**Written report**

Upon receiving the plaintext\_dictionary, we conducted a letter-based frequency analysis on all five candidate plaintext messages to use as reference for what the ciphertext may hold. While the analysis is unable to take into account the possibility of which letters are randomly generated and which letters are encoded, there is a distinctly imbalanced distribution of letters as shown in the graph below. While all five plaintext candidates have very similar distributions, it identifies and allows us to establish a default mapping of each plaintext letter might map to in regards to the ciphertext.

Plaintext #1 Frequency table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | 30 | B | 15 | C | 22 |
| D | 9 | E | 57 | F | 8 |
| G | 7 | H | 7 | I | 32 |
| J | 0 | K | 5 | L | 29 |
| M | 9 | N | 34 | O | 20 |
| P | 12 | Q | 1 | R | 36 |
| S | 44 | T | 27 | U | 22 |
| V | 2 | W | 5 | X | 2 |
| Y | 7 | Z | 4 |

Plaintext #2 Frequency table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | 33 | B | 13 | C | 20 |
| D | 13 | E | 47 | F | 4 |
| G | 16 | H | 14 | I | 33 |
| J | 1 | K | 4 | L | 21 |
| M | 8 | N | 21 | O | 36 |
| P | 9 | Q | 0 | R | 44 |
| S | 42 | T | 30 | U | 15 |
| V | 6 | W | 4 | X | 1 |
| Y | 9 | Z | 3 |

Plaintext #3 Frequency table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | 29 | B | 11 | C | 24 |
| D | 17 | E | 48 | F | 3 |
| G | 13 | H | 9 | I | 41 |
| J | 2 | K | 4 | L | 32 |
| M | 5 | N | 36 | O | 32 |
| P | 10 | Q | 1 | R | 37 |
| S | 36 | T | 22 | U | 17 |
| V | 5 | W | 5 | X | 1 |
| Y | 11 | Z | 1 |

Plaintext #4 Frequency table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | 37 | B | 7 | C | 14 |
| D | 17 | E | 50 | F | 3 |
| G | 21 | H | 11 | I | 414 |
| J | 2 | K | 2 | L | 20 |
| M | 21 | N | 33 | O | 19 |
| P | 12 | Q | 0 | R | 35 |
| S | 49 | T | 26 | U | 16 |
| V | 4 | W | 2 | X | 1 |
| Y | 6 | Z | 0 |

Plaintext #5 Frequency table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | 37 | B | 7 | C | 14 |
| D | 17 | E | 50 | F | 3 |
| G | 21 | H | 11 | I | 41 |
| J | 2 | K | 2 | L | 20 |
| M | 21 | N | 33 | O | 19 |
| P | 12 | Q | 0 | R | 35 |
| S | 49 | T | 26 | U | 16 |
| V | 4 | W | 2 | X | 1 |
| Y | 6 | Z | 0 |

Chart

Description automatically generated

Because each graph has very similar letter frequency behaviors and there is a random chance to randomly insert a new letter into the plaintext, we have opted to use the chi square encryption algorithm to determine which letter matching is the best possible match between the plaintext and the ciphertext.