ANLP 662 – Homework 3

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1. Transliteration

Q1. P(AA|AA) = 0
P(M|AA) = 0
P(A|AA) = 1
P(T|T) = 1/3
P(TO|T) = 2/3
P(S|T) = 0

Q2. 'AH' 'L' 'ER' 'T' can be aligned to the following with the best alignment at the top:

A - R - AA - TO with probability 0.144

The other alignemnts are:

A - R - AA - O
A - R - A - TO
A - R - A - O
A - RA - AA - TO
A - RA - AA - O
A - RA - A - TO
A - R A- A - O
A – RAA - AA - TO
A - RAA - AA - O
A - RAA - A - TO
A - RAA - A - O
AR - R - AA - TO
AR - R - AA - O
AR - R - A - TO
AR - R - A - O
AR - RA - AA - TO
AR – RA - AA - O
AR - RA - A - TO
AR - RA - A - O
AR - RAA - AA - TO
AR - RAA - AA - O
AR - RAA - A - TO
AR - RAA - A - O

ARA - R - AA - TO
ARA - R - AA - O
ARA - R - A - TO
ARA - R - A - O
ARA - RA - AA - TO
ARA - RA - AA - O
ARA - RA - A - TO
ARA - RA - A - O
ARA - RAA - AA - TO
ARA - RAA - AA - O
ARA - RAA - A - TO
ARA - RAA - A - O

Q3. The first 5 alignments produced are:

All possible alignments

['"EY"', '"B"', '"AH"', '"L"']
['"A"', '"B"', '"E"', '"R"', '"U"']
[1, 2, 2, 3, 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, 1, 2, 3, 4]
['"EY"', '"B"', '"AH"', '"L"']
['"A"', '"B"', '"E"', '"R"', '"U"']
[1, 2, 3, 4, 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, 2, 3, 3, 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, 3, 4, 4, 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, 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, 2, 3, 3, 4, 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, 2, 3, 4, 5]
["'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, 3, 4, 5]
["'AH"', '"K"', '"EY"', '"SH"', '"AH"']
["'A"', '"K"', '"A"', '"SH"', '"I"', '"A"']
[1, 1, 2, 3, 4, 5]
["'AH"', '"K"', '"EY"', '"SH"', '"AH"']
["'A"', '"K"', '"A"', '"SH"', '"I"', '"A"']
[1, 2, 3, 4, 4, 5]
["'EY"', '"S"']
["'E"', '"E"', '"S"', '"U"']
[1, 1, 2, 2]
["'EY"', '"S"']
["'E"', '"E"', '"S"', '"U"']
[1, 1, 1, 2]
["'EY"', '"S"']
["'E"', '"E"', '"S"', '"U"']
[1, 2, 2, 2]
["'AE"', '"S"', '"AH"', '"T"', '"OW"', '"N"']
["'A"', '"S"', '"E"', '"T"', '"O"', '"N"']
[1, 2, 3, 4, 5, 6]

Q4. The best scoring alignments from EM are:

Iteration 1

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

Iteration 2

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

Iteration 3

"EY" "B" "AH" "L"
"A" "B" "E" "R" "U"
[1, 2, 3, 4, 4]
"AH" "B" "AW" "T"
"A" "B" "A" "U" "T" "O"
[1, 2, 3, 3, 4, 4]
"EY" "S"

"E" "E" "S" "U"
[1, 1, 2, 2]
"AE" "S" "AH" "T" "OW" "N"
"A" "S" "E" "T" "O" "N"
[1, 2, 3, 4, 5, 6]
"AH" "K" "EY" "SH" "AH"
"A" "K" "A" "SH" "I" "A"
[1, 2, 3, 4, 4, 5]

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

Q5. The accuracy:

Word accuracy 99.4379917572%
Token level accuracy 99.8755581583%

Q6. The decodings are:

"A" "N" "J" "I" "R" "A" "N" "A" "I" "T" "O"

ANGELA NIGHT
ANGELA MIGHT
ANGELA KNIGHT
ANGELA NATO
ANGELS NIGHT

"S" "U" "CH" "I" "I" "B" "E" "N" "R" "A" "R" "U" "Z" "U"

STEPHEN RAILS

STEVEN RAILS
STEPHEN RAWLS
STEPHEN LARS
STEPHEN RILES

"D" "O" "N" "A" "R" "U" "D" "O" "T" "O" "R" "A" "N" "P" "U"

DONALD TRUMP
DONALD TRAMP
DONALD TRUMPS
DONALD TRUMPED
DONALD AUTO LUMP

"SH" "Y" "E" "R" "I" "R" "U" "S" "A" "N" "D" "O" "B" "A" "A" "G" "U"

SHERRILL SANDBERG
SHARE IL SANDBERG
SHARE ILL SANDBERG
CHERYL SANDBERG
SHARE OIL SANDBERG

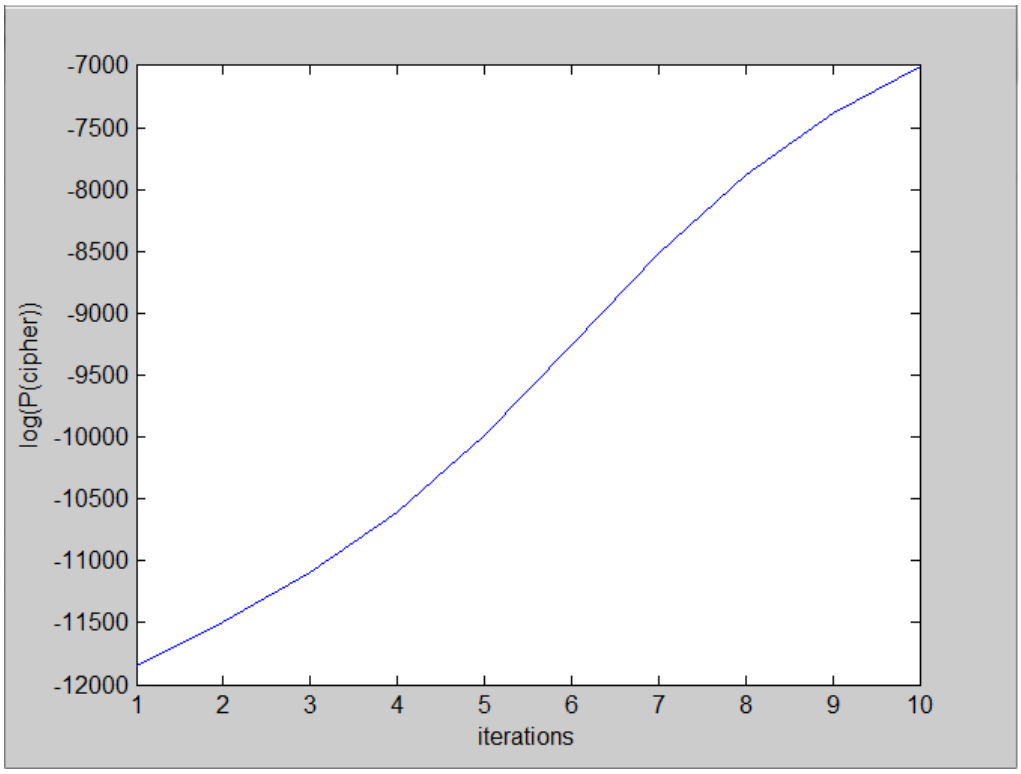
2. Part of Speech Tagging

Q7. The tagging accuracy is 79.2079%

Q8. Yes, the tagging accuracy goes up to 81.8328% with 10 random restarts and 15 EM iterations at max. (M - 15 and ! - 10)

3. Code Breaking

Q9. The graph has logarithm of the probability to account for the numerical underflow. It is monotonically increasing.



Q10. The Viterbi best path after each EM iteration

EM iteration 1
log (P(cipher)) -11848.7968284
THED STHEROUTHE THEATHED MY THED THATHED THAND HE THE WANTHERED THEATHEATHED HED THEATHED THEDOUTHED HE THE THED THASTHE THERED HE WAD ATHERERERE THATHED THED THE WATHATHE MY THED THEATHETHED WAD THEREDERE HE T WATHED THATHANDITHE THERED BEDED HE THED WATHED THE HERITHEDED MY THED THATHEATHE WAD MYOUTHED BE THATHE T THED HE TOWATHE THED THATHEATHE HEDOWATHAND THE THEROUTHED WATH THATHED ANTHEDIND THEATHEATHED HED THATHED ATHED WATHEWATHANTHED INTHED HEREDOUTHATHED THED THABE T WATHERITHED THERERE MY ANTHEDIND THEATHEATHED WATHEATHED THERERED BE THE THED THANTHERED THE ATHE WATHEATHED MY THE THASTHE THED THEATHED THERED WATHATHEROUTHE THI WATHERERED THE WATHASTHATHED ANTHEDIND HED THEDOUTHED THEATHEATHED WATHEATHED MY THE INTHERE THED HED THANTHE MY THE THED THEATHEATHED WATHAND THED THE THE WHED THATHERIND ANTHEDIND THEATHEATHED WATHAND WHED DERERERED HED THERERED BE HED THE WATHEMYOUTHE THEATHED BE WANDE THERE THED THEDOUTHED HED THED THED T WATHEROWAND HERINTHED INDE THED MYOUSTHE THATHED THEDE ANTHEDIND THEATHEATHED WATHAND THEREDED THERED THERITHED THEDED THERED THERED THERED THERITHED THE HED MY HATHE THAND ID THATHERERE THATHEND THATHE HE WAVED ATHED THED THAT THE WAVED BE THERED THATHED THERED THEND THED THEROUTHED WATHE THEROUTHED THANTHE THAND MY WATHE THATHED THEREMY HEDITHERE THEREMY STHAT THEROWATHED STHEDED THEREMY

HED ATHED THEATHEATHED WATHEATHED THED THED THE THE WHED THERE HEDERSTHED THEANTHE STHEROUTHE THESTHED AD THED BE BE THEDERIND BE INTHEDYOUTHED THERITHED HED THE THATHED MY WANGHEATHE THEREDER

EM iteration 2
log (P(cipher)) -11500.0360964
THAD STHEROUTHE THEATHED MY WHER DERERED WATHE HE THE WANDEROND THEATHEWATHE HED HEDOUTHE THEDITHAND HE THE THED THEDYOF BEROND AT WAD ATHEREREDE THATHAT THAT THE WAVEROWE MY WHER THEATHETHED WAD DERENDENG HE T YOWAND THATHANDWAND DEDINT WADED HE THED WATHED THE HEWATHEDED MY THED THATHESTHE WAD IDERERED BE HEATHE Y THED HE YOWATHE THED THATHESTHE IDYOWATHAND THE IDYOWATHED WATH THASTHE ANTHEDOND THEATHEWATHE HED THEANDE ATHED WATHEWATHANTHED INTHED HERESTHEATHAND HAND THABE T WATHEATHAND LATHEMY MY ANTHEDOND THEATHEWATHE WATHEATHED ATHEAVED BE THE WHER THANTHERED THE HATH WATHEATHED MY THE THEDYOF WHER THEATHED WADERE WATHATHEATHEMY YOW WACOUTHEND THE WATHASTHATHED ANTHEDOND HED THEDOUTHED THEATHEWATHE WATHEATHED MY THE INTHENG WHER HED DERERED MY THE WHER THEATHEWATHE WATHEDY HAND THE ING BEDE INTHEDOWED ANTHEDOND THEATHEWATHE WATHEDY BERE DENDEMBED HED ATHEAVED BE HED THE WEDOMBERATHE THETHAND TH WANDE THERE WAND THEDOUTHED HED HAND THES T WATHEROWAND HERINTHED INDE THED DYOUSTHE THATHED THEDE ANTHEDOND THEATHEWATHE WATHEDY HERERDED THERED WEROUTHED THEDED THEDED THERED THEDED THANOWAND THE HED MY HATHE WERED ID YOUTHEAVER THATHEAD MBOWAD HE WAVED ATHED WAND THAT THE WAVED TH THEMBE YOUTHED THEDED DEDED DIND OUTHEATHED WATHE HEDEANTHED DERERED WERED MY WATHE THATHED THEMEMY HEDITHEAT THEMEMY SWAST HEMYOWATHED STHEDED THEMEMY HED ATHER THEATHEWATHE WATHEATHED THAT HAND THE ING BEDE THEDE HEDERSTHED DEDINTHE STHEROUTHE THEDINDE AD THED TH BE IVEDEDIND BE DEYORESTHATHE THEWATHED HED THE DERERED MY WANGHOUTHE YONDEDOW

EM iteration 3
log (P(cipher)) -11095.5568391
YOWE STHEMOUTHE THEATHED MY WHER DEMYOND WATHE ME THE WANDENOND THOUTHEWATHE IND HEDIZZZE THEDOTHAND HE THE STHE WEADYOF BEROND AT WAD IZZZZEANDE THATHAT THAT THE WAVEROWE MY WHER HEROFOUTHED WAD DEVENDENT ME I YOWAND DEATHANDWARE DEDINT WADED ME THAD WETHAD THE HECATHEDED MY THAD THACASTHAN WAD IDRINGED BE ARITHE Y THAD HE YOWATHE THAD THACASTHAN IDYOWATHAND IND HEDITHATED WATH YOMYOME ANTHEDOND THOUTHEWATHE IND THEANDI ATHED WATHEWATHANTHED HERENT HEVESTHEATHAND HAND THABE I WATHEATHIND LATHEMY MY ANTHEDOND THOUTHEWATHE WETHEZZZED ATHEAVED BE THE WHER THANTHEVED THE HATH WATHEATHAN MY THE WEADYOF WHER THEATHED WADERE BUTHATHEATHEMY YOW WAWANGHEND THE WATHASTOWATED ANTHEDOND IND THADOUTOND THOUTHEWATHE WETHEZZZED MY THE INTHENT WHER IND DEVERID MY THE WHER THOUTHEWATHE WETHADY HAND EAT INT BEDE ANTHADOWED ANTHEDOND

THOUTHEWATHE WETHADY BERE DEVERAVED IND ATHEAVED BE HED THE WEDIMBERATHE THETHAND TH WHAST THEVE WAND THADOUTHAN IND HAND THEW I WAWANTOWAND IDRINTHED AVER DEDY DYONDYOR BEACKED THEDE ANTHEDOND THOUTHEWATHE WETHADY HEREADED THEAND WEREATHED THADED THENDY THERED THENDY THANOWAND THE ADE MY HATHE WERED ID YOUTHEAVER DEATHEAD SWAWAD ME WAVED ATHED WOMY YOUT THE WAVED TH THEMBE YOUTHED THENDY DEDED DIMY OUTHEATHAN WATHE HEDELLAVED DEVERID WEVED MY WATHE STHATHE DEDWEMY HEDITHEAT DEDWEMY SWAST HEMYOWATHAN SWADDED DEDWEMY IND ATHER THOUTHEWATHE WETHEZZZED THAT HAND EAT INT BEDE THERE HEDERSTHAD DEDINJUT STHEMOUTHE THERINDE AD THAD TH BE EVEDENGED BE DEYOREDWATHAN THEWATHAN IND THE DEMYOND MY BOMEMOUTHE DOVERYOW

EM iteration 4
log (P(cipher)) -10603.6015111
YOWE NTHEMOUTHE THEATHED MY WHEA DEMYOND WACAD ME THE WANDENOND HEROFOUTHTHE IND REDIZZZE THEDOTHAND HE THE SATE WEADYOF BEROND AT WAD IZZZZEMERE THOUTHT THAT THE WAVEROWE MY WHEA HEROFOUTHED WAD DEVENDENT ME I YOWARE DEATHANDWORE DESTEW BADED ME THAD WETHAD THE HECATHEDAD MY THAD NTHOUSTHAN WAD IDVINGED BE ARITHE Y THAD HE YOWHEAR THAD NTHOUSTHAN IDYOWATHAND ARE IDSATHATED WATH ERMYOME ANTHEDOVE HEROFOUTHTHE IND WAVINEA ORIDY WATHEWATOMEWARE RERENT HEVESTHEATHAND HAVE THABE I WAWANOWATED VITHEMY MY ANTHEDOVE HEROFOUTHTHE WETHEZZZED ATHEAVED BE THE WHEA THANTHEAND THE HATH WATHEATHAN MY THE WEADYOF WHEA THEATHED WADERE INTHIEMEMOUSTY NOW WAWANGHEND THE WATHASTOWATED ANTHEDOVE IND COMYOFTOVE HEROFOUTHTHE WETHEZZZED MY THE INTHENT WHEA IND DEVERID MY THE WHEA HEROFOUTHTHE WETHADY HAVE EAT INT BEDE RECOMYOWED ANTHEDOVE HEROFOUTHTHE WETHADY BERE DEVERAVED IND ATHEAVED BE IND THE WEDIMBEROTHE THETORED TH BLAST THEVE WAND COMYOFTHAN IND HAVE THEW I WAWANTOWAVE IDVINTHED AVER REDY DYOURYOR BEACKED THEDE ANTHEDOVE HEROFOUTHTHE WETHADY ANGEADED THEAND WEREATHER THADED YONEDY CADOND YONEDY THANOWAID THE ADE MY HOWAN YERED ID YEXTHEAVER DEATHEAD SWAWAD ME BAVED OFOND WOMY YOUT THE BAVED TH THEATE YEXTHED YONEDY DADED DIMY OUTHEATHAN WATER REDELLLOND DEVERID WEVED MY WATER STHATHE DESTEMY HEDOFOROF DESTEMY SWACT REMYOWATHAN SWADDEN DESTEMY IND ATHER HEROFOUTHTHE WETHEZZZED THAT HAVE EAT INT BEDE YOURE HEDERSTHAD DESTEWAT NTHEMOUTHE THERINDE AD THAD TH BE EVEDENGED BE DEYOREDWATHAN THEWATHAN IND THE DEMYOND MY BOMEMOUTHE DOVERYOW

EM iteration 5
log (P(cipher)) -9984.09878981
SMBE ITHEMOUTHE THEATHED MY WHEA DEMYONE YOFOD ME THE WANDENONG ALLOFOUTORIN IND REDIOUTE WANDOTHAND AN THE SATE CKIDYOF BEROND AT WAD IZZZZEANDE THAITHT THAT THE WAVAROWE MY WHEA ALLOFOUTORE WAD DEVENDENT ME I YOWARE DEATHANDWORE DESTEW BADED ME THAD WETHAD THE HECATHEDAD MY THAN ITHAISTHAN WAD IDVINGED BE ARITHE Y WAMY AN YOWORAR THAN ITHAISTHAN

IDYOWATHAND ARE IDSATHATED WATH ERMYOME ANTENDOVE ALLOFOUTORIN IND SAVINEA ORIDY WAMBETOTOMEWARE RERENT HEVESTHEATHAND HAVE THABE I WAWANOWATED VITHETE MY ANTENDOVE ALLOFOUTORIN TETHEXTHED ATHEAVED BE THE WHEA NOVEAINONG THE HATH CACHEATHAN MY THE CKIDYOF WHEA CANOTHED WADERE INTHIEMEMOUSTY NOW WAWAREHEND THE SACHASTOWATED ANTENDOVE IND BLADOFTOVE ALLOFOUTORIN TETHEXTHED MY THE INTHENT WHEA IND DEVERIN MY THE WHEA ALLOFOUTORIN WETHADY HAVE EAT YET BEEN REPLADOFED ANTENDOVE ALLOFOUTORIN WETHADY BERE DEVERAVED IND ATHEAVED BE IND THE WEDAIMEROWAN TOUTORED TH BLAST THEAR WAND BLADOFTHAN IND TOVE THEW I WAMBETOWAVE IDVINTHED AVER REDY DYOURYOR BEACKED THEDE ANTENDOVE ALLOFOUTORIN WETHADY ANGEADED THEAND TELLACONG THADED YONEDY LADRED YONEDY THANOWAID THE ADE MY HOWAN YERED ID YEXTHEAVER DEASANIN SWAWAD AR BAVID OFONG WOMY YOUT THE BAVID TH TREATE YEXTORE YONEDY DOKED DIMY OUROUATHAN WATER REDERVLORD DEVERIN TEVED MY WATER STHEALE DESTEMY HEDRIOROF DESTEMY SWAWA REREAWATHAN SWADDEN DESTEMY IND ATHER ALLOFOUTORIN TETHEXTHED THAT HAVE EAT YET BEEN YOURE ONDERSTHAD DESTEWAT ITHEMOUTHE THERALDE AD THAD TH BE EVEDENGED BE DEYORESTITHAN YOUTITHAN IND THE DEMYONE MY BOMEMOUTHE DOVERYOW

Q11. Best decoding from last iteration is :

SAME ECALACOFIK THEAROUS AY MALI DEFLONE BACOS AN THE WARSENONG IGROFOUTORIK IND RESOORCE FANDITHANS IN THE LATE FLASSOF PEROAD IT WAS ARICONALLL THANGHT THAT THE MACARITE AY MALI IGROFOUTORE WAS DEPENDENT AN I SOMPLE SKISHANDWORN SESTEM WASED AN THIS METHAD THE HEPATHESIS AY SAIK UTHIOSTHAN WAS IDVINCED BE ARITAR Y FLAK IN SOMOLAR SAIK UTHIOSTHAN ASSOMPTHANS ARE ASSACHATED WITH ERASHAN INTENSOVE IGROFOUTORIK IND SAVINNI GRISS FAMBUTOTHANJARE REFENT INVESTIGATHANS HAVE SHAWN I FAMPLOFITED VIROUTE AY INTENSOVE IGROFOUTORIK TECHNOFOUS OTOKIZED BE THE MALI EXPLAINONG THE HIGH PAPOKITHAN AY THE FLASSOF MALI PALOTOUS MADERN ARCHIEALACOSTS NAW FAMPREHEND THE SAPHISTOFITED INTENSOVE IND PRADOFTOVE IGROFOUTORIK TECHNOFOUS AY THE INCOUNT MALI IND SEVERIK AY THE MALI IGROFOUTORIK METHADS HAVE NAT QUT BEEN REPRADOFED INTENSOVE IGROFOUTORIK METHADS WERE DEVELAPED IND OTOKIZED BE ALL THE MESAIMEROFIN FOUTORES TA BLAST THEOR YEAD PRADOFTHAN IND COVE THEM I FAMBUTOTOVE IDVINTIGE AVER LESS SKILLYOK PEAPLES THESE INTENSOVE IGROFOUTORIK METHADS INFLODED FINIKS TERRIFONG RAISED YOULDS RIDGED YOULDS CHINIMPAS THE OSE AY HOMAN YEFES AS YERTOKIZER SEASANIK SWAMPS AR WACAS OSONG MOCK BRAM THE WACAS TA FREATE YERTOKE YOULDS DOKES DIMY ORRIGATHAN WATER RESERVAIRS SEVERIK TEPES AY WATER STARIGE SESTEMY HEDRIOLOF SESTEMY SWAMP RECKIMATHAN SWIDDEN SESTEMY IND ATHER IGROFOUTORIK TECHNOFOUS THAT HAVE NAT QUT BEEN YOLLL ONDERSTALD SESTEMOF ECALACOFIK FALLAPSE IS SAID TA BE EVIDENCED BE DEYORESTITHAN SOUTITHAN IND THE DEFLONE AY WHALACOFIK DIVERSIT

Q12. The final substitution probabilities are:

e_i SPACE to c_i SPACE with probability 1.0
e_i A to c_i T with probability 0.481078532226
e_i A to c_i Z with probability 0.515143679568
e_i C to c_i C with probability 0.341839469589
e_i C to c_i Q with probability 0.575167598842
e_i C to c_i R with probability 0.0829929315687
e_i B to c_i A with probability 0.226127980864
e_i B to c_i N with probability 0.0460607560645
e_i B to c_i W with probability 0.159777011694
e_i B to c_i Y with probability 0.366566633559
e_i B to c_i X with probability 0.201467617819
e_i E to c_i L with probability 0.0975465481255
e_i E to c_i S with probability 0.816046327669
e_i E to c_i T with probability 0.0862361013311
e_i D to c_i B with probability 0.0196010851806
e_i D to c_i G with probability 0.0718061873663
e_i D to c_i M with probability 0.203203067993
e_i D to c_i W with probability 0.70538965946
e_i G to c_i C with probability 0.491220937041
e_i G to c_i I with probability 0.0776559833572
e_i G to c_i J with probability 0.351440943064
e_i G to c_i Q with probability 0.071971055882
e_i F to c_i C with probability 0.0348577846133
e_i F to c_i H with probability 0.103214023543
e_i F to c_i Q with probability 0.861898805185
e_i I to c_i E with probability 0.417781129215
e_i I to c_i U with probability 0.0431930684052
e_i I to c_i Z with probability 0.539025356963
e_i H to c_i E with probability 0.245266501739
e_i H to c_i D with probability 0.717092422815
e_i H to c_i T with probability 0.0366877791681
e_i K to c_i D with probability 0.187343918378
e_i K to c_i F with probability 0.123847638341
e_i K to c_i K with probability 0.0267713886865
e_i K to c_i V with probability 0.656825451652
e_i J to c_i B with probability 0.810708137138
e_i J to c_i W with probability 0.188631678217
e_i M to c_i B with probability 0.846491598827
e_i M to c_i I with probability 0.0123317597852
e_i M to c_i T with probability 0.1374821171
e_i L to c_i L with probability 0.173954468372
e_i L to c_i Q with probability 0.0463669338881
e_i L to c_i T with probability 0.101452032026
e_i L to c_i V with probability 0.678224758901

e_i O to c_i E with probability 0.513654508226
e_i O to c_i U with probability 0.375513478596
e_i O to c_i T with probability 0.110815032756
e_i N to c_i G with probability 0.764006493819
e_i N to c_i U with probability 0.022775831002
e_i N to c_i W with probability 0.0618020307041
e_i N to c_i V with probability 0.151415644475
e_i Q to c_i L with probability 0.882896971925
e_i Q to c_i N with probability 0.117103028075
e_i P to c_i M with probability 0.271744366984
e_i P to c_i Y with probability 0.728254218577
e_i S to c_i M with probability 1.0
e_i R to c_i N with probability 0.983680985823
e_i R to c_i Q with probability 0.0163131930988
e_i U to c_i S with probability 0.669381966467
e_i U to c_i T with probability 0.0462235777731
e_i U to c_i V with probability 0.28439445576
e_i T to c_i F with probability 0.0109795506173
e_i T to c_i J with probability 0.958108910459
e_i T to c_i O with probability 0.0193124249468
e_i T to c_i Y with probability 0.011599113977
e_i W to c_i A with probability 0.186571067098
e_i W to c_i G with probability 0.0712936072597
e_i W to c_i I with probability 0.021690220344
e_i W to c_i K with probability 0.374165710345
e_i W to c_i M with probability 0.127832085783
e_i W to c_i N with probability 0.029225409794
e_i W to c_i Q with probability 0.116339751497
e_i W to c_i X with probability 0.0664466963578
e_i V to c_i I with probability 0.98825932333
e_i V to c_i P with probability 0.0117406766702
e_i Y to c_i A with probability 0.0230632722317
e_i Y to c_i F with probability 0.0217423110683
e_i Y to c_i M with probability 0.400808910605
e_i Y to c_i Y with probability 0.0393428664952
e_i Y to c_i X with probability 0.515041641596
e_i X to c_i M with probability 0.68566203796
e_i X to c_i O with probability 0.31433796204
e_i Z to c_i E with probability 0.0295542889186
e_i Z to c_i P with probability 0.970445711081