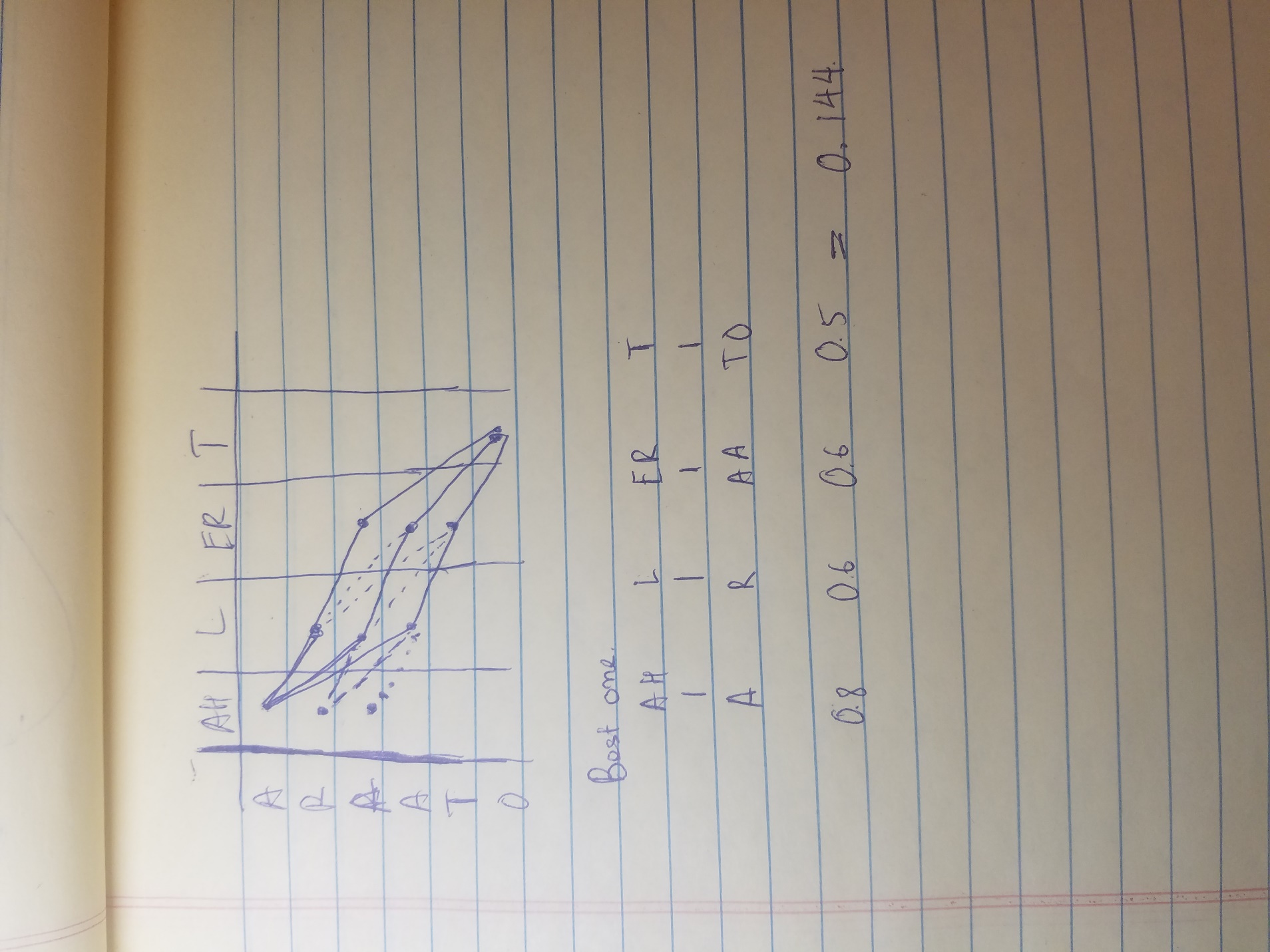
# Duc Minh Le

Question 1:

|  |  |
| --- | --- |
| P(A A | AA) = 1.0  P(M | AA) = 0.0  P(A | AA) = 0.0 | P(T | T) = 0.33  P(T O | T) = 0.67  P(S | T) = 0.0 |

Question 2:



Question 3:

|  |  |
| --- | --- |
| "EY" "B" "AH" "L"  "A" "B" "E" "R" "U"  1 2 3 4 4  "EY" "B" "AH" "L"  "A" "B" "E" "R" "U"  1 2 3 3 4  "EY" "B" "AH" "L"  "A" "B" "E" "R" "U"  1 2 2 3 4  "EY" "B" "AH" "L"  "A" "B" "E" "R" "U"  1 1 2 3 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 2 3 4 4 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 2 3 3 4 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 2 3 3 3 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 2 2 3 4 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 2 2 3 3 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 2 2 2 3 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 1 2 3 4 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 1 2 3 3 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 1 2 2 3 4  "AH" "B" "AW" "T"  "A" "B" "A" "U" "T" "O"  1 1 1 2 3 4 | "AH" "K" "EY" "SH" "AH"  "A" "K" "A" "SH" "I" "A"  1 2 3 4 5 5  "AH" "K" "EY" "SH" "AH"  "A" "K" "A" "SH" "I" "A"  1 2 3 4 4 5  "AH" "K" "EY" "SH" "AH"  "A" "K" "A" "SH" "I" "A"  1 2 3 3 4 5  "AH" "K" "EY" "SH" "AH"  "A" "K" "A" "SH" "I" "A"  1 2 2 3 4 5  "AH" "K" "EY" "SH" "AH"  "A" "K" "A" "SH" "I" "A"  1 1 2 3 4 5  "EY" "S"  "E" "E" "S" "U"  1 2 2 2  "EY" "S"  "E" "E" "S" "U"  1 1 2 2  "EY" "S"  "E" "E" "S" "U"  1 1 1 2  "AE" "S" "AH" "T" "OW" "N"  "A" "S" "E" "T" "O" "N"  1 2 3 4 5 6 |

Question 4:

Iter 1

(('"EY"', ['"A"']), ('"B"', ['"B"']), ('"AH"', ['"E"']), ('"L"', ['"R"', '"U"'])) 0.7055331337167089

(('"AH"', ['"A"']), ('"B"', ['"B"']), ('"AW"', ['"A"', '"U"']), ('"T"', ['"T"', '"O"'])) 0.6105988143164557

(('"AH"', ['"A"']), ('"K"', ['"K"']), ('"EY"', ['"A"']), ('"SH"', ['"SH"', '"I"']), ('"AH"', ['"A"'])) 0.9337147925021705

(('"EY"', ['"E"', '"E"']), ('"S"', ['"S"', '"U"'])) 0.8435620239124157

(('"AE"', ['"A"']), ('"S"', ['"S"']), ('"AH"', ['"E"']), ('"T"', ['"T"']), ('"OW"', ['"O"']), ('"N"', ['"N"'])) 1.0

Iter 2

(('"EY"', ['"A"']), ('"B"', ['"B"']), ('"AH"', ['"E"']), ('"L"', ['"R"', '"U"'])) 0.9779450858537589

(('"AH"', ['"A"']), ('"B"', ['"B"']), ('"AW"', ['"A"', '"U"']), ('"T"', ['"T"', '"O"'])) 0.9731091018443341

(('"AH"', ['"A"']), ('"K"', ['"K"']), ('"EY"', ['"A"']), ('"SH"', ['"SH"', '"I"']), ('"AH"', ['"A"'])) 0.9981740505800589

(('"EY"', ['"E"', '"E"']), ('"S"', ['"S"', '"U"'])) 0.9974489197176026

(('"AE"', ['"A"']), ('"S"', ['"S"']), ('"AH"', ['"E"']), ('"T"', ['"T"']), ('"OW"', ['"O"']), ('"N"', ['"N"'])) 1.0

Iter 3

(('"EY"', ['"A"']), ('"B"', ['"B"']), ('"AH"', ['"E"']), ('"L"', ['"R"', '"U"'])) 0.999681334734887

(('"AH"', ['"A"']), ('"B"', ['"B"']), ('"AW"', ['"A"', '"U"']), ('"T"', ['"T"', '"O"'])) 0.9958439745750437

(('"AH"', ['"A"']), ('"K"', ['"K"']), ('"EY"', ['"A"']), ('"SH"', ['"SH"', '"I"']), ('"AH"', ['"A"'])) 0.9999418511601904

(('"EY"', ['"E"', '"E"']), ('"S"', ['"S"', '"U"'])) 0.9999780106707825

(('"AE"', ['"A"']), ('"S"', ['"S"']), ('"AH"', ['"E"']), ('"T"', ['"T"']), ('"OW"', ['"O"']), ('"N"', ['"N"'])) 1.0

Iter 4

(('"EY"', ['"A"']), ('"B"', ['"B"']), ('"AH"', ['"E"']), ('"L"', ['"R"', '"U"'])) 0.999999064527038

(('"AH"', ['"A"']), ('"B"', ['"B"']), ('"AW"', ['"A"', '"U"']), ('"T"', ['"T"', '"O"'])) 0.9980608605658378

(('"AH"', ['"A"']), ('"K"', ['"K"']), ('"EY"', ['"A"']), ('"SH"', ['"SH"', '"I"']), ('"AH"', ['"A"'])) 0.9999979379262994

(('"EY"', ['"E"', '"E"']), ('"S"', ['"S"', '"U"'])) 0.9999998193010048

(('"AE"', ['"A"']), ('"S"', ['"S"']), ('"AH"', ['"E"']), ('"T"', ['"T"']), ('"OW"', ['"O"']), ('"N"', ['"N"'])) 1.0

Iter 5

(('"EY"', ['"A"']), ('"B"', ['"B"']), ('"AH"', ['"E"']), ('"L"', ['"R"', '"U"'])) 0.9999999979430988

(('"AH"', ['"A"']), ('"B"', ['"B"']), ('"AW"', ['"A"', '"U"']), ('"T"', ['"T"', '"O"'])) 0.9991048104259115

(('"AH"', ['"A"']), ('"K"', ['"K"']), ('"EY"', ['"A"']), ('"SH"', ['"SH"', '"I"']), ('"AH"', ['"A"'])) 0.9999999246114584

(('"EY"', ['"E"', '"E"']), ('"S"', ['"S"', '"U"'])) 0.9999999985151161

(('"AE"', ['"A"']), ('"S"', ['"S"']), ('"AH"', ['"E"']), ('"T"', ['"T"']), ('"OW"', ['"O"']), ('"N"', ['"N"'])) 1.0

Question 5:

Accuracy: 0.9988822652757079

Question 6:

echo '"A" "N" "J" "I" "R" "A" "N" "A" "I" "T" "O"' | carmel -sriIEWk 5 eword.wfsa eword-epron.wfst epron-jpron-unsupervised.wfst

Input line 1: "A" "N" "J" "I" "R" "A" "N" "A" "I" "T" "O"

(185 states / 365 arcs reduce-> 22/202)

(32007 states / 43490 arcs reduce-> 23126/33756)

(20416 states / 28336 arcs reduce-> 17975/25869)

"ANGELA" "NIGHT"

"ANGELA" "MIGHT"

"ANGELA" "KNIGHT"

"ANGELA" "NATO"

"ENGINE" "NIGHT"

echo '"S" "U" "CH" "I" "I" "B" "E" "N" "R" "A" "R" "U" "Z" "U"' | carmel -sriIEWk 5 eword.wfsa eword-epron.wfst epron-jpron-unsupervised.wfst

Input line 1: "S" "U" "CH" "I" "I" "B" "E" "N" "R" "A" "R" "U" "Z" "U"

(187 states / 388 arcs reduce-> 29/230)

(20132 states / 27484 arcs reduce-> 13454/20088)

(11741 states / 16662 arcs reduce-> 10441/15354)

"STEPHENS" "NEWS"

"STEPHEN" "RAILS"

"STEVENS" "NEWS"

"STEVEN" "RAILS"

"STEPHEN" "AROUSE"

echo '"D" "O" "N" "A" "R" "U" "D" "O" "T" "O" "R" "A" "N" "P" "U"' | carmel -sriIEWk 5 eword.wfsa eword-epron.wfst epron-jpron-unsupervised.wfst

Input line 1: "D" "O" "N" "A" "R" "U" "D" "O" "T" "O" "R" "A" "N" "P" "U"

(219 states / 425 arcs reduce-> 30/236)

(34929 states / 47437 arcs reduce-> 25202/36862)

(22135 states / 30728 arcs reduce-> 19424/27971)

"DONALD" "TRUMP"

"DONALD" "TRAMP"

"DONALD" "TRUMPED"

"DONALD" "TRUMPS"

"DONALD" "AUTO" "LUMP"

echo '"SH" "Y" "E" "R" "I" "R" "U" "S" "A" "N" "D" "O" "B" "A" "A" "G" "U"' | carmel -sriIEWk 5 eword.wfsa eword-epron.wfst epron-jpron-unsupervised.wfst

Input line 1: "SH" "Y" "E" "R" "I" "R" "U" "S" "A" "N" "D" "O" "B" "A" "A" "G" "U"

(251 states / 484 arcs reduce-> 35/268)

(42040 states / 57225 arcs reduce-> 30071/43994)

(26522 states / 36896 arcs reduce-> 23366/33716)

"SHERRILL" "SANDBERG"

"CHERYL" "SANDBERG"

"SHARE" "IL" "SANDBERG"

"SHARE" "ILL" "SANDBERG"

"SHARE" "NEW" "SANDBERG"

Question 7:

Accuracy: 0.7920796184947129

Question 8:

**No Reset:**

10 loops: 0.8035662450756791

20 loops: 0.8098279079411155

50 loops: 0.817043334024466

**10 loops:**

5 resets: 0.8035662450756791

10 resets: 0.8035662450756791

15 resets: 0.8223512336719884

Conclusion: Yes, better result is achievable with more iterations and/or random restarts.

Question 9:

Question 10:

Deciphered texts of 5 iterations:

THED THERED HE T THED THEATHED THE HE THEATHED HE THERED THED THED THE THE THED THE HE THERE THERE THERE THED THE THATHED HE HE THERE THATHED T THATHED HE T THED HE HE THEROUTHE THED THE THED THED HE T THEATHED THEREROUTHE THERE THERED THE THE THATHED T THEROUTHED HE THERE THE THERE T THEATHED THERED HE THE THEATHED THE THEROUTHED HE THERE HE THEATHED HE THERE HE HE THERE THEATHED HE THERE HE THE THEROUTHE THE HE HE THED THED THE THATHED THEROUTHE THERE THED THEATHED THERED THE THERE THE THED THEROUTHE THERE THEROUTHE THEATHED THERED THERED HE THE THEROUTHE THED THEROUTHED THED THE THERE THE HE THERE THERED THE THATHED THEATHED THE THE THERE THERED THED THE THEROUTHE HE THED THATHED THERE THE T THED HE THED THERE THERE HE THE THEATHED HE THATHED THED T THERE THEREROUTHE HE THE THERE THERED HE THED THERED HE THE THEROUTHEROUTHE HE THATHED THE THERE THED THERE THATHED THE THERED HE THATHED HE THERED THED THE THERE HE THERED THEREROUTHED THATHED THEROUTHED THE THE THED THE THEROUTHE

THED THERED HE T THED THERITHE THE HE THESTHED HE THERED THED THED THE THE THED THE HE THERE THERE THAND THED THE THERERE HE HE THAND THATHED T WATHERE HE T THED HE HE THATHERED THED THE THED THED BE T THANTHED THEREROUTHE THEND THERED THE THE THATHED T THERERERED HE THERE THE THAND T WATHERED THERED HE THE THATHERE THE THEROUTHED HE THERE BE THATHERE HE THAND HE HE ATHED THANTHED HE THERE HE THE THERITHED THE HE BE THED THED THE THERERE THERITHED THERE THED THEATHED THERED THE THERE THE THED THEROUTHE WATHE THANTHERE THERERED THERED THATHE BE THE THERITHED THED THATHESTHE THED THE THERE THE BE THAND THERED THE THATHED THATHERE THE THE THAND THERED THED THE THEROUTHE HE THED THERERE THAND THE T THED HE THED THAND WATHE HE THE THANTHED HE THATHED THED T THERE THEREROUTHE HE THE THERE THERED HE THED THERED BE THE THERITHEROUTHED HE THERIND THE THERE THED ITHED THATHED THE THERED HE THERERE HE THERED THED THE THERE HE WATHED THEREROUTHED THATHED THEROUTHED THE THE THED THE THERITHED

THED ATHAND HE T THED THERATHE IND HE THERITHE MY THATHE THED THED THE THE THED IND HE WATHE THERE THAND THED THE THERERE HE HE THAND THATHED T WATHERE MY T THED HE HE INTHATHED THAT THE ITHE THED MY T THANTHED THEREATHAND THEND THERED THE THE THATHED T THEDERERED MY THEDE IND THAND T WATHERED INTHED MY THE THATHERE THE THESTHATHE MY WATHE BE THATHEND HE THAND HE HE ATHED THANTHED HE THERE MY IND THERITHED THE TH BE THED ITHE THE WATHERE THERETHED THERE THED THANTHED WATHED IND THERE THE THED THEROUTHE WATHE THANGHERE THERERED THERED THATHE MY THE THEATHAND THAT THATHESTHE THED IND WATHE THE BE THAND THERED THE THATHED THATHERE THE THE THAND ATHAND THED THE THEROUTHE MY THED WATHERE THAND IND T THED MY THED THAND WATHE HE THE THATHAND HE THATHED THED T THERE HEDERERITHE MY THE THERE BERIND TH THED THERED MY THE THERITHATHEATHE MY THERIND THE THERI THED ITHED THATHED THE HEATHE MY WATHERE HE THERED THED IND THEMY HE WATHED ATHEREROUTHE THATHED THATHERIND THE THE THED THE THANTHERE

THED ATHAND HE T THED THERATHE IND HE THERATHE MY THATHE THED THAN THE THE THED IND HE ITHED THERE THAND THED THE BUTHERE HE HE THAND THEREDE T WATHERE MY T WAND HE HE INTHATHED THAT THE ITHE THED MY T THATHEND THEREATHIND THEND THEAND THE THE THEMERE T WANDERERED MY THEDE IND THAND T WATHERED ANTHED MY THE THATHERE THE MERERITHAN MY WATHE BE THATHEND HE THAND HE HE ATHED THANTHED HE THERE MY IND THERATHED THE TH BE THED ITHE THE WATHERE THERETHED THERE THED THANTHED THANDE IND THERE THE THED THEROUTHE WATHE THANGHERE THERERED THEAND THATHE MY THE THEATHAND THAT THATHESTHE THED IND WATHE THE BE THAND ANDEND THE THATHED THATHERE THE THE THAND ATHAND WATH THE THANOUTHE MY THED WATHERE THAND IND T THED MY THED THAND BUTHE HE THE THATHAND HE THATHED WATH T THERE HEDERERITHE MY THE THERE MYOTHE TH THAN THAVED MY THE THERATHATHEATHE MY THERIND THE THEAT HERE ITHED THATHED THE HEATHE MY WATHERE HE THERED THED IND THEMY IN WATHED ATHEREROUTHE THATHED BOUTHERIND THE THE WATH THE THANGHERE

THAS ATHIND AS T THED THERATHE IND AT THERATHE MY THATHE THED THIN THE THE THED IND AS ITHED THERE WAVED THED AND BERITHE IT HE THAND THAREDE T JUTHERE MY T WAND AT AS TOFOUTHED THAT THE THAN THED MY T STHEREND THEREXTHIND THEND THEAND AND WAD THEMERE T WANDERERED MY THEDE IND THAND T WATHEAND ANTHED MY THE WANTHERE THE MERERITHAN MY WATHE BE THATHEND AS THIND HE IT ATHED THINTHED HE THERE MY IND WAREATHED THE TH BE THED NGHE THE WATHERE THERETHED THERE THED THANTHAD STHEDE IND THERE THE THED THEROUTHE WATHE THANGHERE THERERED THEAND THATHE MY THE THEATHAND THAT THATHESTHE THED IND BEVER THE BE THAND ANDEND THE BOUTHED THAINTHE THE THE THAND ATHIND WATH THE THANTHAIN MY THAS WATHERE THAND IND T THED MY HIND THAND BUTHE HE THE THATHIND AS WAVERED WATH T THERE ANDERERITHE MY THE THERE MYOTHE TH WAVE THAVED MY THE HANGATHATHEATHE MY INGHIND THE THOUT HERE ITHED INTHAND THE HEATHE MY WATHERE HE THERED THED IND THEMY IN INTHED ATHEREROUTHE THATHED BOUTHERIND THE THE WATH AND THINGHERE

THAS ATHIND AS T THED WANGUTHE IND AT THESATHE MY WASTHE THED THIN THE THI THED IND AS MBOUT THERE WAVED THED AND BERISTH IT IS THAND OUTHEDE T JUTHERE MY T WAND AT AS TOFOUTHED THAT THE THAN AIND MY T STHEREND THEREXTHIND THEND HALAND AND WAY THEMORE T WANDERERED MY THEDE IND THAND T WATHEAND OUTHED MY THE WANTHERE THE MERERITHAN MY WATHE BE THATHEND AS THIND HE IT HEAST STHEWATH IS THERE MY IND WAREATHED THE TH BE THEN NGHE THE WATHERE OUTHEWAND THERE THED THANTHAD THINDE IND THERE THE THED WASERITHE WATHE THANDINGE THEANGED THEAND THATHE MY THE THEASAVED THAT THATHESTHE THED IND BEVER THE BE THAND ANDEND THE BEASTHE THEMESTH BUT THE THAND ATHIND WATH THE TOREXTHAN MY THAS WATHERE THAND IND T WAND MY HIND THAND BEATH IN THE THATHAST AS WAVERED WATH T DENDE ANDENGHATHE MY THE THERE MYOTHE TH WATH THAVED MY THE HANGACOUTHEATHE MY INGHIND THE THOUT HERE ITHEN ISTHAND THE HEATHE MY WATHERE HE THERED THED IND THEMY IN INTHED ATHEREROUTHE THACAVE BOUTHERIND THE THE WATH AND THARERERE

Question 11:

After 100 Iteration:

THIS ISHAND IS I VERY SINGULAR ONE IT CONSISTS OF HITTHE EMYE THAN THE SEA SAND AND IS ATOUT THREE WALES LONG ITS BREASTH AT NO POINT EXCKEDS I QUARTER OF I WALE IT IS SEPARATED FROM THE WAIN HAND MY I SCARCEMY PERCEPLITHE CREED OOWING ITS WAY THROUGH I WALDERNESS OF REEDS AND SHIME I FAVORITE RESORT OF THE WARSTHEN THE VEVELATION AS WIGHT BE SUPPOSED IS SCANT OR AT HEAST DWARBISH NO TREES OF ANY WAGNITUDE ARE TO BE SEEN NEAR THE WESTERN EXTREMALY WHERE FORT WOULLLIE STANDS AND WHERE ARE SOME WASERATHE FRAME BUINDINGS TENANTED JURING SUMBER MY THE BUGITIVES FROM CHARMESTON JUST AND BEVER WAY BE FOUND INDEED THE BRISTHY PALLELLO BUT THE WHOME ISHAND WITH THE EXCEPLION OF THIS WESTERN POINT AND I HINE OF HARD WHITE BEACH ON THE SEACOAST IS COVERED WITH I DENSE UNDERGROUTH OF THE SWEED MYOTHE SO MUCH PRIZED MY THE HORTICULLURISTS OF ENGHAND THE SHOUT HERE OFTEN ALLAINS THE HEAGHT OF FIFTEEN OR THENTY BEED AND FORMY AN ALLOST IMPENETRATHE COPPICE BURTHENING THE AIR WITH ITS FRIGRANCE

Question 12:

Substitution table

|  |  |  |
| --- | --- | --- |
| orginal: A  B 0.03846153846153846  D 0.25011262554473856  M 0.6840837657651452  Q 0.06579659011942897  orginal: B  B 0.03846153846153846  L 0.5046982080108456  N 0.04621760057591821  P 0.12763362666971215  R 0.030775840762670113  Y 0.29067474133466825  orginal: C  B 0.03846153846153846  I 0.8570342473607785  N 0.1429586104312593  orginal: D  B 0.03846153846153846  H 0.6702439314949041  N 0.08689756388065323  O 0.08151722521367506  S 0.13593634231986493  V 0.02540491883461436  orginal: E  B 0.03846153846153846  Q 0.9994988280440031  orginal: F  B 0.03846153846153846  Y 0.9999999307764458  orginal: G  B 0.03846153846153846  H 0.09274422964378544  T 0.9068988377627346  orginal: H  A 0.030580083806157114  B 0.03846153846153846  F 0.17451987479603293  G 0.7664989548971223  W 0.028394856086975815  orginal: I  B 0.03846153846153846  D 0.6872354091383064  M 0.3127617654820192  orginal: J  B 0.03846153846153846  H 0.6787190430392488  N 0.32117691684360705 | orginal: K  B 0.03846153846153846  N 0.045449347656833915  P 0.05209269813245435  Q 0.3806685936587556  S 0.5072474057463239  orginal: L  B 0.03846153846153846  F 0.3440821819596102  P 0.0651555736653841  S 0.4395566216475707  W 0.1493606255280218  orginal: M  B 0.03846153846153846  F 0.23407241942247214  L 0.13390688983951457  O 0.07261599354559045  P 0.5525965194108414  orginal: N  B 0.03846153846153846  F 0.033656593117837176  O 0.9106894848577991  W 0.055653804033586086  orginal: O  B 0.03846153846153846  D 0.015928729077565974  E 0.9416914837327649  W 0.04237961211325939  orginal: P  B 0.03846153846153846  I 0.019024000699857508  R 0.9809759983386046  orginal: Q  B 0.03846153846153846  H 0.38025221711522034  Z 0.6197476806255261  orginal: R  B 0.03846153846153846  O 0.01801806054416551  W 0.9819819367757323 | orginal: S  B 0.03846153846153846  H 0.04334015017256756  N 0.95665976458123  orginal: T  B 0.03846153846153846  G 0.01969629257299576  L 0.07113908307834037  S 0.9091536476280997  orginal: U  A 0.04940273482404921  B 0.03846153846153846  C 0.8580650060072563  D 0.06430559305966943  M 0.028220261055685803  orginal: V  B 0.03846153846153846  F 0.06861434926419961  J 0.03842830107602761  K 0.7996811601320593  T 0.09245173714563247  orginal: W  A 0.6160607613679495  B 0.03846153846153846  F 0.017677306172460265  J 0.044589816854263345  P 0.301651955557178  R 0.017042249492190572  orginal: X  B 0.03846153846153846  R 0.12743660325518041  U 0.8725633967448193  orginal: Y  B 0.03846153846153846  N 0.3262553088580819  X 0.6736213035410267  orginal: Z  B 0.03846153846153846  J 1.0  orginal: “ “  “ “ 1.0 |