

# Exercises: Frequency Analysis

## Spreadsheet Exercise

In this section you will use a spreadsheet to aid you in conducting frequency analysis. To begin with download the spreadsheet `01b-frequency_analysis.xlsx`. You may want to look into the cells and see what functions are being used - some of them will have been used in the Caesar cipher spreadsheet and will be used in future weeks.

1. There is a piece of ciphertext in Cell B1. In Row 3, the individual ciphertext letters have been split up into separate boxes so that we can correct them back to plaintext.
2. In Rows 8-10, we can see the relative frequencies of letters that we would normally expect in the English language (Row 8), along with the relative frequencies of letters in the ciphertext (Row 10). Below this there is also a chart showing the relative frequencies side-by-side.
3. Use your knowledge from the lecture about frequencies of letters and common word/letter patterns to try and decipher this piece of ciphertext. To do this, enter guesses of how each letter have been encrypted in Row 14. It can be helpful to put capital letters in this row to distinguish them from plaintext letters. E.g., if you guess that the letter 'm' has been encrypted as 'Q', then underneath 'm' in Row 13, enter a 'Q' in Row 14.
4. Identify the source of the text.

The original ciphertext is given below to help find patterns in the text: FL  
TEI TFKI MS EDQUL IQ QDREFN TEIQI WDR FL ADCENDN D QFBE KIQBEDLT LDKIN  
RFLNADN TEI RDFJMQ TEI RMUQBI MS WEMRI WIDJTE WDR D KYRTIQY FT RIIKIN  
TM AI FLIXEDURTFAJI SMQ JMLC RIDRMLR EI HIOT MOIL EMURI DLN EFR ILTIQTDFLKILTR  
WIQI TEI KMRT KDCLFSFBILT MS DJJ RDVI MLJY TEMRI MS IQ QDREFN EFKRIJS  
DJJ TEDT QFBEIR BMUJN AUY RIIKIN DT EFR NFROMRDJ DLN EI JDFVREIN TEI  
CMMN TEFLCR MS TEFR JFSI UOML EFR CUIRTR ODCIR RJDVIR DLN DTTILNDLTR  
TEIQI WIQI FL CQIDT LUKAIQ EFR CDQNIL WDR RODBFMUR DLN AIDUTFSUJ DLN  
EFR EMURI WDR SFJJIN WFTE IVIQY BMRTJY JUXUQY  
TEFR RFLNADN TEI RDFJMQ EDR D RTMQY TM TIJJ TEI RTMQY MS EFR JFSI AUT  
EI LIVIQ TMJN FT TM DLY ULTFJ MLI NDY TEIQI BDKI TM EFK MLI RFLNADN  
TEI JDLNRKDL D KDL MS OMMQ DLN EUKAJI AFQTE TEFR KDL OJIDRIN EFK CQIDTJY

WFTE DL DOT QIBFTDTFML NIDJFLC WFTE TEI WFNJY NFSSIQILT JMTR NFROILRIN  
 AY CMN TM KIL DLN AIFLC OJIDRIN EI WDR RTQUBH WFTE TEI EDOOY BMLBIFT  
 TEDT LMW RFLNADN TEI RDFJMQ WDR DT JDRT BMLSQMLTIN WFTE RFLNADN TEI  
 JDLNRKDL FT WMUJN AI LM ADN TEFLC WIQI EI TM LDQQDTI TEI RTMQY MS EFR  
 JFSI RM TEDT DJJ KFCET HLMW EFR RTQDLCI DNVILTUQIR DLN BMLGIBTUQI LM  
 JMLCIQ DR TM TEI RMUQBI MS EFR SDAUJMUR WIDJTE  
 DBBMQNFLCJY RFLNADN TEI RDFJMQ EIJN RIVIL QIBIOTFMLR ML RIVIL NFSSIQILT  
 NDYR DLN DJTEMUCE ML IDBE MBBDRFML D KUJTFTUNI MS CUIRTR WDR DRRIKAJIN  
 TM JFRTIL EI SDFJIN LMT TM DNNQIRR EFR WMQNR SQMK SFQRT TM JDRT TM  
 EFR RFKOJI JFRTILIQ RFLNADN TEI JDLNRKDL SMJMWFLC FR EFR LDQQDTFML  
 MS TEI RTQDLCI DLN WMLNIQSUI DNVILTUQIR EI IXOIQFILBIN FL EFR RIVIL  
 VMYDCIR

## Exercises

1. The following message has been encrypted using a monoalphabetic cipher.  
 Using your frequency analysis spreadsheet, break the code and read the message. Then identify the source of the text.  
 VANA GH OPNRGTANO PH DHUA XHQ BGHV PLA NQDAO RGK OH KH E KH E  
 R SQDD CHFFEPFAGPO VLRP EF PLEGBEGT HS XHQ VHQDKGP TAP PLEO SNHF  
 RGX HPLAN TQX E YQOP VRGGR PADD XHQ LHV EF SAADEGT THPPR FRBA  
 XHQ QGKANOPRGK GAUAN THGGR TEUA XHQ QJ GAUAN THGGR DAP XHQ KHV  
 GAUAN THGGR NQG RNHQGK RGK KAOANP XHQ GAUAN THGGR FRBA XHQ CNX  
 GAUAN THGGR ORX THHKIXA GAUAN THGGR PADD R DEA RGK LQNP XHQ VAUA  
 BGHVG ARCL HPLAN SHN OH DHGT XHQ LARNPO IAAG RCLEGT IQP XHQNA  
 PHH OLX PH ORX EP ORX EP EGOEKA VA IHPL BGHV VLRPO IAAG THEGT  
 HG THEGT HG  
 VA BGHV PLA TRFA RGK VANA THGGR JDRX EP RGK ES XHQ ROB FA LHV  
 EF SAADEGT KHGP PADD FA XHQNA PHH IDEGK PH OAA GAUAN THGGR TEUA  
 XHQ QJ GAUAN THGGR DAP XHQ KHV GAUAN THGGR NQG RNHQGK RGK KAOANP  
 XHQ GAUAN THGGR FRBA XHQ CNX GAUAN THGGR ORX THHKIXA GAUAN THGGR  
 PADD R DEA RGK LQNP XHQ GAUAN THGGR TEUA XHQ QJ GAUAN THGGR DAP  
 XHQ KHV GAUAN THGGR NQG RNHQGK RGK KAOANP XHQ GAUAN THGGR FRBA  
 XHQ CNX GAUAN THGGR ORX THHKIXA GAUAN THGGR PADD R DEA RGK LQNP  
 XHQ VAUA BGHVG ARCL HPLAN SHN OH DHGT XHQ LARNPO IAAG RCLEGT  
 IQP XHQNA PHH OLX PH ORX EP PH ORX EP
2. The following message has been encrypted using a monoalphabetic cipher.  
 Using your frequency analysis spreadsheet, break the code and read the message. Then identify the source of the text.  
 ND IW DZ GDN ND IW NTLN HF NTW MUWFNHDG KTWNTWZ NHF GDISWZ HG  
 NTW AHGR ND FUVVWZ NTW FSHGXF LGR LZZDKF DV DUNZLXWDUF VDZNUGW  
 DZ ND NLJW LZAF LXLHGFN L FWL DV NZDUISWF LGR IB DQQDFHGX WGR  
 NTWA ND RHW ND FSWWQ GD ADZW LGR IB L FSWWQ ND FLB KW WGR NTW  
 TWLZNLPTW LGR NTW NTUFLGR GLNUZLS FTDPIJF NTLN VSWFT HF TWHZ ND  
 HN HF L PDGFUAALNHDG RWEDUNSB ND IW KHFTWR ND RHW ND FSWWQ ND  
 FSWWQ QWZPTLGPW ND RZWLA LB NTWZWF NTW ZUI VDZ HG NTLN FSWWQ DV  
 RWLNT KTLN RZWLA ALB PDAW KTWG KW TLEW FTUVVSWR DVV NTHF ADZNLS  
 PDHS AUFN XHEW UF QLUFW NTWZWF NTW ZWFQWPN NTLN ALJWF PLSLAHNB  
 DV FD SDGX SHVW VDZ KTD KDUSR IWLZ NTW KTHQF LGR FPDZGF DV NHAU

NTW DQQZWFFDZF KZDGX NTW QZDUR ALGF PDGNUAWSB NTW QLGXF DV RWFQHFWR  
 SDEW NTW SLKF RWSLB NTW HGFDSWGPW DV DVVHPW LGR NTW FQUZGF NTLN  
 QLNHWGN AWZHN DV NTW UGKDZNTB NLJWF KTWG TW THAFWSV AHXTN THF  
 MUHWNUF ALJW KHNT L ILZW IDRJHG KTD KDUSR VLZRWSF IWLZ ND XZUGN  
 LGR FKWLN UGRWZ L KWLZB SHVW IUN NTLN NTW RZWLR DV FDAWNTHGX LVNWZ  
 RWLNT NTW UGRHFPDEWZWR PDUGNZB VZDA KTDFW IDUZG GD NZLEWSSWZ ZWNUZGF  
 QUOOSWF NTW KHSS LGR ALJWF UF ZLNTWZ IWLZ NTDFW HSSF KW TLEW NTLG  
 VSB ND DNTWZF NTLN KW JGDK GDN DV NTUF PDGFPHWGPW RDWF ALJW PDKLZRF  
 DV UF LSS LGR NTUF NTW GLNHEW TUW DV ZWFDSUNHDG HF FHPJSHWR DEWZ  
 KHNT NTW QLSW PLFN DV NTDUXTN

3. The following message has been encrypted using a monoalphabetic cipher. Using your frequency analysis spreadsheet, break the code and read the message. Then identify the source of the text.

ZVGXSEZVPKQTIJXTIVJTCPXKOQKVUFZISXS  
 UQSPQSXSZVPGXXJIPJZIALXJXKZTHKIHTVSPTVPIKIV  
 LMZVTQSEJZIAQQWQVSPVOKXSJZIUXALVLCCLIEVLPXS  
 EJLVSKCUGVSXVXJZVPKJLHMWTIJZVJKQTIQRLIWSQFU  
 IPEIQRJZIMQHSJLCMQHUPZVLPUCRVXUJQZVGIKQTIXT  
 OQLJVS MIXSPIVUXSEFXJZVSQAUITVSQRJZVJMQHSJLC  
 XRXSPJZVJJZIPXKJLXMJZISVTIPXKXSJZIIDLITIIIV  
 KJQRJZIMQHSJLCYHKJQSJZIAQLPILKQRJZLIKJVIK  
 JLVSKCUGVSXVTQUPVGXVVS PAHWQGXSVXSJZITXPKJQR  
 JZIMVLOVJZXVSTQHSJVSXKQSIQRJZIFXUPIKJVSPUIV  
 KJWSQFSOQLJXQSKQRIHLQOIXFVKSQJVAUIJQUXEZJQS  
 VSCTVOQLFLWEXGXSEJZIIDVMJUQMVUXJCQRJZIMVKJ  
 UIPLVMHUVVKJZILIVLISQTVOKQRJZXKMQHSJLCVKCIJ  
 JQMTOVLIFXJZQHLQFSQLPSVSMIKHLGICTVOKAHJXRQ  
 HSPJZVJAXKJLXJBZIOQKJJQFSSVTIPACMQHSJPLVMH  
 UVXKVRVXLUCFIUWSQFSOUVMIXKZVUUISJILZILIKQT  
 IQRTCSQJIKVKJZICTVCLIRLIKZTCTITQLCFZISXJVUW  
 QGILTCJLVGIUKFXJZTXSV