |Davies |105 |1 |

106 |Casper |106 |1 |

107 |Crouch |107 |1 |

108 |Red |108 |1 |

109 | | | |

110 | | | |

111 | | | |

112 |Kelly |112 |1 |

113 | | | |

114 |Michael |114 |1 |

115 | | | |

116 |Nienberg |116 |1 |

117 |Charles |116 |2 |

118 | | | |

119 | | | |

120 | | | |

121 |Ajose |121 |1 |

122 | | | |

123 |James |123 |1 |

124 | | | |

125 | | | |

126 | | | |

127 |Aguirrie |127 |1 |

First 30 Linear Probes: min = 1, max = 2, avg = 1.03

Last 30 Linear Probes: min = 1, max = 6, avg = 1.47

Theoretical probe count: 1.342105

Filling to 87% capacity with new hash algorithm linear probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Eye |126 |3 |

1 |Finagle |1 |1 |

2 |magnetic |0 |3 |

3 |orthodontist |3 |1 |

4 |Clark |4 |1 |

5 |Judy |5 |1 |

6 |scat |2 |5 |

7 |Yolk |7 |1 |

8 |Bhandari |8 |1 |

9 |Matthew |8 |2 |

10 |Garza |10 |1 |

11 |Clayton |11 |1 |

12 |Maiden |10 |3 |

13 |Octavio |13 |1 |

14 |Scott |14 |1 |

15 |Arauza |15 |1 |

16 |Adam |15 |2 |

17 |Vinnela |14 |4 |

18 |Akhila |13 |6 |

19 |Syncopate |11 |9 |

20 |Afterwards |13 |8 |

21 |Chris |21 |1 |

22 |ratiocination |14 |9 |

23 |rationalize |10 |14 |

24 |toluene |9 |16 |

25 |Daniels |25 |1 |

26 |Farral |26 |1 |

27 |Misogamist |25 |3 |

28 |wet |20 |9 |

29 |Screen |29 |1 |

30 |inlet |29 |2 |

31 |Salkowski |31 |1 |

32 |Jutty |32 |1 |

33 |Dugger |33 |1 |

34 |Staple |34 |1 |

35 |Lisa |35 |1 |

36 |Jordon |36 |1 |

37 |Paschal |37 |1 |

38 |Dustin |38 |1 |

39 |Veronica |39 |1 |

40 |Todd |40 |1 |

41 |Christopher |39 |3 |

42 |Fernando |38 |5 |

43 |Joel |42 |2 |

44 |mole |33 |12 |

45 |Buck |45 |1 |

46 |Under |45 |2 |

47 |Joseph |47 |1 |

48 |Perfect |46 |3 |

49 |parasympathetic |33 |17 |

50 |sparse |20 |31 |

51 |constrain |51 |1 |

52 |quandary |52 |1 |

53 |Cook |53 |1 |

54 |Cook |53 |2 |

55 |Alcantara |55 |1 |

56 |Honor |55 |2 |

57 |Ellington |57 |1 |

58 |Kyle |57 |2 |

59 |Person |59 |1 |

60 |cap |60 |1 |

61 |dactyl |54 |8 |

62 |brutalize |62 |1 |

63 |option |41 |23 |

64 |forgetful |7 |58 |

65 |sponsor |28 |38 |

66 |Zulfiqar |66 |1 |

67 |Constriction |66 |2 |

68 |exhilarate |65 |4 |

69 |Robert |69 |1 |

70 |Jeffrey |70 |1 |

71 |live |69 |3 |

72 |guard |40 |33 |

73 |poison |73 |1 |

74 |John |74 |1 |

75 |Rush |74 |2 |

76 |prepossess |74 |3 |

77 |Corey |77 |1 |

78 |Derek |77 |2 |

79 |nosegay |79 |1 |

80 |prologue |42 |39 |

81 |seal |66 |16 |

82 | | | |

83 |1234567890123456 |83 |1 |

84 |Northwest |84 |1 |

85 |Gurung |85 |1 |

86 | | | |

87 | | | |

88 | | | |

89 |noggin |89 |1 |

90 | | | |

91 | | | |

92 |Acevedo |92 |1 |

93 |Carmona |93 |1 |

94 |Egbe |93 |2 |

95 | | | |

96 |Qamruddin |96 |1 |

97 | | | |

98 | | | |

99 | | | |

100 | | | |

101 | | | |

102 |Necromancer |102 |1 |

103 | | | |

104 | | | |

105 |Davies |105 |1 |

106 |Casper |106 |1 |

107 |Crouch |107 |1 |

108 |Red |108 |1 |

109 |Wade |105 |5 |

110 |Wine |109 |2 |

111 |wince |107 |5 |

112 |Kelly |112 |1 |

113 | | | |

114 |Michael |114 |1 |

115 |marsupial |115 |1 |

116 |Nienberg |116 |1 |

117 |Charles |116 |2 |

118 |Irreversible |117 |2 |

119 | | | |

120 |privilege |120 |1 |

121 |Ajose |121 |1 |

122 |Fabricate |122 |1 |

123 |James |123 |1 |

124 |cauldron |122 |3 |

125 |Fabulous |125 |1 |

126 |Batbold |126 |1 |

127 |Aguirrie |127 |1 |

First 30 Linear Probes: min = 1, max = 2, avg = 1.03

Last 30 Linear Probes: min = 1, max = 58, avg = 11.07

Theoretical probe count: 4.5

Filling to 40% capacity with new hash algorithm random probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Egbe |93 |3 |

1 | | | |

2 | | | |

3 | | | |

4 |Clark |4 |1 |

5 |Judy |5 |1 |

6 | | | |

7 | | | |

8 |Bhandari |8 |1 |

9 | | | |

10 |Garza |10 |1 |

11 |Clayton |11 |1 |

12 | | | |

13 |Octavio |13 |1 |

14 |Scott |14 |1 |

15 |Arauza |15 |1 |

16 | | | |

17 | | | |

18 | | | |

19 | | | |

20 | | | |

21 |Chris |21 |1 |

22 | | | |

23 |Charles |116 |3 |

24 |Derek |77 |4 |

25 |Daniels |25 |1 |

26 |Farral |26 |1 |

27 | | | |

28 | | | |

29 | | | |

30 | | | |

31 |Salkowski |31 |1 |

32 | | | |

33 |Dugger |33 |1 |

34 | | | |

35 |Lisa |35 |1 |

36 |Jordon |36 |1 |

37 |Paschal |37 |1 |

38 |Dustin |38 |1 |

39 |Veronica |39 |1 |

40 |Todd |40 |1 |

41 | | | |

42 | | | |

43 | | | |

44 | | | |

45 |Buck |45 |1 |

46 | | | |

47 |Joseph |47 |1 |

48 | | | |

49 | | | |

50 | | | |

51 | | | |

52 | | | |

53 |Cook |53 |1 |

54 | | | |

55 |Alcantara |55 |1 |

56 | | | |

57 |Ellington |57 |1 |

58 |Matthew |8 |2 |

59 | | | |

60 | | | |

61 | | | |

62 | | | |

63 |Akhila |13 |2 |

64 |Vinnela |14 |2 |

65 |Adam |15 |2 |

66 |Zulfiqar |66 |1 |

67 | | | |

68 | | | |

69 |Robert |69 |1 |

70 |Jeffrey |70 |1 |

71 | | | |

72 | | | |

73 | | | |

74 |John |74 |1 |

75 | | | |

76 | | | |

77 |Corey |77 |1 |

78 | | | |

79 | | | |

80 | | | |

81 | | | |

82 | | | |

83 |1234567890123456 |83 |1 |

84 | | | |

85 |Gurung |85 |1 |

86 | | | |

87 | | | |

88 | | | |

89 | | | |

90 | | | |

91 | | | |

92 |Acevedo |92 |1 |

93 |Carmona |93 |1 |

94 | | | |

95 | | | |

96 |Qamruddin |96 |1 |

97 | | | |

98 | | | |

99 | | | |

100 | | | |

101 | | | |

102 | | | |

103 | | | |

104 | | | |

105 |Davies |105 |1 |

106 |Casper |106 |1 |

107 |Crouch |107 |1 |

108 |Red |108 |1 |

109 | | | |

110 | | | |

111 | | | |

112 |Kelly |112 |1 |

113 | | | |

114 |Michael |114 |1 |

115 | | | |

116 |Nienberg |116 |1 |

117 | | | |

118 | | | |

119 | | | |

120 | | | |

121 |Ajose |121 |1 |

122 | | | |

123 |James |123 |1 |

124 |Kyle |57 |5 |

125 | | | |

126 | | | |

127 |Aguirrie |127 |1 |

First 30 Random Probes: min = 1, max = 3, avg = 1.07

Last 30 Random Probes: min = 1, max = 5, avg = 1.50

Theoretical probe count: 1.283192

Filling to 87% capacity with new hash algorithm random probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Egbe |93 |3 |

1 |Finagle |1 |1 |

2 |scat |2 |1 |

3 |orthodontist |3 |1 |

4 |Clark |4 |1 |

5 |Judy |5 |1 |

6 | | | |

7 |Yolk |7 |1 |

8 |Bhandari |8 |1 |

9 |toluene |9 |1 |

10 |Garza |10 |1 |

11 |Clayton |11 |1 |

12 |exhilarate |65 |4 |

13 |Octavio |13 |1 |

14 |Scott |14 |1 |

15 |Arauza |15 |1 |

16 |Wine |109 |3 |

17 | | | |

18 |nosegay |79 |5 |

19 | | | |

20 |wet |20 |1 |

21 |Chris |21 |1 |

22 |guard |40 |6 |

23 |Charles |116 |3 |

24 |Derek |77 |4 |

25 |Daniels |25 |1 |

26 |Farral |26 |1 |

27 |Wade |105 |2 |

28 |sponsor |28 |1 |

29 |Screen |29 |1 |

30 | | | |

31 |Salkowski |31 |1 |

32 |Jutty |32 |1 |

33 |Dugger |33 |1 |

34 |Staple |34 |1 |

35 |Lisa |35 |1 |

36 |Jordon |36 |1 |

37 |Paschal |37 |1 |

38 |Dustin |38 |1 |

39 |Veronica |39 |1 |

40 |Todd |40 |1 |

41 |option |41 |1 |

42 |Joel |42 |1 |

43 | | | |

44 |cauldron |122 |2 |

45 |Buck |45 |1 |

46 |Perfect |46 |1 |

47 |Joseph |47 |1 |

48 |Eye |126 |2 |

49 |ratiocination |14 |3 |

50 |magnetic |0 |2 |

51 |constrain |51 |1 |

52 |quandary |52 |1 |

53 |Cook |53 |1 |

54 |wince |107 |4 |

55 |Alcantara |55 |1 |

56 |prepossess |74 |6 |

57 |Ellington |57 |1 |

58 |Matthew |8 |2 |

59 |Person |59 |1 |

60 |Maiden |10 |2 |

61 |Syncopate |11 |2 |

62 |brutalize |62 |1 |

63 |Akhila |13 |2 |

64 |Vinnela |14 |2 |

65 |Adam |15 |2 |

66 |Zulfiqar |66 |1 |

67 |privilege |120 |4 |

68 |mole |33 |3 |

69 |Robert |69 |1 |

70 |Jeffrey |70 |1 |

71 |noggin |89 |6 |

72 |seal |66 |11 |

73 |poison |73 |1 |

74 |John |74 |1 |

75 |Misogamist |25 |2 |

76 | | | |

77 |Corey |77 |1 |

78 | | | |

79 |inlet |29 |2 |

80 |Afterwards |13 |5 |

81 | | | |

82 |forgetful |7 |4 |

83 |1234567890123456 |83 |1 |

84 |Northwest |84 |1 |

85 |Gurung |85 |1 |

86 | | | |

87 |sparse |20 |5 |

88 |Fernando |38 |2 |

89 |Christopher |39 |2 |

90 |Honor |55 |3 |

91 | | | |

92 |Acevedo |92 |1 |

93 |Carmona |93 |1 |

94 | | | |

95 |Under |45 |2 |

96 |Qamruddin |96 |1 |

97 | | | |

98 | | | |

99 | | | |

100 |parasympathetic |33 |5 |

101 |Constriction |66 |3 |

102 |Necromancer |102 |1 |

103 |Cook |53 |2 |

104 |dactyl |54 |2 |

105 |Davies |105 |1 |

106 |Casper |106 |1 |

107 |Crouch |107 |1 |

108 |Red |108 |1 |

109 |Rush |74 |3 |

110 |cap |60 |2 |

111 | | | |

112 |Kelly |112 |1 |

113 | | | |

114 |Michael |114 |1 |

115 |marsupial |115 |1 |

116 |Nienberg |116 |1 |

117 |Irreversible |117 |1 |

118 |prologue |42 |8 |

119 |live |69 |2 |

120 |rationalize |10 |6 |

121 |Ajose |121 |1 |

122 |Fabricate |122 |1 |

123 |James |123 |1 |

124 |Kyle |57 |5 |

125 |Fabulous |125 |1 |

126 |Batbold |126 |1 |

127 |Aguirrie |127 |1 |

First 30 Random Probes: min = 1, max = 3, avg = 1.10

Last 30 Random Probes: min = 1, max = 11, avg = 3.17

Theoretical probe count: 2.376505

Starting Relative File Processing

Enter the new size of the hashtable: 128

Filling to 40% capacity with old hash algorithm linear probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Aguirrie |0 |1 |

1 |Alcantara |0 |2 |

2 |Bhandari |0 |3 |

3 |1234567890123456 |3 |1 |

4 |Carmona |0 |5 |

5 |Casper |0 |6 |

6 |Cook |0 |7 |

7 |Daniels |0 |8 |

8 |Nienberg |0 |9 |

9 |Paschal |0 |10 |

10 |Red |0 |11 |

11 |Salkowski |0 |12 |

12 |Zulfiqar |0 |13 |

13 |Qamruddin |0 |14 |

14 |Acevedo |0 |15 |

15 |Ajose |0 |16 |

16 |Arauza |0 |17 |

17 |Buck |0 |18 |

18 |Clark |0 |19 |

19 |Crouch |0 |20 |

20 |Davies |0 |21 |

21 |Dugger |0 |22 |

22 |Egbe |0 |23 |

23 |Ellington |0 |24 |

24 |Farral |0 |25 |

25 |Garza |0 |26 |

26 |Gurung |0 |27 |

27 |Joseph |0 |28 |

28 |Kelly |0 |29 |

29 |Corey |0 |30 |

30 |Adam |0 |31 |

31 |Clayton |0 |32 |

32 |Dustin |0 |33 |

33 |Robert |0 |34 |

34 |Kyle |0 |35 |

35 |Scott |0 |36 |

36 |Octavio |0 |37 |

37 |Judy |0 |38 |

38 |Derek |0 |39 |

39 |Jeffrey |0 |40 |

40 |Jordon |0 |41 |

41 |Vinnela |0 |42 |

42 |Lisa |0 |43 |

43 |Todd |0 |44 |

44 |Veronica |0 |45 |

45 |Matthew |0 |46 |

46 |Michael |0 |47 |

47 |Akhila |0 |48 |

48 |John |0 |49 |

49 |Charles |0 |50 |

50 |James |0 |51 |

51 |Chris |0 |52 |

52 | | | |

53 | | | |

54 | | | |

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First 30 Linear Probes: min = 1, max = 30, avg = 15.40

Last 30 Linear Probes: min = 23, max = 52, avg = 37.50

Theoretical probe count: 1.342105

Filling to 87% capacity with old hash algorithm linear probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Aguirrie |0 |1 |

1 |Alcantara |0 |2 |

2 |Bhandari |0 |3 |

3 |1234567890123456 |3 |1 |

4 |Carmona |0 |5 |

5 |Casper |0 |6 |

6 |Cook |0 |7 |

7 |Daniels |0 |8 |

8 |Nienberg |0 |9 |

9 |Paschal |0 |10 |

10 |Red |0 |11 |

11 |Salkowski |0 |12 |

12 |Zulfiqar |0 |13 |

13 |Qamruddin |0 |14 |

14 |Acevedo |0 |15 |

15 |Ajose |0 |16 |

16 |Arauza |0 |17 |

17 |Buck |0 |18 |

18 |Clark |0 |19 |

19 |Crouch |0 |20 |

20 |Davies |0 |21 |

21 |Dugger |0 |22 |

22 |Egbe |0 |23 |

23 |Ellington |0 |24 |

24 |Farral |0 |25 |

25 |Garza |0 |26 |

26 |Gurung |0 |27 |

27 |Joseph |0 |28 |

28 |Kelly |0 |29 |

29 |Corey |0 |30 |

30 |Adam |0 |31 |

31 |Clayton |0 |32 |

32 |Dustin |0 |33 |

33 |Robert |0 |34 |

34 |Kyle |0 |35 |

35 |Scott |0 |36 |

36 |Octavio |0 |37 |

37 |Judy |0 |38 |

38 |Derek |0 |39 |

39 |Jeffrey |0 |40 |

40 |Jordon |0 |41 |

41 |Vinnela |0 |42 |

42 |Lisa |0 |43 |

43 |Todd |0 |44 |

44 |Veronica |0 |45 |

45 |Matthew |0 |46 |

46 |Michael |0 |47 |

47 |Akhila |0 |48 |

48 |John |0 |49 |

49 |Charles |0 |50 |

50 |James |0 |51 |

51 |Chris |0 |52 |

52 |Wade |0 |53 |

53 |Christopher |0 |54 |

54 |Fernando |0 |55 |

55 |Batbold |0 |56 |

56 |Joel |0 |57 |

57 |Fabulous |0 |58 |

58 |Misogamist |0 |59 |

59 |Maiden |0 |60 |

60 |Eye |0 |61 |

61 |Constriction |0 |62 |

62 |Necromancer |0 |63 |

63 |Syncopate |0 |64 |

64 |Yolk |0 |65 |

65 |Afterwards |0 |66 |

66 |Person |0 |67 |

67 |Northwest |0 |68 |

68 |Irreversible |0 |69 |

69 |Fabricate |0 |70 |

70 |Honor |0 |71 |

71 |Staple |0 |72 |

72 |Under |0 |73 |

73 |Jutty |0 |74 |

74 |Finagle |0 |75 |

75 |Cook |0 |76 |

76 |Rush |0 |77 |

77 |Wine |0 |78 |

78 |Screen |0 |79 |

79 |Perfect |0 |80 |

80 |mole |0 |81 |

81 |parasympathetic |20 |62 |

82 |poison |0 |83 |

83 |brutalize |0 |84 |

84 |cap |0 |85 |

85 |ratiocination |14 |72 |

86 |cauldron |0 |87 |

87 |prepossess |0 |88 |

88 |wince |0 |89 |

89 |orthodontist |0 |90 |

90 |live |0 |91 |

91 |magnetic |0 |92 |

92 |inlet |0 |93 |

93 |constrain |0 |94 |

94 |marsupial |0 |95 |

95 |rationalize |0 |96 |

96 |scat |0 |97 |

97 |toluene |0 |98 |

98 |wet |0 |99 |

99 |sparse |0 |100 |

100 |quandary |0 |101 |

101 |dactyl |0 |102 |

102 |nosegay |0 |103 |

103 |option |0 |104 |

104 |forgetful |0 |105 |

105 |privilege |0 |106 |

106 |sponsor |0 |107 |

107 |exhilarate |0 |108 |

108 |guard |0 |109 |

109 |noggin |0 |110 |

110 |prologue |0 |111 |

111 |seal |0 |112 |

112 | | | |

113 | | | |

114 | | | |

115 | | | |

116 | | | |

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125 | | | |

126 | | | |

127 | | | |

First 30 Linear Probes: min = 1, max = 30, avg = 15.40

Last 30 Linear Probes: min = 72, max = 112, avg = 97.03

Theoretical probe count: 4.5

Filling to 40% capacity with old hash algorithm random probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Aguirrie |0 |1 |

1 | | | |

2 | | | |

3 |1234567890123456 |3 |1 |

4 | | | |

5 | | | |

6 |Salkowski |0 |11 |

7 | | | |

8 | | | |

9 |Vinnela |0 |48 |

10 |Akhila |0 |56 |

11 | | | |

12 | | | |

13 | | | |

14 |Paschal |0 |9 |

15 | | | |

16 |Buck |0 |17 |

17 | | | |

18 | | | |

19 | | | |

20 | | | |

21 | | | |

22 | | | |

23 | | | |

24 | | | |

25 | | | |

26 | | | |

27 |Scott |0 |39 |

28 |Charles |0 |58 |

29 | | | |

30 | | | |

31 |Kelly |0 |31 |

32 | | | |

33 |Acevedo |0 |14 |

34 | | | |

35 |Bhandari |0 |3 |

36 | | | |

37 | | | |

38 | | | |

39 | | | |

40 |Judy |0 |42 |

41 |Qamruddin |0 |13 |

42 | | | |

43 | | | |

44 | | | |

45 | | | |

46 |Joseph |0 |30 |

47 | | | |

48 | | | |

49 | | | |

50 |Alcantara |0 |2 |

51 | | | |

52 |Jeffrey |0 |46 |

53 | | | |

54 |Dustin |0 |36 |

55 | | | |

56 | | | |

57 |Arauza |0 |16 |

58 | | | |

59 |Zulfiqar |0 |12 |

60 | | | |

61 |Adam |0 |33 |

62 |Octavio |0 |41 |

63 | | | |

64 |Veronica |0 |53 |

65 | | | |

66 | | | |

67 |Casper |0 |5 |

68 | | | |

69 | | | |

70 |Lisa |0 |50 |

71 | | | |

72 | | | |

73 | | | |

74 | | | |

75 |Carmona |0 |4 |

76 |Nienberg |0 |8 |

77 | | | |

78 |Farral |0 |26 |

79 | | | |

80 |Todd |0 |52 |

81 | | | |

82 | | | |

83 | | | |

84 |Robert |0 |37 |

85 | | | |

86 | | | |

87 | | | |

88 | | | |

89 |Gurung |0 |28 |

90 |Clark |0 |18 |

91 |Ajose |0 |15 |

92 | | | |

93 | | | |

94 |Egbe |0 |22 |

95 |Red |0 |10 |

96 | | | |

97 | | | |

98 | | | |

99 |Crouch |0 |19 |

100 | | | |

101 | | | |

102 |Daniels |0 |7 |

103 |Michael |0 |55 |

104 | | | |

105 |Garza |0 |27 |

106 |James |0 |61 |

107 | | | |

108 | | | |

109 |Davies |0 |20 |

110 |Cook |0 |6 |

111 |Kyle |0 |38 |

112 |John |0 |57 |

113 | | | |

114 |Chris |0 |62 |

115 |Clayton |0 |35 |

116 |Jordon |0 |47 |

117 | | | |

118 | | | |

119 |Matthew |0 |54 |

120 | | | |

121 | | | |

122 | | | |

123 | | | |

124 |Dugger |0 |21 |

125 |Ellington |0 |25 |

126 |Corey |0 |32 |

127 |Derek |0 |44 |

First 30 Random Probes: min = 1, max = 32, avg = 15.10

Last 30 Random Probes: min = 22, max = 62, avg = 42.17

Theoretical probe count: 1.283192

Filling to 87% capacity with old hash algorithm random probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Aguirrie |0 |1 |

1 |cauldron |0 |133 |

2 |Fernando |0 |70 |

3 |1234567890123456 |3 |1 |

4 |nosegay |0 |193 |

5 |Irreversible |0 |93 |

6 |Salkowski |0 |11 |

7 |Joel |0 |75 |

8 |Constriction |0 |84 |

9 |Vinnela |0 |48 |

10 |Akhila |0 |56 |

11 |seal |0 |251 |

12 |Christopher |0 |69 |

13 |sponsor |0 |216 |

14 |Paschal |0 |9 |

15 |privilege |0 |211 |

16 |Buck |0 |17 |

17 |Necromancer |0 |85 |

18 |Northwest |0 |91 |

19 |exhilarate |0 |220 |

20 |parasympathetic |20 |1 |

21 |Yolk |0 |88 |

22 |cap |0 |131 |

23 |forgetful |0 |210 |

24 |magnetic |0 |153 |

25 | | | |

26 | | | |

27 |Scott |0 |39 |

28 |Charles |0 |58 |

29 | | | |

30 | | | |

31 |Kelly |0 |31 |

32 |Syncopate |0 |86 |

33 |Acevedo |0 |14 |

34 | | | |

35 |Bhandari |0 |3 |

36 |Fabricate |0 |99 |

37 | | | |

38 |brutalize |0 |127 |

39 | | | |

40 |Judy |0 |42 |

41 |Qamruddin |0 |13 |

42 |marsupial |0 |156 |

43 |Fabulous |0 |76 |

44 |Cook |0 |109 |

45 |Eye |0 |81 |

46 |Joseph |0 |30 |

47 |Staple |0 |102 |

48 |Finagle |0 |106 |

49 |ratiocination |14 |3 |

50 |Alcantara |0 |2 |

51 | | | |

52 |Jeffrey |0 |46 |

53 |orthodontist |0 |149 |

54 |Dustin |0 |36 |

55 |Person |0 |90 |

56 |dactyl |0 |192 |

57 |Arauza |0 |16 |

58 |live |0 |151 |

59 |Zulfiqar |0 |12 |

60 | | | |

61 |Adam |0 |33 |

62 |Octavio |0 |41 |

63 |noggin |0 |243 |

64 |Veronica |0 |53 |

65 |Under |0 |103 |

66 |Batbold |0 |71 |

67 |Casper |0 |5 |

68 |Wade |0 |64 |

69 |Jutty |0 |105 |

70 |Lisa |0 |50 |

71 |wince |0 |148 |

72 |Misogamist |0 |77 |

73 | | | |

74 | | | |

75 |Carmona |0 |4 |

76 |Nienberg |0 |8 |

77 |constrain |0 |155 |

78 |Farral |0 |26 |

79 |Maiden |0 |79 |

80 |Todd |0 |52 |

81 |Honor |0 |100 |

82 |wet |0 |187 |

83 | | | |

84 |Robert |0 |37 |

85 |option |0 |195 |

86 |poison |0 |123 |

87 | | | |

88 | | | |

89 |Gurung |0 |28 |

90 |Clark |0 |18 |

91 |Ajose |0 |15 |

92 |prologue |0 |244 |

93 |scat |0 |160 |

94 |Egbe |0 |22 |

95 |Red |0 |10 |

96 |prepossess |0 |139 |

97 |rationalize |0 |157 |

98 |Screen |0 |118 |

99 |Crouch |0 |19 |

100 |quandary |0 |190 |

101 |Afterwards |0 |89 |

102 |Daniels |0 |7 |

103 |Michael |0 |55 |

104 |Perfect |0 |119 |

105 |Garza |0 |27 |

106 |James |0 |61 |

107 |Wine |0 |117 |

108 | | | |

109 |Davies |0 |20 |

110 |Cook |0 |6 |

111 |Kyle |0 |38 |

112 |John |0 |57 |

113 |toluene |0 |177 |

114 |Chris |0 |62 |

115 |Clayton |0 |35 |

116 |Jordon |0 |47 |

117 |sparse |0 |188 |

118 | | | |

119 |Matthew |0 |54 |

120 |Rush |0 |110 |

121 |inlet |0 |154 |

122 |guard |0 |221 |

123 |mole |0 |122 |

124 |Dugger |0 |21 |

125 |Ellington |0 |25 |

126 |Corey |0 |32 |

127 |Derek |0 |44 |

First 30 Random Probes: min = 1, max = 32, avg = 15.10

Last 30 Random Probes: min = 3, max = 251, avg = 172.57

Theoretical probe count: 2.376505

New Hashing Function

Filling to 40% capacity with new hash algorithm linear probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 | | | |

1 | | | |

2 | | | |

3 | | | |

4 |Clark |4 |1 |

5 |Judy |5 |1 |

6 | | | |

7 | | | |

8 |Bhandari |8 |1 |

9 |Matthew |8 |2 |

10 |Garza |10 |1 |

11 |Clayton |11 |1 |

12 | | | |

13 |Octavio |13 |1 |

14 |Scott |14 |1 |

15 |Arauza |15 |1 |

16 |Adam |15 |2 |

17 |Vinnela |14 |4 |

18 |Akhila |13 |6 |

19 | | | |

20 | | | |

21 |Chris |21 |1 |

22 | | | |

23 | | | |

24 | | | |

25 |Daniels |25 |1 |

26 |Farral |26 |1 |

27 | | | |

28 | | | |

29 | | | |

30 | | | |

31 |Salkowski |31 |1 |

32 | | | |

33 |Dugger |33 |1 |

34 | | | |

35 |Lisa |35 |1 |

36 |Jordon |36 |1 |

37 |Paschal |37 |1 |

38 |Dustin |38 |1 |

39 |Veronica |39 |1 |

40 |Todd |40 |1 |

41 | | | |

42 | | | |

43 | | | |

44 | | | |

45 |Buck |45 |1 |

46 | | | |

47 |Joseph |47 |1 |

48 | | | |

49 | | | |

50 | | | |

51 | | | |

52 | | | |

53 |Cook |53 |1 |

54 | | | |

55 |Alcantara |55 |1 |

56 | | | |

57 |Ellington |57 |1 |

58 |Kyle |57 |2 |

59 | | | |

60 | | | |

61 | | | |

62 | | | |

63 | | | |

64 | | | |

65 | | | |

66 |Zulfiqar |66 |1 |

67 | | | |

68 | | | |

69 |Robert |69 |1 |

70 |Jeffrey |70 |1 |

71 | | | |

72 | | | |

73 | | | |

74 |John |74 |1 |

75 | | | |

76 | | | |

77 |Corey |77 |1 |

78 |Derek |77 |2 |

79 | | | |

80 | | | |

81 | | | |

82 | | | |

83 |1234567890123456 |83 |1 |

84 | | | |

85 |Gurung |85 |1 |

86 | | | |

87 | | | |

88 | | | |

89 | | | |

90 | | | |

91 | | | |

92 |Acevedo |92 |1 |

93 |Carmona |93 |1 |

94 |Egbe |93 |2 |

95 | | | |

96 |Qamruddin |96 |1 |

97 | | | |

98 | | | |

99 | | | |

100 | | | |

101 | | | |

102 | | | |

103 | | | |

104 | | | |

105 |Davies |105 |1 |

106 |Casper |106 |1 |

107 |Crouch |107 |1 |

108 |Red |108 |1 |

109 | | | |

110 | | | |

111 | | | |

112 |Kelly |112 |1 |

113 | | | |

114 |Michael |114 |1 |

115 | | | |

116 |Nienberg |116 |1 |

117 |Charles |116 |2 |

118 | | | |

119 | | | |

120 | | | |

121 |Ajose |121 |1 |

122 | | | |

123 |James |123 |1 |

124 | | | |

125 | | | |

126 | | | |

127 |Aguirrie |127 |1 |

First 30 Linear Probes: min = 1, max = 2, avg = 1.03

Last 30 Linear Probes: min = 1, max = 6, avg = 1.47

Theoretical probe count: 1.342105

Filling to 87% capacity with new hash algorithm linear probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Eye |126 |3 |

1 |Finagle |1 |1 |

2 |magnetic |0 |3 |

3 |orthodontist |3 |1 |

4 |Clark |4 |1 |

5 |Judy |5 |1 |

6 |scat |2 |5 |

7 |Yolk |7 |1 |

8 |Bhandari |8 |1 |

9 |Matthew |8 |2 |

10 |Garza |10 |1 |

11 |Clayton |11 |1 |

12 |Maiden |10 |3 |

13 |Octavio |13 |1 |

14 |Scott |14 |1 |

15 |Arauza |15 |1 |

16 |Adam |15 |2 |

17 |Vinnela |14 |4 |

18 |Akhila |13 |6 |

19 |Syncopate |11 |9 |

20 |Afterwards |13 |8 |

21 |Chris |21 |1 |

22 |ratiocination |14 |9 |

23 |rationalize |10 |14 |

24 |toluene |9 |16 |

25 |Daniels |25 |1 |

26 |Farral |26 |1 |

27 |Misogamist |25 |3 |

28 |wet |20 |9 |

29 |Screen |29 |1 |

30 |inlet |29 |2 |

31 |Salkowski |31 |1 |

32 |Jutty |32 |1 |

33 |Dugger |33 |1 |

34 |Staple |34 |1 |

35 |Lisa |35 |1 |

36 |Jordon |36 |1 |

37 |Paschal |37 |1 |

38 |Dustin |38 |1 |

39 |Veronica |39 |1 |

40 |Todd |40 |1 |

41 |Christopher |39 |3 |

42 |Fernando |38 |5 |

43 |Joel |42 |2 |

44 |mole |33 |12 |

45 |Buck |45 |1 |

46 |Under |45 |2 |

47 |Joseph |47 |1 |

48 |Perfect |46 |3 |

49 |parasympathetic |33 |17 |

50 |sparse |20 |31 |

51 |constrain |51 |1 |

52 |quandary |52 |1 |

53 |Cook |53 |1 |

54 |Cook |53 |2 |

55 |Alcantara |55 |1 |

56 |Honor |55 |2 |

57 |Ellington |57 |1 |

58 |Kyle |57 |2 |

59 |Person |59 |1 |

60 |cap |60 |1 |

61 |dactyl |54 |8 |

62 |brutalize |62 |1 |

63 |option |41 |23 |

64 |forgetful |7 |58 |

65 |sponsor |28 |38 |

66 |Zulfiqar |66 |1 |

67 |Constriction |66 |2 |

68 |exhilarate |65 |4 |

69 |Robert |69 |1 |

70 |Jeffrey |70 |1 |

71 |live |69 |3 |

72 |guard |40 |33 |

73 |poison |73 |1 |

74 |John |74 |1 |

75 |Rush |74 |2 |

76 |prepossess |74 |3 |

77 |Corey |77 |1 |

78 |Derek |77 |2 |

79 |nosegay |79 |1 |

80 |prologue |42 |39 |

81 |seal |66 |16 |

82 | | | |

83 |1234567890123456 |83 |1 |

84 |Northwest |84 |1 |

85 |Gurung |85 |1 |

86 | | | |

87 | | | |

88 | | | |

89 |noggin |89 |1 |

90 | | | |

91 | | | |

92 |Acevedo |92 |1 |

93 |Carmona |93 |1 |

94 |Egbe |93 |2 |

95 | | | |

96 |Qamruddin |96 |1 |

97 | | | |

98 | | | |

99 | | | |

100 | | | |

101 | | | |

102 |Necromancer |102 |1 |

103 | | | |

104 | | | |

105 |Davies |105 |1 |

106 |Casper |106 |1 |

107 |Crouch |107 |1 |

108 |Red |108 |1 |

109 |Wade |105 |5 |

110 |Wine |109 |2 |

111 |wince |107 |5 |

112 |Kelly |112 |1 |

113 | | | |

114 |Michael |114 |1 |

115 |marsupial |115 |1 |

116 |Nienberg |116 |1 |

117 |Charles |116 |2 |

118 |Irreversible |117 |2 |

119 | | | |

120 |privilege |120 |1 |

121 |Ajose |121 |1 |

122 |Fabricate |122 |1 |

123 |James |123 |1 |

124 |cauldron |122 |3 |

125 |Fabulous |125 |1 |

126 |Batbold |126 |1 |

127 |Aguirrie |127 |1 |

First 30 Linear Probes: min = 1, max = 2, avg = 1.03

Last 30 Linear Probes: min = 1, max = 58, avg = 11.07

Theoretical probe count: 4.5

Filling to 40% capacity with new hash algorithm random probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Egbe |93 |3 |

1 | | | |

2 | | | |

3 | | | |

4 |Clark |4 |1 |

5 |Judy |5 |1 |

6 | | | |

7 | | | |

8 |Bhandari |8 |1 |

9 | | | |

10 |Garza |10 |1 |

11 |Clayton |11 |1 |

12 | | | |

13 |Octavio |13 |1 |

14 |Scott |14 |1 |

15 |Arauza |15 |1 |

16 | | | |

17 | | | |

18 | | | |

19 | | | |

20 | | | |

21 |Chris |21 |1 |

22 | | | |

23 |Charles |116 |3 |

24 |Derek |77 |4 |

25 |Daniels |25 |1 |

26 |Farral |26 |1 |

27 | | | |

28 | | | |

29 | | | |

30 | | | |

31 |Salkowski |31 |1 |

32 | | | |

33 |Dugger |33 |1 |

34 | | | |

35 |Lisa |35 |1 |

36 |Jordon |36 |1 |

37 |Paschal |37 |1 |

38 |Dustin |38 |1 |

39 |Veronica |39 |1 |

40 |Todd |40 |1 |

41 | | | |

42 | | | |

43 | | | |

44 | | | |

45 |Buck |45 |1 |

46 | | | |

47 |Joseph |47 |1 |

48 | | | |

49 | | | |

50 | | | |

51 | | | |

52 | | | |

53 |Cook |53 |1 |

54 | | | |

55 |Alcantara |55 |1 |

56 | | | |

57 |Ellington |57 |1 |

58 |Matthew |8 |2 |

59 | | | |

60 | | | |

61 | | | |

62 | | | |

63 |Akhila |13 |2 |

64 |Vinnela |14 |2 |

65 |Adam |15 |2 |

66 |Zulfiqar |66 |1 |

67 | | | |

68 | | | |

69 |Robert |69 |1 |

70 |Jeffrey |70 |1 |

71 | | | |

72 | | | |

73 | | | |

74 |John |74 |1 |

75 | | | |

76 | | | |

77 |Corey |77 |1 |

78 | | | |

79 | | | |

80 | | | |

81 | | | |

82 | | | |

83 |1234567890123456 |83 |1 |

84 | | | |

85 |Gurung |85 |1 |

86 | | | |

87 | | | |

88 | | | |

89 | | | |

90 | | | |

91 | | | |

92 |Acevedo |92 |1 |

93 |Carmona |93 |1 |

94 | | | |

95 | | | |

96 |Qamruddin |96 |1 |

97 | | | |

98 | | | |

99 | | | |

100 | | | |

101 | | | |

102 | | | |

103 | | | |

104 | | | |

105 |Davies |105 |1 |

106 |Casper |106 |1 |

107 |Crouch |107 |1 |

108 |Red |108 |1 |

109 | | | |

110 | | | |

111 | | | |

112 |Kelly |112 |1 |

113 | | | |

114 |Michael |114 |1 |

115 | | | |

116 |Nienberg |116 |1 |

117 | | | |

118 | | | |

119 | | | |

120 | | | |

121 |Ajose |121 |1 |

122 | | | |

123 |James |123 |1 |

124 |Kyle |57 |5 |

125 | | | |

126 | | | |

127 |Aguirrie |127 |1 |

First 30 Random Probes: min = 1, max = 3, avg = 1.07

Last 30 Random Probes: min = 1, max = 5, avg = 1.50

Theoretical probe count: 1.283192

Filling to 87% capacity with new hash algorithm random probing

ADDRESS |KEY |ORIGINAL ADDRESS |PROBES |

0 |Egbe |93 |3 |

1 |Finagle |1 |1 |

2 |scat |2 |1 |

3 |orthodontist |3 |1 |

4 |Clark |4 |1 |

5 |Judy |5 |1 |

6 | | | |

7 |Yolk |7 |1 |

8 |Bhandari |8 |1 |

9 |toluene |9 |1 |

10 |Garza |10 |1 |

11 |Clayton |11 |1 |

12 |exhilarate |65 |4 |

13 |Octavio |13 |1 |

14 |Scott |14 |1 |

15 |Arauza |15 |1 |

16 |Wine |109 |3 |

17 | | | |

18 |nosegay |79 |5 |

19 | | | |

20 |wet |20 |1 |

21 |Chris |21 |1 |

22 |guard |40 |6 |

23 |Charles |116 |3 |

24 |Derek |77 |4 |

25 |Daniels |25 |1 |

26 |Farral |26 |1 |

27 |Wade |105 |2 |

28 |sponsor |28 |1 |

29 |Screen |29 |1 |

30 | | | |

31 |Salkowski |31 |1 |

32 |Jutty |32 |1 |

33 |Dugger |33 |1 |

34 |Staple |34 |1 |

35 |Lisa |35 |1 |

36 |Jordon |36 |1 |

37 |Paschal |37 |1 |

38 |Dustin |38 |1 |

39 |Veronica |39 |1 |

40 |Todd |40 |1 |

41 |option |41 |1 |

42 |Joel |42 |1 |

43 | | | |

44 |cauldron |122 |2 |

45 |Buck |45 |1 |

46 |Perfect |46 |1 |

47 |Joseph |47 |1 |

48 |Eye |126 |2 |

49 |ratiocination |14 |3 |

50 |magnetic |0 |2 |

51 |constrain |51 |1 |

52 |quandary |52 |1 |

53 |Cook |53 |1 |

54 |wince |107 |4 |

55 |Alcantara |55 |1 |

56 |prepossess |74 |6 |

57 |Ellington |57 |1 |

58 |Matthew |8 |2 |

59 |Person |59 |1 |

60 |Maiden |10 |2 |

61 |Syncopate |11 |2 |

62 |brutalize |62 |1 |

63 |Akhila |13 |2 |

64 |Vinnela |14 |2 |

65 |Adam |15 |2 |

66 |Zulfiqar |66 |1 |

67 |privilege |120 |4 |

68 |mole |33 |3 |

69 |Robert |69 |1 |

70 |Jeffrey |70 |1 |

71 |noggin |89 |6 |

72 |seal |66 |11 |

73 |poison |73 |1 |

74 |John |74 |1 |

75 |Misogamist |25 |2 |

76 | | | |

77 |Corey |77 |1 |

78 | | | |

79 |inlet |29 |2 |

80 |Afterwards |13 |5 |

81 | | | |

82 |forgetful |7 |4 |

83 |1234567890123456 |83 |1 |

84 |Northwest |84 |1 |

85 |Gurung |85 |1 |

86 | | | |

87 |sparse |20 |5 |

88 |Fernando |38 |2 |

89 |Christopher |39 |2 |

90 |Honor |55 |3 |

91 | | | |

92 |Acevedo |92 |1 |

93 |Carmona |93 |1 |

94 | | | |

95 |Under |45 |2 |

96 |Qamruddin |96 |1 |

97 | | | |

98 | | | |

99 | | | |

100 |parasympathetic |33 |5 |

101 |Constriction |66 |3 |

102 |Necromancer |102 |1 |

103 |Cook |53 |2 |

104 |dactyl |54 |2 |

105 |Davies |105 |1 |

106 |Casper |106 |1 |

107 |Crouch |107 |1 |

108 |Red |108 |1 |

109 |Rush |74 |3 |

110 |cap |60 |2 |

111 | | | |

112 |Kelly |112 |1 |

113 | | | |

114 |Michael |114 |1 |

115 |marsupial |115 |1 |

116 |Nienberg |116 |1 |

117 |Irreversible |117 |1 |

118 |prologue |42 |8 |

119 |live |69 |2 |

120 |rationalize |10 |6 |

121 |Ajose |121 |1 |

122 |Fabricate |122 |1 |

123 |James |123 |1 |

124 |Kyle |57 |5 |

125 |Fabulous |125 |1 |

126 |Batbold |126 |1 |

127 |Aguirrie |127 |1 |

First 30 Random Probes: min = 1, max = 3, avg = 1.10

Last 30 Random Probes: min = 1, max = 11, avg = 3.17

Theoretical probe count: 2.376505

Press any key to continue...