VectorLite Encryption

Version 5L

Test Results

Warning

This software is provided for algorithmic proof of concept testing and demonstration use only.

This software should not to be used to protect files of value or need.

It is recommended to contain the software within an independent folder or directory separate from useful valuable files. Test files should be ***copied*** into a test folder – leaving original files in place. Plain-text test files are provided, in addition to a program to create test patterned files.

No Warranty or Guarantee is Expressed or Implied.

VectorLite Encryption has not been peer reviewed. Please test / demonstrate with caution. Version 5M testing has improved, but bugs may / likely exist.

Export Restrictions

The software and executable programs may be subject to United States export regulation. Please comply with all regulatory laws and governance.

Version 5L Document Revision History

July 28, 2021 Initial Release, extracted from prior version 5L User's Guide+

Additions to this document will be made as time permits.

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Notes

*This document is intended for all users, including the **patient** technically advanced*

Version 5M

Version 5M is a substantial upgrade, with emphasis upon:

1. Multi threaded performance for the encrypt and decrypt programs
2. Improved I/O performance, buffering input / output up to 100,000 bytes at a time
3. Elimination / simplification of command line options no longer relevant
4. A new ***random*** program to better handle C run-time library pseudo-random issues
5. Numerous clean-ups, bug fixes, and so forth.
6. The inclusion of two new analytical utility programs.
   a) ***file-stats*** Display mean, std dev, and co-var (cv) of a file's histogram of byte values
   b) ***check-proximity*** Display histogram of average distance between common byte values

Known Limitations

1. Plain-text file sizes are limited by the standard 32 bit C library I/O functions. The maximum plain-text input file size to ***encrypt*** is approximately 1.2 giga-bytes, and is actually limited by the larger output cipher-text file which must later be read as input by ***decrypt***. Cipher-text files are typically 60 % larger than the plain-text input file size. A later release may implement the 64 bit IO to remove this limit.
2. Several counters and index variables may also be 32 bit limited at this time.

Known Risks

1. ***file-stats*** displays a file's byte value statistics based on the histogram, not the individual bytes. Determination if the two computations result in the same or different results will be performed soon. The intended purposed of ***file-stats*** is to determine input file suitability to ***random*** – that is all.
2. Software generated random numbers will always be an issue – the new ***random*** program lessons the C language run-time library's ***srand*** and ***rand*** functions predictability. This is by introducing an additional unknown (***random's*** input file), and multiple human provided random seed values spread across a wide range of accepted values (in place of platform clock time).

Test Results

Version 5M testing continues to improved over previous versions. Preliminary testing has run the ***encrypt -> decrypt*** cycle through multiple times using different key-table files constructed with different options and option combinations.

Test file types included JPG images, an e-book, a MP3 music file, a very large zip file, and binary program distribution release, and byte value pattern files of continuous binary zeros & ASCII character sequences.

All tests have successfully reconstructed their original plain-text file's contents, verified by a file comparison tool. The test results for version 5L, the previous release follow.

Version 5M multi-threaded tests with updated false data rates and other program updates is underway and a document update will be released when completed with new charts and tables.

All cipher-text files appear to have random, equally numbered, byte values within the cipher-text. This appears independent of plain-text content. Histograms are provided as evidence in this section. Graphs will be added as time permits. Additional files will be added to testing time permitting.

All cipher-text files have duplicate byte patterns at what probability theory would indicate a near 100% randomized output file would have. This is as best the author can determine, for the file sizes capable to be analyzed on a 2015/ 16 generation PC with 4 cores (8 threads) and 32 GB memory.

Key-Trace file data reveals Alpha key-table elements are landed upon in a random probabilistic manner. Histogram output is provided as evidence of this here too.

Histograms and Graphs

Detailed test results are provided for in the following pages. Time permits for the inclusion of three test files as of this writing. More will be included as time permits.

File 1 is an everyday JPG picture file of Lake Medicine Man Lake near Jasper Canada.

File 2 is a file consisting entirely of binary value 0 bytes, at the same size of the JPG above.

File 3 is a file consisting of the repeated ASCII character cap A & B bytes, twice the size of the 0 file (2).

File 2 representative of a zeroed out segment of blocks on a persistent storage device.

File 3 is an ASCII character pattern file, to help determine how well input plain-text patterns are removed from output cipher-text.

Results from additional pattern files and other file types will be included as free time permits.

The pattern files were created with the ***create-pattern-file*** utility program included in the download zip.

File 1 – Lake.jpg

This plain-text file is a jpg file of the photo shown below, taken by the author many years ago, and is royalty free and available for any use. The file is 402,587 bytes in length. The file's byte value histogram and duplicate byte value patterns are shown in the next two tables following this scenic picture.

Figure 3 – Lake.jpg, Lake Medicine Man

The following pages provide details of Lake.jpg's data characteristics during the encryption process from start to end, including duplicate repetitive byte sequence pattern detection results.

Tables 1 and 2 on the following page illustrate two basic characteristics of the Lake.jpg file – the byte value histogram and some of the numbers of repeated byte sequence patterns detected within the file.

Tables 3 and 4 on the page after, illustrate the resultant cipher-text flat byte value distribution and elimination of all but the statistically probable duplicate byte value pattern sequences.

Table 5 is a histogram of the landing counts with the Alpha (and Vector) key table cells used to obtain displacement values when searching for biased alpha plain-text values. The histogram confirms the desired random statistical distribution sought. The larger value for 0 is a result of the flagged cells not being eligible for landing, of which there are approximately 2,050 within the key-table.

Lake.jpg Test Results, con't

```
Plain-Text Input Values ( not A-Biased ) histogram count listing:
------------------------------------------------------------------------

Format: [xxx] = yyyyy    Where: xxx is the value of the byte counted,
                                yyy is the number of those values counted

[000] =  4250    [001] =  2173    [002] =  1658    [003] =  2384    [004] =  1777    [005] =  1453    [006] =  1753    [007] =  2468
[008] =  1501    [009] =  1408    [010] =  1817    [011] =  1181    [012] =  1879    [013] =  1387    [014] =  2054    [015] =  1645
[016] =  1211    [017] =  1258    [018] =  1269    [019] =  1148    [020] =  2584    [021] =  1653    [022] =  1014    [023] =  1052
[024] =  2253    [025] =  2144    [026] =  1227    [027] =  1422    [028] =  2501    [029] =  1863    [030] =  1773    [031] =  1313
[032] =  1961    [033] =  1298    [034] =  1219    [035] =  2060    [036] =  2086    [037] =   954    [038] =  1254    [039] =  1748
[040] =  2224    [041] =  2220    [042] =  1855    [043] =  1522    [044] =  1120    [045] =  1090    [046] =  1300    [047] =   922
[048] =  1602    [049] =  1975    [050] =  1683    [051] =  1645    [052] =  2091    [053] =  1452    [054] =  1342    [055] =  1232
[056] =  2370    [057] =  2428    [058] =  1390    [059] =  1767    [060] =  1874    [061] =  2149    [062] =  1446    [063] =  1279
[064] =  2060    [065] =  1770    [066] =  1396    [067] =  1255    [068] =   898    [069] =  1698    [070] =  1978    [071] =  1806
[072] =  2126    [073] =  1970    [074] =  2058    [075] =  1360    [076] =  1422    [077] =  1630    [078] =  1999    [079] =  1843
[080] =  1735    [081] =  1896    [082] =  2235    [083] =  1968    [084] =  1687    [085] =  1550    [086] =  1540    [087] =  1427
[088] =  1326    [089] =  1074    [090] =  1761    [091] =  1392    [092] =  1670    [093] =  1131    [094] =  1219    [095] =   787
[096] =  1687    [097] =  1169    [098] =  1484    [099] =  1906    [100] =  1627    [101] =  1155    [102] =  1250    [103] =  1472
[104] =  1525    [105] =  2195    [106] =  2019    [107] =  1240    [108] =  1277    [109] =  1408    [110] =  1668    [111] =   991
[112] =  1816    [113] =  2418    [114] =  1907    [115] =  2283    [116] =  1183    [117] =  1238    [118] =  1572    [119] =  1411
[120] =  1445    [121] =  1614    [122] =  2295    [123] =  1520    [124] =   945    [125] =  1366    [126] =  1172    [127] =   823
[128] =  2276    [129] =  1814    [130] =  1484    [131] =  1763    [132] =  1099    [133] =  1390    [134] =  1425    [135] =  1091
[136] =  1126    [137] =  1082    [138] =  2632    [139] =   950    [140] =  2515    [141] =  1296    [142] =  2439    [143] =  1581
[144] =  1904    [145] =  2026    [146] =  1811    [147] =  1867    [148] =  1573    [149] =  1673    [150] =  1297    [151] =  1144
[152] =  1335    [153] =  1173    [154] =  2268    [155] =  1114    [156] =  2360    [157] =  1306    [158] =  2220    [159] =  1319
[160] =  1934    [161] =  1388    [162] =  1506    [163] =  1604    [164] =  2100    [165] =  2352    [166] =  1754    [167] =  2138
[168] =  1788    [169] =  1980    [170] =  1430    [171] =  1391    [172] =  1245    [173] =  1857    [174] =  1467    [175] =  1200
[176] =  1332    [177] =  1446    [178] =  1118    [179] =  1062    [180] =  1670    [181] =  1702    [182] =  1264    [183] =  1444
[184] =  1858    [185] =  1656    [186] =   977    [187] =  1367    [188] =  1131    [189] =  1460    [190] =   957    [191] =   793
[192] =  1940    [193] =  1584    [194] =  1013    [195] =  1269    [196] =  1132    [197] =  1741    [198] =  1963    [199] =  2164
[200] =  1829    [201] =  1703    [202] =  1252    [203] =  1162    [204] =  1082    [205] =  1805    [206] =  1725    [207] =  1822
[208] =  1480    [209] =  1023    [210] =  2316    [211] =  1828    [212] =  1966    [213] =  1197    [214] =  1685    [215] =  1192
[216] =  1313    [217] =  1085    [218] =  1598    [219] =  1379    [220] =  1811    [221] =  1284    [222] =  1434    [223] =   877
[224] =  1794    [225] =  1027    [226] =  1424    [227] =  2129    [228] =  2004    [229] =  1306    [230] =  1651    [231] =  2072
[232] =  1096    [233] =  1923    [234] =  1282    [235] =  1656    [236] =  1163    [237] =  1652    [238] =  1374    [239] =  1236
[240] =   927    [241] =  1259    [242] =  1282    [243] =  1526    [244] =  1748    [245] =  1732    [246] =  1232    [247] =  1233
[248] =   809    [249] =  1291    [250] =  1237    [251] =   994    [252] =  1131    [253] =   898    [254] =   817    [255] =   525
```

Table 1 Lake.jpg Original Byte Value Histogram Plain-Text

Table 1 above illustrates the Lake.jpg file contains more of the byte value 0, and fewer by 8 times less the value 255, with moderate to significant variance between many value counts.

```
Duplicate Patterns Final Results - ** Exclusive Counts **
------------------------------------------------------------------------------

Duplicates of  3:  45001    Extra Counts: 22268    Largest Individual Extra Count Size: 257    Largest Occurrances: 1
Duplicates of  4:  13569    Extra Counts: 10450    Largest Individual Extra Count Size: 254    Largest Occurrances: 1
Duplicates of  5:  11258    Extra Counts: 8700     Largest Individual Extra Count Size: 253    Largest Occurrances: 1
Duplicates of  6:  10083    Extra Counts: 7672     Largest Individual Extra Count Size: 240    Largest Occurrances: 1
Duplicates of  7:   8554    Extra Counts: 6288     Largest Individual Extra Count Size: 239    Largest Occurrances: 1
Duplicates of  8:   6790    Extra Counts: 4604     Largest Individual Extra Count Size: 238    Largest Occurrances: 1
Duplicates of  9:   6381    Extra Counts: 4272     Largest Individual Extra Count Size: 238    Largest Occurrances: 1
Duplicates of 10:   5930    Extra Counts: 3918     Largest Individual Extra Count Size: 230    Largest Occurrances: 1
Duplicates of 11: 191032    Extra Counts: 187948   Largest Individual Extra Count Size: 237    Largest Occurrances: 1
```

Table 2 Lake.jpg Repetitive Byte Value Sequences Original Plain-Text

Table 2 above illustrates the Lake.jpg file has many repeating byte value sequences as well. Not only of sequences up to 11, but a large count of at least 1 of those patterns: 237 + 1 of them. The pattern check program cuts off at 11…

Lake.jpg Test Results, con't

```
Histogram count of byte values within file: test-jpg-lake.ctext
------------------------------------------------------------------------

Format: [xxx] = yyyyy    Where: xxx is the value of the byte counted,
                                yyy is the number of those values counted

[000] =  2711   [001] =  2708   [002] =  2622   [003] =  2588   [004] =  2654   [005] =  2673   [006] =  2552   [007] =  2697
[008] =  2728   [009] =  2533   [010] =  2623   [011] =  2750   [012] =  2708   [013] =  2611   [014] =  2666   [015] =  2679
[016] =  2707   [017] =  2641   [018] =  2656   [019] =  2588   [020] =  2700   [021] =  2662   [022] =  2761   [023] =  2761
[024] =  2701   [025] =  2661   [026] =  2716   [027] =  2631   [028] =  2622   [029] =  2742   [030] =  2636   [031] =  2665
[032] =  2685   [033] =  2638   [034] =  2723   [035] =  2746   [036] =  2658   [037] =  2672   [038] =  2740   [039] =  2670
[040] =  2740   [041] =  2691   [042] =  2687   [043] =  2658   [044] =  2639   [045] =  2648   [046] =  2669   [047] =  2646
[048] =  2620   [049] =  2615   [050] =  2736   [051] =  2810   [052] =  2721   [053] =  2710   [054] =  2643   [055] =  2628
[056] =  2725   [057] =  2703   [058] =  2689   [059] =  2592   [060] =  2696   [061] =  2674   [062] =  2717   [063] =  2745
[064] =  2644   [065] =  2690   [066] =  2698   [067] =  2672   [068] =  2649   [069] =  2658   [070] =  2625   [071] =  2734
[072] =  2634   [073] =  2733   [074] =  2643   [075] =  2694   [076] =  2611   [077] =  2662   [078] =  2625   [079] =  2727
[080] =  2684   [081] =  2720   [082] =  2659   [083] =  2616   [084] =  2720   [085] =  2667   [086] =  2707   [087] =  2651
[088] =  2599   [089] =  2670   [090] =  2612   [091] =  2614   [092] =  2613   [093] =  2620   [094] =  2604   [095] =  2649
[096] =  2658   [097] =  2673   [098] =  2768   [099] =  2829   [100] =  2617   [101] =  2751   [102] =  2664   [103] =  2687
[104] =  2574   [105] =  2772   [106] =  2668   [107] =  2734   [108] =  2714   [109] =  2590   [110] =  2623   [111] =  2670
[112] =  2702   [113] =  2673   [114] =  2729   [115] =  2696   [116] =  2643   [117] =  2762   [118] =  2674   [119] =  2642
[120] =  2747   [121] =  2698   [122] =  2735   [123] =  2697   [124] =  2634   [125] =  2719   [126] =  2741   [127] =  2700
[128] =  2731   [129] =  2702   [130] =  2702   [131] =  2782   [132] =  2789   [133] =  2632   [134] =  2734   [135] =  2608
[136] =  2651   [137] =  2732   [138] =  2714   [139] =  2609   [140] =  2725   [141] =  2643   [142] =  2592   [143] =  2631
[144] =  2732   [145] =  2646   [146] =  2743   [147] =  2725   [148] =  2628   [149] =  2626   [150] =  2678   [151] =  2756
[152] =  2689   [153] =  2756   [154] =  2764   [155] =  2676   [156] =  2732   [157] =  2712   [158] =  2638   [159] =  2791
[160] =  2619   [161] =  2671   [162] =  2640   [163] =  2655   [164] =  2799   [165] =  2715   [166] =  2783   [167] =  2763
[168] =  2756   [169] =  2657   [170] =  2578   [171] =  2685   [172] =  2636   [173] =  2791   [174] =  2650   [175] =  2665
[176] =  2764   [177] =  2754   [178] =  2694   [179] =  2721   [180] =  2699   [181] =  2655   [182] =  2594   [183] =  2665
[184] =  2714   [185] =  2740   [186] =  2728   [187] =  2709   [188] =  2688   [189] =  2745   [190] =  2776   [191] =  2706
[192] =  2630   [193] =  2573   [194] =  2736   [195] =  2614   [196] =  2577   [197] =  2599   [198] =  2600   [199] =  2795
[200] =  2643   [201] =  2734   [202] =  2641   [203] =  2691   [204] =  2769   [205] =  2689   [206] =  2651   [207] =  2718
[208] =  2626   [209] =  2721   [210] =  2609   [211] =  2632   [212] =  2701   [213] =  2692   [214] =  2596   [215] =  2770
[216] =  2677   [217] =  2665   [218] =  2635   [219] =  2750   [220] =  2684   [221] =  2706   [222] =  2657   [223] =  2669
[224] =  2707   [225] =  2629   [226] =  2711   [227] =  2714   [228] =  2774   [229] =  2744   [230] =  2640   [231] =  2694
[232] =  2664   [233] =  2744   [234] =  2686   [235] =  2750   [236] =  2671   [237] =  2651   [238] =  2631   [239] =  2731
[240] =  2708   [241] =  2672   [242] =  2577   [243] =  2683   [244] =  2646   [245] =  2690   [246] =  2756   [247] =  2696
[248] =  2716   [249] =  2806   [250] =  2738   [251] =  2686   [252] =  2644   [253] =  2637   [254] =  2692   [255] =  2795

Grand Total of byte histogram entries: 686992
Size of file                         : 686992 bytes.
```

Table 3 Lake.ctext Cipher-Text File Byte Value Histogram Entire File

Table 3 illustrates the flat and level byte value distribution of the final resultant cipher-text file for Lake.jpg

```
Duplicate Patterns Final Results - ** Exclusive Counts **
------------------------------------------------------------------------------

Duplicates of  3:  14075    Extra Counts: 161    Largest Individual Extra Count Size: 2    Largest Occurrances: 161
Duplicates of  4:     61    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  5:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  6:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  7:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  8:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  9:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of 10:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of 11:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
```

Table 4 Lake.jpg Cipher-Text Duplicate Byte Value Sequences Entire File

Table 4 illustrates the elimination of all but the random probability based duplicate byte sequence patterns. The expected probability of duplicate 3 byte patterns for a file of size 683,516 is ~ 233,597,402,886 chances divided by the odds of 1 in 16,777,216 = 13,923. The observed result is only 148 different or ~ 1+ %.

Lake.jpg Test Results, con't

Histogram of key-table element landing counts for type: C
(Cipher-Text bytes representing Plain-Text byte values)

Last Entry of Histogram with non-zero count is: 26 (entries are 0 based)

	Total		1st Qtr		2nd Qtr		3rd Qtr		4th Qtr	
	Count	Hits	Count	Hits	Count	Hits	Count	Hits	Count	Hits
Number of Elements Landed on 0 times:	3003	0	17101	0	17005	0	17123	0	17183	0
Number of Elements Landed on 1 times:	1983	1983	19194	19194	19376	19376	19640	19640	19813	19813
Number of Elements Landed on 2 times:	3943	7886	14729	29458	14788	29576	14606	29212	14777	29554
Number of Elements Landed on 3 times:	5817	17451	8343	25029	8407	25221	8282	24846	8005	24015
Number of Elements Landed on 4 times:	7225	28900	3935	15740	3732	14928	3784	15136	3677	14708
Number of Elements Landed on 5 times:	7777	38885	1529	7645	1493	7465	1437	7185	1393	6965
Number of Elements Landed on 6 times:	7669	46014	490	2940	526	3156	478	2868	498	2988
Number of Elements Landed on 7 times:	6985	48895	152	1064	154	1078	128	896	132	924
Number of Elements Landed on 8 times:	5854	46832	42	336	34	272	43	344	44	352
Number of Elements Landed on 9 times:	4760	42840	15	135	16	144	12	108	13	117
Number of Elements Landed on 10 times:	3544	35440	3	30	2	20	3	30	1	10
Number of Elements Landed on 11 times:	2489	27379	1	11	2	22	0	0	0	0
Number of Elements Landed on 12 times:	1757	21084	2	24	1	12	0	0	0	0
Number of Elements Landed on 13 times:	1100	14300	0	0	0	0	0	0	0	0
Number of Elements Landed on 14 times:	724	10136	0	0	0	0	0	0	0	0
Number of Elements Landed on 15 times:	424	6360	0	0	0	0	0	0	0	0
Number of Elements Landed on 16 times:	242	3872	0	0	0	0	0	0	0	0
Number of Elements Landed on 17 times:	116	1972	0	0	0	0	0	0	0	0
Number of Elements Landed on 18 times:	58	1044	0	0	0	0	0	0	0	0
Number of Elements Landed on 19 times:	40	760	0	0	0	0	0	0	0	0
Number of Elements Landed on 20 times:	11	220	0	0	0	0	0	0	0	0
Number of Elements Landed on 21 times:	8	168	0	0	0	0	0	0	0	0
Number of Elements Landed on 22 times:	1	22	0	0	0	0	0	0	0	0
Number of Elements Landed on 23 times:	2	46	0	0	0	0	0	0	0	0
Number of Elements Landed on 24 times:	2	48	0	0	0	0	0	0	0	0
Number of Elements Landed on 25 times:	2	50	0	0	0	0	0	0	0	0
Number of Elements Landed on 1000 or more:	0		0		0		0		0	
Grand Total Landing Count:	65536	402587	65536	101606	65536	101270	65536	100265	65536	99446

Sanity Check, Three Values should be identical:
Total Histogram: 402587 Sum of 4 Qtrs: 402587 C records count: 402587

Table 5 Lake.jpg Key-Table Element Usage Plain-Text Searches Only

Table 5 lists out how many times each alpha key-table cell was utilized to return a raw displacement distance to later become the cipher-text value after a displacement bias is applied next. This does not represent the entire landing history during the encryption process – a filter for only the plain-text values from the input file was applied. The cipher-text file also includes 40% re-vector bytes. The histogram is bell shaped as expect. The bell shape has been observed to flatten out in relationship to larger file sizes in the analysis of those files, as would expected for a random based landings.

Tables 6, 7, and 8 list out the histograms for VectorLite's intermediate processing steps, as applied to the plain-text input bytes only.

Table 6 is a listing of the plain-text input bytes after they have had their alpha-bias applied. The results confirm an even distribution of byte values. These are the values used to search within the alpha key-table for the displacement distance value bytes.

Table 7 is a histogram of the raw displacement values returned from alpha key-table searches. One may note the favoritism towards small distance values. This is an expected result due to the scrambling and duplicate values per row and column for some values. Once again this is for the plain-text input bytes only.

Lake.jpg Test Results, con't

Search Items - P-Text w/ A-Bias Applied key-table histogram count listing:

Format: [xxx] = yyyyy Where: xxx is the value of the byte counted,
yyy is the number of those values counted

[000] = 1519	[001] = 1542	[002] = 1525	[003] = 1545	[004] = 1567	[005] = 1584	[006] = 1583	[007] = 1577
[008] = 1584	[009] = 1690	[010] = 1507	[011] = 1612	[012] = 1588	[013] = 1589	[014] = 1538	[015] = 1635
[016] = 1573	[017] = 1574	[018] = 1536	[019] = 1607	[020] = 1548	[021] = 1573	[022] = 1586	[023] = 1537
[024] = 1625	[025] = 1527	[026] = 1625	[027] = 1562	[028] = 1634	[029] = 1529	[030] = 1507	[031] = 1585
[032] = 1565	[033] = 1501	[034] = 1556	[035] = 1557	[036] = 1626	[037] = 1560	[038] = 1618	[039] = 1522
[040] = 1572	[041] = 1592	[042] = 1551	[043] = 1608	[044] = 1565	[045] = 1615	[046] = 1532	[047] = 1612
[048] = 1553	[049] = 1589	[050] = 1569	[051] = 1593	[052] = 1577	[053] = 1535	[054] = 1536	[055] = 1521
[056] = 1580	[057] = 1556	[058] = 1605	[059] = 1600	[060] = 1624	[061] = 1593	[062] = 1564	[063] = 1619
[064] = 1593	[065] = 1563	[066] = 1613	[067] = 1540	[068] = 1547	[069] = 1603	[070] = 1596	[071] = 1591
[072] = 1504	[073] = 1594	[074] = 1623	[075] = 1566	[076] = 1544	[077] = 1520	[078] = 1594	[079] = 1605
[080] = 1598	[081] = 1543	[082] = 1563	[083] = 1620	[084] = 1535	[085] = 1478	[086] = 1647	[087] = 1583
[088] = 1542	[089] = 1634	[090] = 1564	[091] = 1634	[092] = 1540	[093] = 1604	[094] = 1577	[095] = 1507
[096] = 1600	[097] = 1558	[098] = 1554	[099] = 1559	[100] = 1516	[101] = 1534	[102] = 1634	[103] = 1515
[104] = 1565	[105] = 1568	[106] = 1603	[107] = 1591	[108] = 1678	[109] = 1556	[110] = 1538	[111] = 1554
[112] = 1547	[113] = 1557	[114] = 1510	[115] = 1601	[116] = 1562	[117] = 1495	[118] = 1644	[119] = 1594
[120] = 1648	[121] = 1680	[122] = 1630	[123] = 1549	[124] = 1548	[125] = 1628	[126] = 1556	[127] = 1524
[128] = 1509	[129] = 1541	[130] = 1604	[131] = 1627	[132] = 1606	[133] = 1575	[134] = 1578	[135] = 1631
[136] = 1488	[137] = 1568	[138] = 1627	[139] = 1600	[140] = 1556	[141] = 1564	[142] = 1568	[143] = 1494
[144] = 1665	[145] = 1599	[146] = 1534	[147] = 1553	[148] = 1598	[149] = 1567	[150] = 1579	[151] = 1501
[152] = 1605	[153] = 1500	[154] = 1553	[155] = 1531	[156] = 1605	[157] = 1606	[158] = 1559	[159] = 1628
[160] = 1576	[161] = 1586	[162] = 1605	[163] = 1562	[164] = 1589	[165] = 1539	[166] = 1577	[167] = 1617
[168] = 1627	[169] = 1569	[170] = 1629	[171] = 1576	[172] = 1602	[173] = 1567	[174] = 1556	[175] = 1480
[176] = 1536	[177] = 1625	[178] = 1643	[179] = 1482	[180] = 1548	[181] = 1603	[182] = 1552	[183] = 1621
[184] = 1581	[185] = 1500	[186] = 1605	[187] = 1531	[188] = 1570	[189] = 1512	[190] = 1551	[191] = 1526
[192] = 1632	[193] = 1583	[194] = 1586	[195] = 1626	[196] = 1541	[197] = 1584	[198] = 1572	[199] = 1573
[200] = 1604	[201] = 1474	[202] = 1566	[203] = 1483	[204] = 1605	[205] = 1516	[206] = 1575	[207] = 1610
[208] = 1571	[209] = 1566	[210] = 1606	[211] = 1568	[212] = 1504	[213] = 1673	[214] = 1582	[215] = 1623
[216] = 1559	[217] = 1534	[218] = 1593	[219] = 1586	[220] = 1524	[221] = 1568	[222] = 1596	[223] = 1555
[224] = 1531	[225] = 1526	[226] = 1588	[227] = 1562	[228] = 1618	[229] = 1572	[230] = 1620	[231] = 1588
[232] = 1517	[233] = 1532	[234] = 1603	[235] = 1585	[236] = 1594	[237] = 1538	[238] = 1554	[239] = 1543
[240] = 1641	[241] = 1535	[242] = 1533	[243] = 1514	[244] = 1597	[245] = 1532	[246] = 1667	[247] = 1600
[248] = 1615	[249] = 1480	[250] = 1618	[251] = 1591	[252] = 1560	[253] = 1508	[254] = 1519	[255] = 1666

Table 6 Lake.jpg Alpha Biased Plain-Text Values Plain-Text Only

C-Text Non-D-Biased Return Values from Alpha Table Search - histogram:

Format: [xxx] = yyyyy Where: xxx is the value of the displacement return value
yyy is the number of those values counted

[000] = 0	[001] = 2511	[002] = 2527	[003] = 2421	[004] = 2469	[005] = 2415	[006] = 2463	[007] = 2467
[008] = 2473	[009] = 2441	[010] = 2421	[011] = 2385	[012] = 2400	[013] = 2397	[014] = 2389	[015] = 2396
[016] = 2449	[017] = 2425	[018] = 2374	[019] = 2356	[020] = 2299	[021] = 2299	[022] = 2286	[023] = 2318
[024] = 2304	[025] = 2233	[026] = 2198	[027] = 2302	[028] = 2218	[029] = 2111	[030] = 2244	[031] = 2211
[032] = 2206	[033] = 2135	[034] = 2182	[035] = 2207	[036] = 2194	[037] = 2171	[038] = 2196	[039] = 2147
[040] = 2119	[041] = 2073	[042] = 2023	[043] = 2109	[044] = 2086	[045] = 2120	[046] = 2097	[047] = 2020
[048] = 2133	[049] = 2056	[050] = 1969	[051] = 2022	[052] = 2036	[053] = 2051	[054] = 2036	[055] = 2050
[056] = 2001	[057] = 2007	[058] = 1925	[059] = 2009	[060] = 1996	[061] = 1908	[062] = 1994	[063] = 1979
[064] = 1895	[065] = 1996	[066] = 1990	[067] = 1976	[068] = 1922	[069] = 1947	[070] = 1823	[071] = 1894
[072] = 1832	[073] = 1904	[074] = 1914	[075] = 1855	[076] = 1794	[077] = 1881	[078] = 1882	[079] = 1851
[080] = 1855	[081] = 1805	[082] = 1736	[083] = 1778	[084] = 1820	[085] = 1812	[086] = 1666	[087] = 1776
[088] = 1785	[089] = 1745	[090] = 1804	[091] = 1741	[092] = 1683	[093] = 1814	[094] = 1728	[095] = 1689
[096] = 1735	[097] = 1788	[098] = 1674	[099] = 1691	[100] = 1680	[101] = 1632	[102] = 1677	[103] = 1773
[104] = 1672	[105] = 1686	[106] = 1580	[107] = 1743	[108] = 1609	[109] = 1620	[110] = 1652	[111] = 1624
[112] = 1635	[113] = 1596	[114] = 1580	[115] = 1571	[116] = 1616	[117] = 1593	[118] = 1580	[119] = 1554
[120] = 1593	[121] = 1545	[122] = 1499	[123] = 1513	[124] = 1560	[125] = 1538	[126] = 1549	[127] = 1500
[128] = 1534	[129] = 1468	[130] = 1448	[131] = 1552	[132] = 1468	[133] = 1461	[134] = 1512	[135] = 1484
[136] = 1438	[137] = 1471	[138] = 1445	[139] = 1484	[140] = 1423	[141] = 1390	[142] = 1419	[143] = 1451
[144] = 1456	[145] = 1428	[146] = 1368	[147] = 1417	[148] = 1431	[149] = 1345	[150] = 1417	[151] = 1401
[152] = 1381	[153] = 1314	[154] = 1400	[155] = 1381	[156] = 1400	[157] = 1363	[158] = 1341	[159] = 1309
[160] = 1301	[161] = 1297	[162] = 1309	[163] = 1330	[164] = 1328	[165] = 1319	[166] = 1306	[167] = 1288
[168] = 1294	[169] = 1301	[170] = 1264	[171] = 1234	[172] = 1229	[173] = 1293	[174] = 1251	[175] = 1282
[176] = 1284	[177] = 1223	[178] = 1333	[179] = 1264	[180] = 1208	[181] = 1253	[182] = 1198	[183] = 1229
[184] = 1227	[185] = 1235	[186] = 1231	[187] = 1183	[188] = 1210	[189] = 1210	[190] = 1223	[191] = 1173
[192] = 1206	[193] = 1176	[194] = 1227	[195] = 1137	[196] = 1195	[197] = 1188	[198] = 1118	[199] = 1117
[200] = 1153	[201] = 1170	[202] = 1185	[203] = 1108	[204] = 1089	[205] = 1069	[206] = 1113	[207] = 1053
[208] = 1122	[209] = 1026	[210] = 1108	[211] = 1054	[212] = 1094	[213] = 1059	[214] = 1127	[215] = 1057
[216] = 1031	[217] = 1070	[218] = 1089	[219] = 1103	[220] = 1014	[221] = 1080	[222] = 1019	[223] = 1012
[224] = 1036	[225] = 1054	[226] = 1009	[227] = 1020	[228] = 1070	[229] = 1002	[230] = 987	[231] = 993
[232] = 988	[233] = 991	[234] = 937	[235] = 1040	[236] = 1062	[237] = 1021	[238] = 964	[239] = 994
[240] = 968	[241] = 1000	[242] = 1028	[243] = 964	[244] = 965	[245] = 893	[246] = 992	[247] = 953
[248] = 906	[249] = 910	[250] = 1010	[251] = 951	[252] = 934	[253] = 892	[254] = 923	[255] = 941

Table 7 Lake.jpg Returned Alpha Table Displacement Values Plain-Text Searches Only

Lake.jpg Test Results, con't

C-Text Values (D-Biased SI values) Written to Output - histogram:

Format: [xxx] = yyyyy Where: xxx is the value of the c-text output byte
yyy is the number of those values counted

[000] =	1600	[001] =	1591	[002] =	1519	[003] =	1498	[004] =	1526	[005] =	1567	[006] =	1522	[007] =	1616
[008] =	1599	[009] =	1486	[010] =	1546	[011] =	1622	[012] =	1599	[013] =	1532	[014] =	1538	[015] =	1551
[016] =	1601	[017] =	1511	[018] =	1582	[019] =	1542	[020] =	1578	[021] =	1612	[022] =	1622	[023] =	1637
[024] =	1605	[025] =	1565	[026] =	1601	[027] =	1533	[028] =	1505	[029] =	1594	[030] =	1521	[031] =	1482
[032] =	1539	[033] =	1522	[034] =	1576	[035] =	1621	[036] =	1551	[037] =	1618	[038] =	1641	[039] =	1588
[040] =	1622	[041] =	1586	[042] =	1617	[043] =	1555	[044] =	1526	[045] =	1522	[046] =	1566	[047] =	1558
[048] =	1560	[049] =	1545	[050] =	1657	[051] =	1677	[052] =	1611	[053] =	1580	[054] =	1533	[055] =	1550
[056] =	1609	[057] =	1601	[058] =	1544	[059] =	1482	[060] =	1533	[061] =	1565	[062] =	1555	[063] =	1606
[064] =	1536	[065] =	1564	[066] =	1624	[067] =	1554	[068] =	1568	[069] =	1583	[070] =	1520	[071] =	1599
[072] =	1548	[073] =	1565	[074] =	1587	[075] =	1551	[076] =	1528	[077] =	1617	[078] =	1522	[079] =	1627
[080] =	1573	[081] =	1596	[082] =	1580	[083] =	1511	[084] =	1602	[085] =	1610	[086] =	1555	[087] =	1524
[088] =	1551	[089] =	1556	[090] =	1553	[091] =	1517	[092] =	1537	[093] =	1573	[094] =	1565	[095] =	1539
[096] =	1537	[097] =	1578	[098] =	1586	[099] =	1631	[100] =	1488	[101] =	1595	[102] =	1574	[103] =	1545
[104] =	1465	[105] =	1632	[106] =	1534	[107] =	1604	[108] =	1598	[109] =	1517	[110] =	1556	[111] =	1587
[112] =	1571	[113] =	1563	[114] =	1614	[115] =	1587	[116] =	1514	[117] =	1608	[118] =	1578	[119] =	1557
[120] =	1614	[121] =	1554	[122] =	1609	[123] =	1569	[124] =	1565	[125] =	1550	[126] =	1637	[127] =	1601
[128] =	1619	[129] =	1608	[130] =	1617	[131] =	1649	[132] =	1627	[133] =	1579	[134] =	1567	[135] =	1487
[136] =	1578	[137] =	1607	[138] =	1619	[139] =	1529	[140] =	1603	[141] =	1596	[142] =	1436	[143] =	1562
[144] =	1581	[145] =	1557	[146] =	1608	[147] =	1608	[148] =	1510	[149] =	1527	[150] =	1541	[151] =	1592
[152] =	1559	[153] =	1623	[154] =	1580	[155] =	1575	[156] =	1600	[157] =	1571	[158] =	1516	[159] =	1634
[160] =	1534	[161] =	1605	[162] =	1580	[163] =	1539	[164] =	1670	[165] =	1567	[166] =	1638	[167] =	1594
[168] =	1594	[169] =	1509	[170] =	1535	[171] =	1572	[172] =	1545	[173] =	1631	[174] =	1551	[175] =	1566
[176] =	1598	[177] =	1603	[178] =	1563	[179] =	1636	[180] =	1573	[181] =	1552	[182] =	1513	[183] =	1580
[184] =	1572	[185] =	1614	[186] =	1597	[187] =	1598	[188] =	1548	[189] =	1606	[190] =	1672	[191] =	1581
[192] =	1578	[193] =	1508	[194] =	1601	[195] =	1516	[196] =	1488	[197] =	1493	[198] =	1542	[199] =	1664
[200] =	1543	[201] =	1643	[202] =	1532	[203] =	1556	[204] =	1656	[205] =	1619	[206] =	1557	[207] =	1618
[208] =	1564	[209] =	1593	[210] =	1501	[211] =	1555	[212] =	1580	[213] =	1597	[214] =	1533	[215] =	1659
[216] =	1548	[217] =	1563	[218] =	1497	[219] =	1617	[220] =	1571	[221] =	1559	[222] =	1559	[223] =	1565
[224] =	1530	[225] =	1502	[226] =	1602	[227] =	1588	[228] =	1637	[229] =	1586	[230] =	1524	[231] =	1604
[232] =	1583	[233] =	1589	[234] =	1555	[235] =	1637	[236] =	1511	[237] =	1530	[238] =	1508	[239] =	1586
[240] =	1619	[241] =	1575	[242] =	1526	[243] =	1572	[244] =	1571	[245] =	1583	[246] =	1625	[247] =	1604
[248] =	1610	[249] =	1661	[250] =	1568	[251] =	1623	[252] =	1525	[253] =	1566	[254] =	1583	[255] =	1656

Table 8 Lake.jpg Cipher-Text Byte Value Histogram Plain-Text Items Only

Table 8 is a histogram of alpha key-table distance values after the displacement-bias has been applied. The values are the final cipher-text output values. Once again, for the table is for plain-text input bytes. One can note the flat distribution of the cipher-text byte value content, which is the desired result.

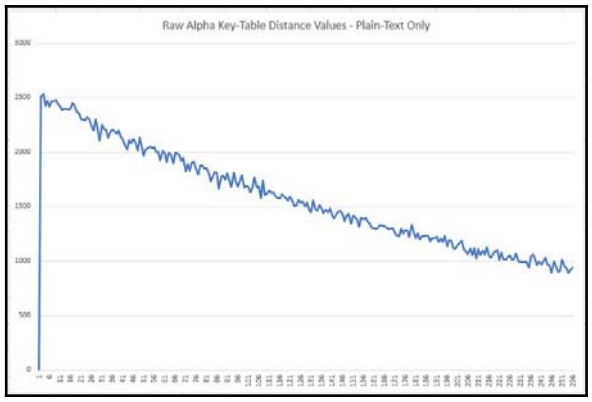


Figure 4 Lake.jpg Raw Alpha Search Values

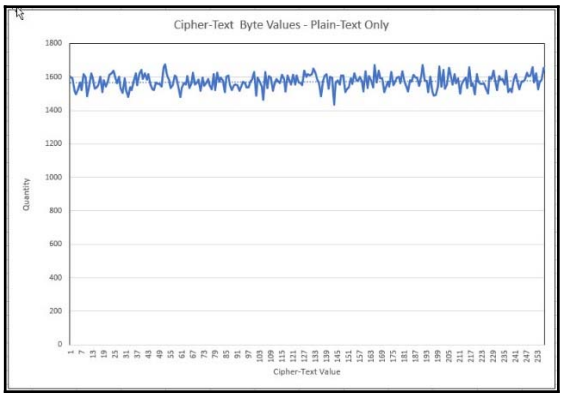


Figure 5 Lake.jpg D-Biased Final Cipher-Text

Figures 4 & 5 illustrate the need or rational to apply a post Alpha Key-Table bias to the returned values, as it is readily apparent the distance (or displacement) values favor smaller values.

File 2 – test-pattern-0.ptext

This plain-text file is a solid block of continuous binary 0 bytes at the same length as the Lake.jpg file, generated by the utility program ***create-pattern-file***. The file is to provide comparative cipher-text results against other files, to help verify cipher-text values are independent of plain-text input, and devoid of any patterns contained within the plain-text. The pattern of this plain-text file is, of course, continuous.

Table 9 below is provided as confirmation as to the binary zero value byte content. A pattern check was not run against this file, as the entire file is a pattern of every size up to the length of the file.

```
Histogram count of byte values within file: test-pattern-0.ptext
------------------------------------------------------------------------

Format: [xxx] = yyyyy    Where: xxx is the value of the byte counted,
                                yyy is the number of those values counted

[000] = 402588    [001] =      0    [002] =      0    [003] =      0    [004] =      0    [005] =      0    [006] =      0    [007] =      0
[008] =      0    [009] =      0    [010] =      0    [011] =      0    [012] =      0    [013] =      0    [014] =      0    [015] =      0
[016] =      0    [017] =      0    [018] =      0    [019] =      0    [020] =      0    [021] =      0    [022] =      0    [023] =      0
[024] =      0    [025] =      0    [026] =      0    [027] =      0    [028] =      0    [029] =      0    [030] =      0    [031] =      0
[032] =      0    [033] =      0    [034] =      0    [035] =      0    [036] =      0    [037] =      0    [038] =      0    [039] =      0
[040] =      0    [041] =      0    [042] =      0    [043] =      0    [044] =      0    [045] =      0    [046] =      0    [047] =      0
[048] =      0    [049] =      0    [050] =      0    [051] =      0    [052] =      0    [053] =      0    [054] =      0    [055] =      0
[056] =      0    [057] =      0    [058] =      0    [059] =      0    [060] =      0    [061] =      0    [062] =      0    [063] =      0
[064] =      0    [065] =      0    [066] =      0    [067] =      0    [068] =      0    [069] =      0    [070] =      0    [071] =      0
[072] =      0    [073] =      0    [074] =      0    [075] =      0    [076] =      0    [077] =      0    [078] =      0    [079] =      0
[080] =      0    [081] =      0    [082] =      0    [083] =      0    [084] =      0    [085] =      0    [086] =      0    [087] =      0
[088] =      0    [089] =      0    [090] =      0    [091] =      0    [092] =      0    [093] =      0    [094] =      0    [095] =      0
[096] =      0    [097] =      0    [098] =      0    [099] =      0    [100] =      0    [101] =      0    [102] =      0    [103] =      0
[104] =      0    [105] =      0    [106] =      0    [107] =      0    [108] =      0    [109] =      0    [110] =      0    [111] =      0
[112] =      0    [113] =      0    [114] =      0    [115] =      0    [116] =      0    [117] =      0    [118] =      0    [119] =      0
[120] =      0    [121] =      0    [122] =      0    [123] =      0    [124] =      0    [125] =      0    [126] =      0    [127] =      0
[128] =      0    [129] =      0    [130] =      0    [131] =      0    [132] =      0    [133] =      0    [134] =      0    [135] =      0
[136] =      0    [137] =      0    [138] =      0    [139] =      0    [140] =      0    [141] =      0    [142] =      0    [143] =      0
[144] =      0    [145] =      0    [146] =      0    [147] =      0    [148] =      0    [149] =      0    [150] =      0    [151] =      0
[152] =      0    [153] =      0    [154] =      0    [155] =      0    [156] =      0    [157] =      0    [158] =      0    [159] =      0
[160] =      0    [161] =      0    [162] =      0    [163] =      0    [164] =      0    [165] =      0    [166] =      0    [167] =      0
[168] =      0    [169] =      0    [170] =      0    [171] =      0    [172] =      0    [173] =      0    [174] =      0    [175] =      0
[176] =      0    [177] =      0    [178] =      0    [179] =      0    [180] =      0    [181] =      0    [182] =      0    [183] =      0
[184] =      0    [185] =      0    [186] =      0    [187] =      0    [188] =      0    [189] =      0    [190] =      0    [191] =      0
[192] =      0    [193] =      0    [194] =      0    [195] =      0    [196] =      0    [197] =      0    [198] =      0    [199] =      0
[200] =      0    [201] =      0    [202] =      0    [203] =      0    [204] =      0    [205] =      0    [206] =      0    [207] =      0
[208] =      0    [209] =      0    [210] =      0    [211] =      0    [212] =      0    [213] =      0    [214] =      0    [215] =      0
[216] =      0    [217] =      0    [218] =      0    [219] =      0    [220] =      0    [221] =      0    [222] =      0    [223] =      0
[224] =      0    [225] =      0    [226] =      0    [227] =      0    [228] =      0    [229] =      0    [230] =      0    [231] =      0
[232] =      0    [233] =      0    [234] =      0    [235] =      0    [236] =      0    [237] =      0    [238] =      0    [239] =      0
[240] =      0    [241] =      0    [242] =      0    [243] =      0    [244] =      0    [245] =      0    [246] =      0    [247] =      0
[248] =      0    [249] =      0    [250] =      0    [251] =      0    [252] =      0    [253] =      0    [254] =      0    [255] =      0

Grand Total of byte histogram entries: 402588
Size of file                         : 402588 bytes.
```

Table 9 Test-Pattern-0.ptext Original File Histogram

Test-pattern-0.ptext, con't

```
Histogram count of byte values within file: test-pattern-0.ctext
------------------------------------------------------------------

Format: [xxx] = yyyyy    Where: xxx is the value of the byte counted,
                                yyy is the number of those values counted

[000] =  2615   [001] =  2674   [002] =  2702   [003] =  2655   [004] =  2718   [005] =  2621   [006] =  2621   [007] =  2678
[008] =  2702   [009] =  2667   [010] =  2799   [011] =  2679   [012] =  2727   [013] =  2626   [014] =  2667   [015] =  2805
[016] =  2695   [017] =  2719   [018] =  2708   [019] =  2714   [020] =  2730   [021] =  2636   [022] =  2751   [023] =  2658
[024] =  2681   [025] =  2700   [026] =  2684   [027] =  2747   [028] =  2705   [029] =  2710   [030] =  2662   [031] =  2668
[032] =  2750   [033] =  2689   [034] =  2659   [035] =  2660   [036] =  2707   [037] =  2633   [038] =  2714   [039] =  2748
[040] =  2696   [041] =  2636   [042] =  2682   [043] =  2629   [044] =  2674   [045] =  2657   [046] =  2688   [047] =  2643
[048] =  2633   [049] =  2668   [050] =  2743   [051] =  2665   [052] =  2655   [053] =  2690   [054] =  2734   [055] =  2637
[056] =  2715   [057] =  2673   [058] =  2659   [059] =  2744   [060] =  2785   [061] =  2607   [062] =  2632   [063] =  2687
[064] =  2646   [065] =  2692   [066] =  2811   [067] =  2787   [068] =  2663   [069] =  2664   [070] =  2705   [071] =  2645
[072] =  2751   [073] =  2645   [074] =  2778   [075] =  2803   [076] =  2685   [077] =  2714   [078] =  2695   [079] =  2727
[080] =  2714   [081] =  2666   [082] =  2672   [083] =  2684   [084] =  2784   [085] =  2672   [086] =  2700   [087] =  2689
[088] =  2720   [089] =  2718   [090] =  2621   [091] =  2665   [092] =  2684   [093] =  2713   [094] =  2784   [095] =  2675
[096] =  2733   [097] =  2706   [098] =  2654   [099] =  2651   [100] =  2664   [101] =  2683   [102] =  2596   [103] =  2733
[104] =  2656   [105] =  2709   [106] =  2790   [107] =  2648   [108] =  2615   [109] =  2637   [110] =  2820   [111] =  2721
[112] =  2717   [113] =  2728   [114] =  2695   [115] =  2694   [116] =  2683   [117] =  2640   [118] =  2749   [119] =  2691
[120] =  2697   [121] =  2665   [122] =  2778   [123] =  2630   [124] =  2713   [125] =  2687   [126] =  2728   [127] =  2770
[128] =  2705   [129] =  2683   [130] =  2687   [131] =  2597   [132] =  2647   [133] =  2674   [134] =  2690   [135] =  2684
[136] =  2746   [137] =  2675   [138] =  2677   [139] =  2661   [140] =  2690   [141] =  2701   [142] =  2647   [143] =  2715
[144] =  2650   [145] =  2618   [146] =  2688   [147] =  2685   [148] =  2732   [149] =  2635   [150] =  2751   [151] =  2719
[152] =  2674   [153] =  2587   [154] =  2678   [155] =  2684   [156] =  2667   [157] =  2665   [158] =  2732   [159] =  2658
[160] =  2721   [161] =  2755   [162] =  2618   [163] =  2675   [164] =  2681   [165] =  2640   [166] =  2728   [167] =  2683
[168] =  2657   [169] =  2615   [170] =  2718   [171] =  2625   [172] =  2708   [173] =  2662   [174] =  2697   [175] =  2667
[176] =  2732   [177] =  2670   [178] =  2784   [179] =  2743   [180] =  2704   [181] =  2681   [182] =  2617   [183] =  2684
[184] =  2741   [185] =  2637   [186] =  2715   [187] =  2688   [188] =  2661   [189] =  2613   [190] =  2741   [191] =  2599
[192] =  2701   [193] =  2763   [194] =  2698   [195] =  2633   [196] =  2725   [197] =  2708   [198] =  2720   [199] =  2702
[200] =  2669   [201] =  2633   [202] =  2709   [203] =  2596   [204] =  2726   [205] =  2692   [206] =  2722   [207] =  2676
[208] =  2665   [209] =  2777   [210] =  2727   [211] =  2537   [212] =  2664   [213] =  2685   [214] =  2655   [215] =  2660
[216] =  2664   [217] =  2702   [218] =  2638   [219] =  2647   [220] =  2656   [221] =  2661   [222] =  2768   [223] =  2722
[224] =  2723   [225] =  2729   [226] =  2702   [227] =  2653   [228] =  2585   [229] =  2719   [230] =  2718   [231] =  2660
[232] =  2696   [233] =  2612   [234] =  2650   [235] =  2644   [236] =  2601   [237] =  2672   [238] =  2704   [239] =  2684
[240] =  2606   [241] =  2681   [242] =  2631   [243] =  2643   [244] =  2726   [245] =  2678   [246] =  2705   [247] =  2684
[248] =  2648   [249] =  2731   [250] =  2638   [251] =  2719   [252] =  2645   [253] =  2652   [254] =  2707   [255] =  2838

Grand Total of byte histogram entries: 687916
Size of file                         : 687916 bytes.
```

Table 10 Test-Pattern-0.ctext Histogram of Total Cipher-Text

Table 10 illustrates the desired cipher-text of a flat value distribution, while table 11 confirms only random statistical probable duplicate byte sequences.

```
Duplicate Patterns Final Results - ** Exclusive Counts **
-------------------------------------------------------------------------------

Duplicates of  3:  13945    Extra Counts: 153    Largest Individual Extra Count Size: 2    Largest Occurrances: 153
Duplicates of  4:     50    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  5:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  6:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  7:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  8:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of  9:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of 10:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
Duplicates of 11:      0    Extra Counts: 0      Largest Individual Extra Count Size: 0    Largest Occurrances: 0
```

Table 11 Test-Pattern-0.ctext Duplicate Byte Sequence Patterns

The expected 3 byte patterns for a pure random file of 687,916 bytes is ~ 236,614,555,486 / 16,777,216 = 14,103. The results are only 158 off, or about 1%. The count of 4 byte duplicate patterns is down by a factor of 278, which exceeds the expectation of 256.

Test-pattern-0.ptext, con't

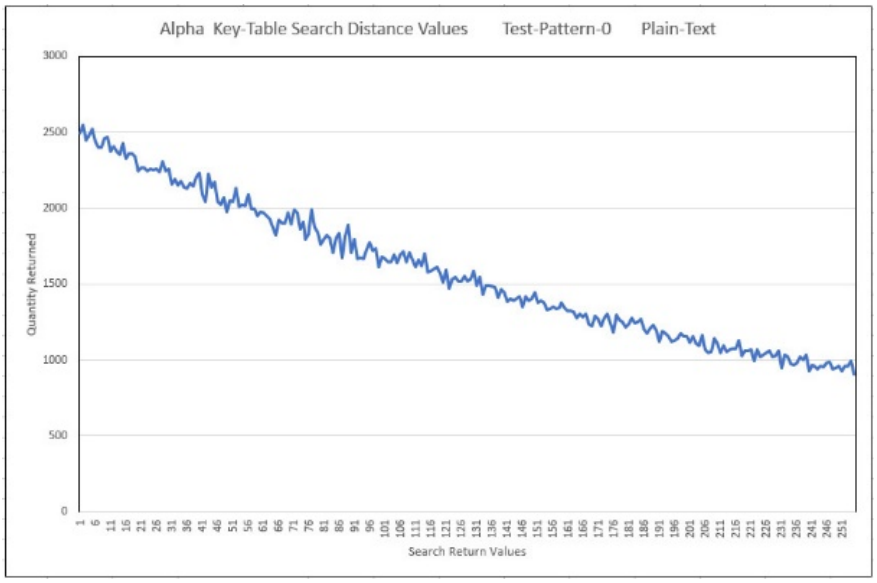


Figure 6 Alpha Key-Table Search Values Plain-Text Only

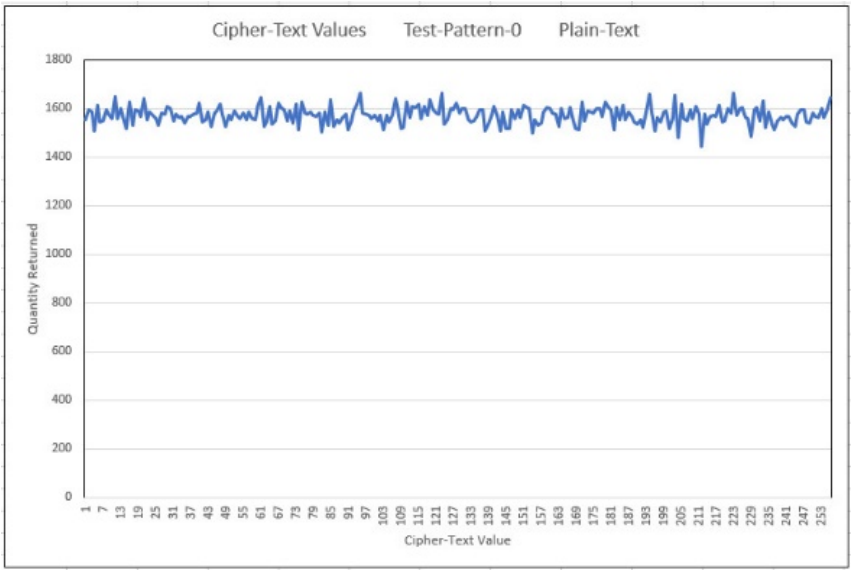


Figure 7 Cipher-Text Values Plain-Text Only

File 3 – test-pattern-AB.ptext

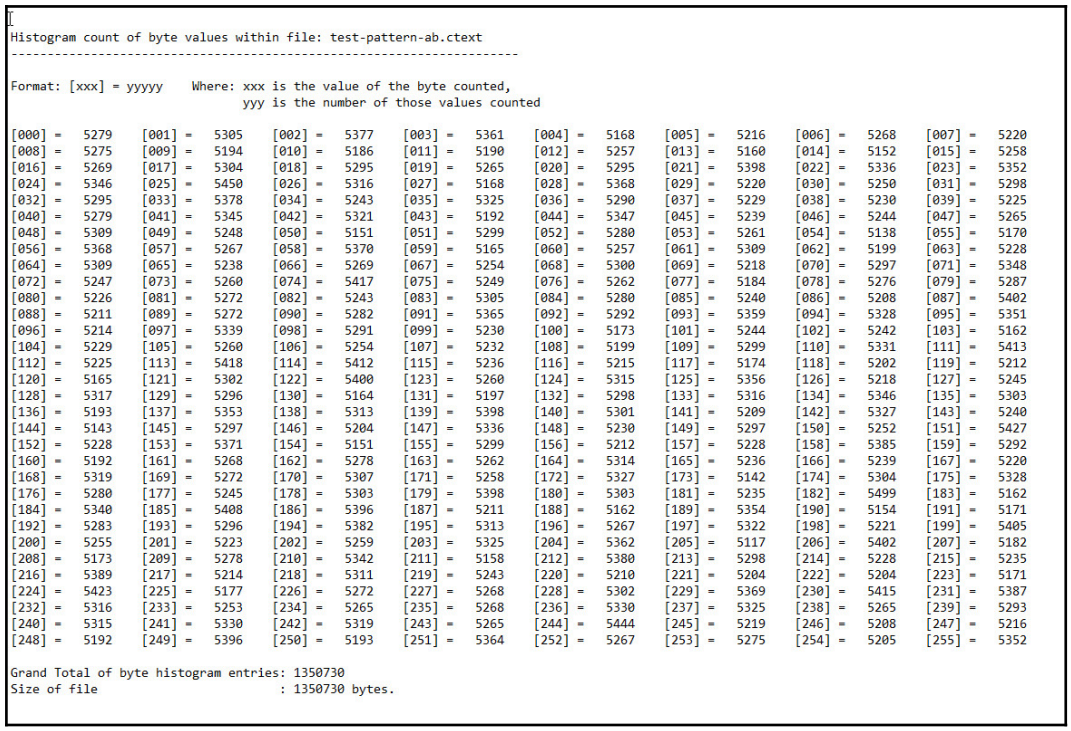
```
Histogram count of byte values within file: test-pattern-ab.ptext
------------------------------------------------------------------------

Format: [xxx] = yyyyy    Where: xxx is the value of the byte counted,
                                yyy is the number of those values counted

[000] =      0    [001] =      0    [002] =      0    [003] =      0    [004] =      0    [005] =      0    [006] =      0    [007] =      0
[008] =      0    [009] =      0    [010] =      0    [011] =      0    [012] =      0    [013] =      0    [014] =      0    [015] =      0
[016] =      0    [017] =      0    [018] =      0    [019] =      0    [020] =      0    [021] =      0    [022] =      0    [023] =      0
[024] =      0    [025] =      0    [026] =      0    [027] =      0    [028] =      0    [029] =      0    [030] =      0    [031] =      0
[032] =      0    [033] =      0    [034] =      0    [035] =      0    [036] =      0    [037] =      0    [038] =      0    [039] =      0
[040] =      0    [041] =      0    [042] =      0    [043] =      0    [044] =      0    [045] =      0    [046] =      0    [047] =      0
[048] =      0    [049] =      0    [050] =      0    [051] =      0    [052] =      0    [053] =      0    [054] =      0    [055] =      0
[056] =      0    [057] =      0    [058] =      0    [059] =      0    [060] =      0    [061] =      0    [062] =      0    [063] =      0
[064] =      0    [065] = 402588    [066] = 402588    [067] =      0    [068] =      0    [069] =      0    [070] =      0    [071] =      0
[072] =      0    [073] =      0    [074] =      0    [075] =      0    [076] =      0    [077] =      0    [078] =      0    [079] =      0
[080] =      0    [081] =      0    [082] =      0    [083] =      0    [084] =      0    [085] =      0    [086] =      0    [087] =      0
[088] =      0    [089] =      0    [090] =      0    [091] =      0    [092] =      0    [093] =      0    [094] =      0    [095] =      0
[096] =      0    [097] =      0    [098] =      0    [099] =      0    [100] =      0    [101] =      0    [102] =      0    [103] =      0
[104] =      0    [105] =      0    [106] =      0    [107] =      0    [108] =      0    [109] =      0    [110] =      0    [111] =      0
[112] =      0    [113] =      0    [114] =      0    [115] =      0    [116] =      0    [117] =      0    [118] =      0    [119] =      0
[120] =      0    [121] =      0    [122] =      0    [123] =      0    [124] =      0    [125] =      0    [126] =      0    [127] =      0
[128] =      0    [129] =      0    [130] =      0    [131] =      0    [132] =      0    [133] =      0    [134] =      0    [135] =      0
[136] =      0    [137] =      0    [138] =      0    [139] =      0    [140] =      0    [141] =      0    [142] =      0    [143] =      0
[144] =      0    [145] =      0    [146] =      0    [147] =      0    [148] =      0    [149] =      0    [150] =      0    [151] =      0
[152] =      0    [153] =      0    [154] =      0    [155] =      0    [156] =      0    [157] =      0    [158] =      0    [159] =      0
[160] =      0    [161] =      0    [162] =      0    [163] =      0    [164] =      0    [165] =      0    [166] =      0    [167] =      0
[168] =      0    [169] =      0    [170] =      0    [171] =      0    [172] =      0    [173] =      0    [174] =      0    [175] =      0
[176] =      0    [177] =      0    [178] =      0    [179] =      0    [180] =      0    [181] =      0    [182] =      0    [183] =      0
[184] =      0    [185] =      0    [186] =      0    [187] =      0    [188] =      0    [189] =      0    [190] =      0    [191] =      0
[192] =      0    [193] =      0    [194] =      0    [195] =      0    [196] =      0    [197] =      0    [198] =      0    [199] =      0
[200] =      0    [201] =      0    [202] =      0    [203] =      0    [204] =      0    [205] =      0    [206] =      0    [207] =      0
[208] =      0    [209] =      0    [210] =      0    [211] =      0    [212] =      0    [213] =      0    [214] =      0    [215] =      0
[216] =      0    [217] =      0    [218] =      0    [219] =      0    [220] =      0    [221] =      0    [222] =      0    [223] =      0
[224] =      0    [225] =      0    [226] =      0    [227] =      0    [228] =      0    [229] =      0    [230] =      0    [231] =      0
[232] =      0    [233] =      0    [234] =      0    [235] =      0    [236] =      0    [237] =      0    [238] =      0    [239] =      0
[240] =      0    [241] =      0    [242] =      0    [243] =      0    [244] =      0    [245] =      0    [246] =      0    [247] =      0
[248] =      0    [249] =      0    [250] =      0    [251] =      0    [252] =      0    [253] =      0    [254] =      0    [255] =      0

Grand Total of byte histogram entries: 805176
Size of file                         : 805176 bytes.
```

Table 12 Test-Pattern-AB.ptext Plain-Text byte Histogram

Table 12 above is provided as documentation of the byte pattern file of the ASCII characters A & B within test file number 2.

The following page illustrates the result of the resultant cipher-text file byte values and counts of the duplicate byte sequence patterns detected within the file.

Test-pattern-AB.ptext, con't



Histogram count of byte values within file: test-pattern-ab.ctext

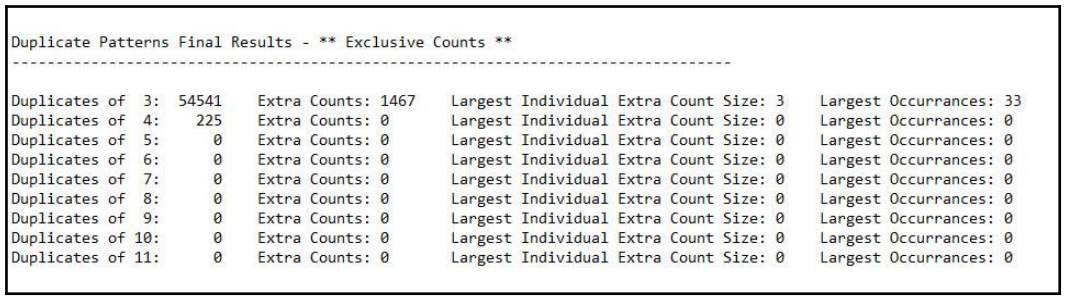
Format: [xxx] = yyyyy Where: xxx is the value of the byte counted,
yyy is the number of those values counted

[000] =	5279	[001] =	5305	[002] =	5377	[003] =	5361	[004] =	5168	[005] =	5216	[006] =	5268	[007] =	5220
[008] =	5275	[009] =	5194	[010] =	5186	[011] =	5190	[012] =	5257	[013] =	5160	[014] =	5152	[015] =	5258
[016] =	5269	[017] =	5304	[018] =	5295	[019] =	5265	[020] =	5295	[021] =	5398	[022] =	5336	[023] =	5352
[024] =	5346	[025] =	5450	[026] =	5316	[027] =	5168	[028] =	5368	[029] =	5220	[030] =	5250	[031] =	5298
[032] =	5295	[033] =	5378	[034] =	5243	[035] =	5325	[036] =	5290	[037] =	5229	[038] =	5230	[039] =	5225
[040] =	5279	[041] =	5345	[042] =	5321	[043] =	5192	[044] =	5347	[045] =	5239	[046] =	5244	[047] =	5265
[048] =	5309	[049] =	5248	[050] =	5151	[051] =	5299	[052] =	5280	[053] =	5261	[054] =	5138	[055] =	5170
[056] =	5368	[057] =	5267	[058] =	5370	[059] =	5165	[060] =	5257	[061] =	5309	[062] =	5199	[063] =	5228
[064] =	5309	[065] =	5238	[066] =	5269	[067] =	5254	[068] =	5300	[069] =	5218	[070] =	5297	[071] =	5348
[072] =	5247	[073] =	5260	[074] =	5417	[075] =	5249	[076] =	5262	[077] =	5184	[078] =	5276	[079] =	5287
[080] =	5226	[081] =	5272	[082] =	5243	[083] =	5305	[084] =	5280	[085] =	5240	[086] =	5208	[087] =	5402
[088] =	5211	[089] =	5272	[090] =	5282	[091] =	5365	[092] =	5292	[093] =	5359	[094] =	5328	[095] =	5351
[096] =	5214	[097] =	5339	[098] =	5291	[099] =	5230	[100] =	5173	[101] =	5244	[102] =	5242	[103] =	5162
[104] =	5229	[105] =	5260	[106] =	5254	[107] =	5232	[108] =	5199	[109] =	5299	[110] =	5331	[111] =	5413
[112] =	5225	[113] =	5418	[114] =	5412	[115] =	5236	[116] =	5215	[117] =	5174	[118] =	5202	[119] =	5212
[120] =	5165	[121] =	5302	[122] =	5400	[123] =	5260	[124] =	5315	[125] =	5356	[126] =	5218	[127] =	5245
[128] =	5317	[129] =	5296	[130] =	5164	[131] =	5197	[132] =	5298	[133] =	5316	[134] =	5346	[135] =	5303
[136] =	5193	[137] =	5353	[138] =	5313	[139] =	5398	[140] =	5301	[141] =	5209	[142] =	5327	[143] =	5240
[144] =	5143	[145] =	5297	[146] =	5204	[147] =	5336	[148] =	5230	[149] =	5297	[150] =	5252	[151] =	5427
[152] =	5228	[153] =	5371	[154] =	5151	[155] =	5299	[156] =	5212	[157] =	5228	[158] =	5385	[159] =	5292
[160] =	5192	[161] =	5268	[162] =	5278	[163] =	5262	[164] =	5314	[165] =	5236	[166] =	5239	[167] =	5220
[168] =	5319	[169] =	5272	[170] =	5307	[171] =	5258	[172] =	5327	[173] =	5142	[174] =	5304	[175] =	5328
[176] =	5280	[177] =	5245	[178] =	5303	[179] =	5398	[180] =	5303	[181] =	5235	[182] =	5499	[183] =	5162
[184] =	5340	[185] =	5408	[186] =	5396	[187] =	5211	[188] =	5162	[189] =	5354	[190] =	5154	[191] =	5171
[192] =	5283	[193] =	5296	[194] =	5382	[195] =	5313	[196] =	5267	[197] =	5322	[198] =	5221	[199] =	5405
[200] =	5255	[201] =	5223	[202] =	5259	[203] =	5325	[204] =	5362	[205] =	5117	[206] =	5402	[207] =	5182
[208] =	5173	[209] =	5278	[210] =	5342	[211] =	5158	[212] =	5380	[213] =	5298	[214] =	5228	[215] =	5235
[216] =	5389	[217] =	5214	[218] =	5311	[219] =	5243	[220] =	5210	[221] =	5204	[222] =	5204	[223] =	5171
[224] =	5423	[225] =	5177	[226] =	5272	[227] =	5268	[228] =	5302	[229] =	5369	[230] =	5415	[231] =	5387
[232] =	5316	[233] =	5253	[234] =	5265	[235] =	5268	[236] =	5330	[237] =	5325	[238] =	5265	[239] =	5293
[240] =	5315	[241] =	5330	[242] =	5319	[243] =	5265	[244] =	5444	[245] =	5219	[246] =	5208	[247] =	5216
[248] =	5192	[249] =	5396	[250] =	5193	[251] =	5364	[252] =	5267	[253] =	5275	[254] =	5205	[255] =	5352

Grand Total of byte histogram entries: 1350730
Size of file : 1350730 bytes.

Table 13 Test-Pattern-AB.ctext Cipher-Text byte Histogram

Table 13 illustrates the relative equal distribution of cipher-text values output.



Duplicate Patterns Final Results - ** Exclusive Counts **

Duplicates of 3:	54541	Extra Counts: 1467	Largest Individual Extra Count Size: 3	Largest Occurrances: 33
Duplicates of 4:	225	Extra Counts: 0	Largest Individual Extra Count Size: 0	Largest Occurrances: 0
Duplicates of 5:	0	Extra Counts: 0	Largest Individual Extra Count Size: 0	Largest Occurrances: 0
Duplicates of 6:	0	Extra Counts: 0	Largest Individual Extra Count Size: 0	Largest Occurrances: 0
Duplicates of 7:	0	Extra Counts: 0	Largest Individual Extra Count Size: 0	Largest Occurrances: 0
Duplicates of 8:	0	Extra Counts: 0	Largest Individual Extra Count Size: 0	Largest Occurrances: 0
Duplicates of 9:	0	Extra Counts: 0	Largest Individual Extra Count Size: 0	Largest Occurrances: 0
Duplicates of 10:	0	Extra Counts: 0	Largest Individual Extra Count Size: 0	Largest Occurrances: 0
Duplicates of 11:	0	Extra Counts: 0	Largest Individual Extra Count Size: 0	Largest Occurrances: 0

Table 18 Test-Pattern-AB.ctext Cipher-Text Duplicate Byte Patterns

The cipher-text file size for that shown in table 13 is 1,350,730 bytes in size. A duplicate 3 byte pattern for this file size has approximately 912,236,441,812 (912 gig) chances. The probability of each 3 peat is approx. 256 * 256 * 256 or 16,777,216. This results in 54,373 likely random duplications, which is less than 200 different than observed. The 4 byte patterns drop by a factor of 242 – only 14 or approximately 6% away from the desired probability of 256.

Test-pattern-AB.ptext, con't

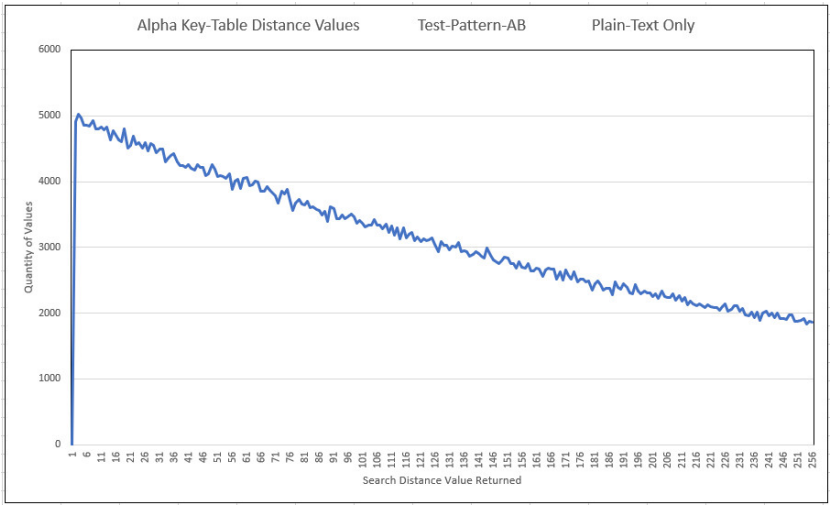


Figure 8 Alpha Key-Table Search Return Values Plain-Text

Figure 8 illustrates the typical distribution of return values from the Alpha key-table searches, favoring smaller values.

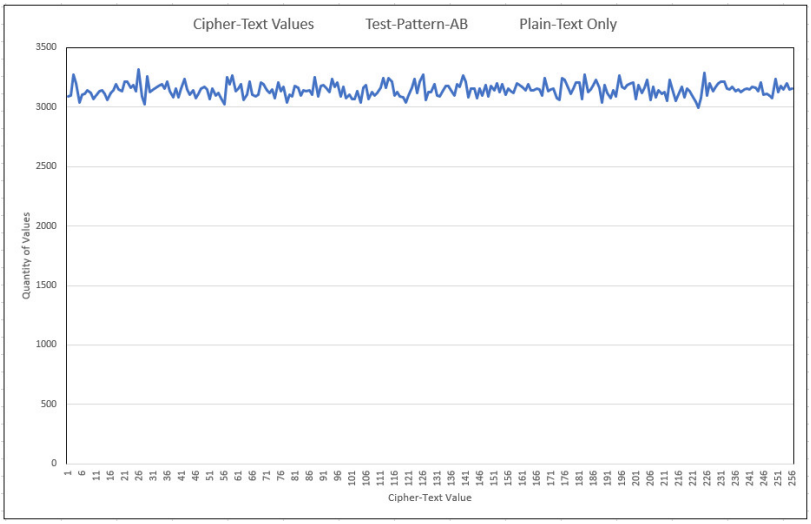


Figure 9 Cipher-Text Values Plain-Text

Figure 9 illustrates the effectiveness of the post search D bias applied to the alpha key-table search results, to generate the final cipher-text values. Only the translated true plain-text input items are illustrated, but false data items produce identical results, as do re-vector items .