Cipher Text 3

Having solved all the other encryptions first I have determined by process of elimination this one is the stream cipher. I tried various arrangements of a possible stream relating to character n-1, shifting based on either the potential plaintext or ciphertext value. I also tried varying the shift of the first letter, a shift of 26-(n-1). None of the methods which I tried broke the ciphertext into any readable English.

Cipher Text 8

Cipher for this text is Vigenère with a key of "APP". To decrypt this text, I applied a test for the shift and permutation ciphers, neither of which resulted in a likely candidate. Testing the text for repeated sequences indicated groupings of repeated trigrams with intervals of 9, 15 and 21 between repeats.

```
Index of repeat  AOT in ciphertext: 693
Index of repeat  AOT in ciphertext: 714
Index of repeat  AOT in ciphertext: 723
Index of repeat  ZPZ in ciphertext: 703
Index of repeat  ZPZ in ciphertext: 730
Index of repeat  PZT in ciphertext: 704
Index of repeat  PZT in ciphertext: 731
Index of repeat  PIS in ciphertext: 709
Index of repeat  PIS in ciphertext: 718
Index of repeat  SJZ in ciphertext: 711
Index of repeat  SJZ in ciphertext: 720
Index of repeat  JZA in ciphertext: 712
Index of repeat  JZA in ciphertext: 721
```

The common denominator between these is 3, so I grouped the letters into every third letter, looked at the letter frequencies.

{'A': 9.35, 'B': 1.27, 'C': 3.09, 'D': 3.33, 'E': 13.23, 'F': 2.3, 'G': 1.43, 'H': 5.07, 'I': 5.55, 'J': 1.11, 'K': 0.87, 'L': 3.01, 'M': 3.09, 'N': 7.37, 'O': 7.77, 'P': 1.82, 'Q': 0.16, 'R': 6.26, 'S': 6.42, 'T': 8.08, 'U': 3.8, 'V': 1.74, 'W': 1.58, 'X': 0.4, 'Y': 1.66, 'Z': 0.24}

{'A': 2.61, 'B': 2.54, 'C': 6.97, 'D': 8.32, 'E': 1.51, 'F': 0.0, 'G': 7.37, 'H': 6.34, 'I': 8.4, 'J': 3.8, 'K': 0.79, 'L': 1.58, 'M': 0.32, 'N': 1.82, 'O': 0.24, 'P': 9.83, 'Q': 1.51, 'R': 2.54, 'S': 4.83, 'T': 12.36, 'U': 1.9, 'V': 2.22, 'W': 4.6, 'X': 6.1, 'Y': 0.79, 'Z': 0.71}

{'A': 3.57, 'B': 1.98, 'C': 7.45, 'D': 5.87, 'E': 2.38, 'F': 0.16, 'G': 8.41, 'H': 6.03, 'I': 9.12, 'J': 2.3, 'K': 1.03, 'L': 1.27, 'M': 0.24, 'N': 1.51, 'O': 0.08, 'P': 9.6, 'Q': 1.51, 'R': 2.62, 'S': 6.19, 'T': 12.85, 'U': 1.9, 'V': 1.67, 'W': 4.52, 'X': 6.03, 'Y': 0.32, 'Z': 1.43}

I applied the appropriate shift to align with English letter frequencies. By looking for a frequency between 8 and 10 followed by a frequency between 10 and 13 five spaces later I found

potential key letters. In this case, the first grouping aligned with English, so a shift of 0(A), and the other two groups had similar frequencies peaking on the shifted “T”, so a shift of -14 (P) to revert to plaintext was applied. The resulting text clearly describes a Japanese amphibious assault on Java.

thejapaneseamphibiousforcesgatheredtostrikeatjavaandonfebruarythemainamericanbritish
dutchaustraliancommandabdacomnavalforceunderdoormansailednortheastfromsurabayato
interceptaconvoyoftheeasterninvasionforceapproachingfromthemakassarstraittheabdaforc
econsistedoftwoheavycruisershmsexeterandusshoustonthreelightcruisershnlmsderuyterdo
ormansflagshiphnlmsjavahmasperthandninedestroyershmselectrahmsencounterhmsjupiter
hnlmskortenaerhnlmswittedewithussaldenussjohndedwardsussjohndfordandusspauljonest
hejapanesetaskforceprotectingtheconvoycommandedbyrearadmiraltakeotakagiconsistedof
twoheavynachiandhaguroandtwolightcruisersnakaandjintsuanddestroyersyudachisamidar
emurasameharusameminegumoasagumoyukikazetokitsukazeamatsukazehatsukazeyamak
azekawakazesazanamiandushioincludingthethdestroyersquadronunderthecommandofrear
admiralshojinishimurathejapaneseheavycruisersweremuchmorepowerfularmedwithtenin
mmgunseachandsuperbtorpedoesbycomparisonexeterwasarmedonlywithsixinmmgunswhi
lehoustoncarriednineinmmgunsonlysixremainedoperableafterheraftturrethadbeenknocked
outinanearlierairattacktheabdaforceengagedthejapaneseinthejavaseaandthebattleragedinte
rmittentlyfrommidafternoontomidnightastheallestriedtoreachandattackthetrooptransports
ofthejavainvasionfleetbuttheywererepulsedbysuperiorfirepowertheallieshadlocalairsuperi
orityduringthedaylighthoursbecausejapaneseairpowercouldnotreachthefleetinthebadweath
ertheweatheralsohinderedcommunicationsmakingcooperationbetweenthemanyalliedpartie
sinvolvedinreconnaissanceaircoverandfleetheadquartersevenworsethanitalreadywasthejap
anesealsojammedtheradiofrequenciesexeterwastheonlyshipinthebattleequippedwithradara
nemergingtechnologyatthetimethebattleconsistedofaseriesofattemptsoverasevenhourperio
dbydoormanscombinedstrikingforcetoreachandattacktheinvasionconvoyeachwasrebuffed
bytheescortforcewithheavylossesbeinginflictedontheallies thefleetssightedeachotheratabou
tonfebruaryandclosedtofiringrangeopeningfireatbothsidesexhibitedpoorgunneryandtorped
oskillsduringthisphaseofthebattledespiteherrecentrefitwiththeadditionofmoderntypeguner
ycontrolradarexetersgunfiredidnotcomeclosetothejapaneseshipswhilehoustononlymanage
dtoachieveastraddleononeoftheopposingcruiserstheonlynotableresultofthegunneryexchan
gewasexeterbeingcriticallydamagedbyahitintheboilerroomfromaninmmshelltheshipthenli
mpedawaytosurabayaescortedbywittedewiththejapaneselaunchedtwohugetorpedosalvoesi
nallbutscoredonlyonehitonkortenaershewasstruckbyalonglancebrokeintwoandsankrapidly
afterthehitelectracoveringexeterengagedinaduelwithjintsuandasagumoscoringseveralhitsb
utsufferingseveredamagetohersuperstructureafteraseriousfirestartedonelectraandherremai
ningturretranoutofammunitionabandonshipwasorderedonthejapanesesideonlyasagumowas
forcedtoretirebecauseofdamagethealliedfleetbrokeoffandturnedawayaroundcoveredbyasm
okescreenlaidbythefourdestroyersofusdestroyerdivisiondesdivtheyalsolaunchedatorpedoat
tackbutattoolongarangetobeeffectivedoormansforceturnedsouthtowardthejavacoastthenwe

standnorthasnightfellinanattempttoevadethejapaneseescortgroupandfallontheconvoyitwas
atthispointtheshipsofdesdivtheirtorpedoesexpendedleftontheirowninitiativetoreturntosura
bayashortlyafteratjupiterranontoamineandwassunkwhileaboutminuteslaterthefleetpassedw
herekortenaerhadsunkearlierandencounterwasdetachedtopickupsurvivorsdoormanscomma
ndnowreducedtofourcruisersagainencounteredthejapaneseescortgroupatbothcolumnsexch
angedfireinthedarknessatlongrangeuntilderuyterandjavaweresunkbyonedevastatingtorped
osalvodoormanandmostofhiscrewwentdownwithderuyteronlyweresavedfrombothshipsonl
ythecruisersperthandhoustonremainedlowonfuelandammunitionandfollowingdoormanslas
tinstructionsthetwoshipsretiredarrivingattanjungpriokonfebruaryalthoughthealliedfleetdid
notreachtheinvasionfleetthebattledidgivethedefendersofjavaaonedayrespite

Cipher Text 13

The cipher for text 8 is the shift method with a key of 14.

To aid in decryption the text was ran through a python script to provide the frequency of each letter occurring in the cipher text. As the result was close to a normal distribution of English texts with mismatched letters, the text was decrypted through a shifting algorithm for all 25 key possibilities with correction for wrapping outside the normal alphabet ASCII range.

atlexingtonscxamradardetectedtheinboundjapaneseaircraftatarangeofnmimikmandvectore
dninewildcatstointerceptexpectingthejapanesetorpedobomberstobeatamuchloweraltitudet
hantheyactuallyweresixofthewildcatswerestationedtoolowandthusmissedthejapaneseaircra
ftastheypassedbyoverheadbecauseoftheheavylossesinaircraftsufferedthenightbeforethejap
anesecouldnotexecuteafulltorpedoattackonbothcarrierslieutenantcommandershigekazushi
mazakicommandingthejapanesetorpedoplanessenttoattacklexingtonandfourtoattackyorkto
wnawildcatshotdownoneandpatrollingyorktownsbdsdestroyedthreemoreasthejapanesetorp
edoplanesdescendedtotakeattackpositionfoursbdswereshotdownbyzerosescortingthetorpe
doplanesthejapaneseattackbeganatasthecarriersstationedydmapartandtheirescortsopenedfi
rewithantiaircraftgunsthefourtorpedoplaneswhichattackedyorktownallmissedtheremaining
torpedoplanessuccessfullyemployedapincerattackonlexingtonwhichhadamuchlargerturnin
gradiusthanyorktownandathitherwithtwotypetorpedoesthefirsttorpedobuckledtheportaviati
ongasolinestowagetanksundetectedgasolinevaporsspreadintosurroundingcompartmentsthe
secondtorpedorupturedtheportwatermainreducingwaterpressuretothethreeforwardfireroom
sandforcingtheassociatedboilerstobeshutdowntheshiphowevercouldstillmakeknmphkmhw
ithherremainingboilersfourofthejapanesetorpedoplaneswereshotdownbyantiaircraftfirethej
apanesedivebomberscircledtoattackfromupwindandthusdidnotbegintheirdivesfromftmunti
lthreetofourminutesafterthetorpedoplanesbegantheirattackstheshkakudivebombersunderta
kahashilineduponlexingtonwhiletheremainingdirectedbytamotsuematargetedyorktownesc
ortingzerosshieldedtakahashisaircraftfromfourlexingtoncapwildcatswhichattemptedtointer
venebuttwowildcatscirclingaboveyorktownwereabletodisruptemasformationtakahashisbo
mbersdamagedlexingtonwithtwobombhitsandseveralnearmissescausingfireswhichwereco
ntainedbyatyorktownwashitinthecenterofherflightdeckbyasinglekglbsemiarmorpiercingbo
mbwhichpenetratedfourdecksbeforeexplodingcausingseverestructuraldamagetoanaviation
storageroomandkillingorseriouslywoundingmenuptonearmissesdamagedyorktownshullbel
owthewaterlinetwoofthedivebomberswereshotdownbyacapwildcatduringtheattackasthejap
aneseaircraftcompletedtheirattacksandbegantowithdrawbelievingthattheyinflictedfatalda
magetobothcarrierstheyranagauntletofcapwildcatsandsbdsintheensuingaerialduelsthreesbd
sandthreewildcatsfortheusandthreetorpedobombersonedivebomberandonezeroforthejapan
eseweredownedbytheusandjapanesestrikegroupswereontheirwaybacktotheirrespectivecarr
iersduringtheirreturnaircraftfromthetwoadversariespassedeachotherintheairresultinginmor
eairtoairaltercationskannosandtakahashisaircraftwereshotdownkillingbothofthemrecovery
reassessmentandretreateditsourceeditbetathestrikeforceswithmanydamagedaircraftreached

andlandedontheirrespectivecarriersbetweenandinspiteofdamageyorktownandlexingtonwer
ebothabletorecoveraircraftfromtheirreturningairgroupsduringrecoveryoperationsforvariou
sreasonstheuslostanadditionalfivesbdstwotbdsandawildcatandthejapaneselosttwozerosfive
divebombersandonetorpedoplanefortysixoftheoriginalaircraftfromthejapanesestrikeforcer
eturnedfromthemissionandlandedonzuikakuofthesethreemorezerosfourdivebombersandfiv
etorpedoplaneswerejudgeddamagedbeyondrepairandwereimmediatelyjettisonedintotheoc
eanastfrecovereditsaircraftfletcherassessedthesituationthereturningaviatorsreportedtheyhe
avilydamagedonecarrierbutthatanotherhadescapeddamagefletchernotedthatbothhiscarriers
werehurtandthathisairgroupshadsufferedhighfighterlossesfuelwasalsoaconcernduetothelos
sofneoshoatfitchnotifiedfletcherthathehadreportsoftwoundamagedjapanesecarriersandthat
thiswassupportedbyradiointerceptsbelievingthathefacedoverwhelmingjapanesecarriersupe
riorityfletcherelectedtowithdrawtffromthebattlefletcherradioedmacarthurtheapproximatep
ositionofthejapanesecarriersandsuggestedthatheattackwithhislandbasedbombersaroundhar
ainformedtakagithatonlyzeroseightdivebombersandfourtorpedoplanesfromthecarrierswere
currentlyoperationaltakagiwasworriedabouthisshipsfuellevelshiscruiserswereatandsomeof
hisdestroyerswereaslowasattakaginotifiedinouehisfliershadsunktwoamericancarriersyorkt
ownandasaratogaclassbutheavylossesinaircraftmeanthecouldnotcontinuetoprovideaircove
rfortheinvasioninouewhosereconnaissanceaircraftsightedcracesshipsearlierthatdayrecalled
theinvasionconvoytorabaulpostponedmotojulyandorderedhisforcestoassemblenortheastoft
hesolomonstobegintheryoperationzuikakuandherescortsturnedtowardsrabaulwhileshkaku
headedforjapan

Cipher Text 18

Transform, 10 rows by 8 columns permutation cipher. To decrypt this text, I built a test sentence – "THEQUICKBROWNFOXJUMPSOVERTHELAZYDOG". I then encrypted the text by hand and devised an algorithm to return the text to its plaintext state. I then applied a loop to run through each possible combination of transform from 2x2 and up, as anything smaller than a 2x2 is trivial to recognize a pattern by hand. Applying the algorithm and testing for multiple English words present in the results indicated either a 10x4 or 10x8 transform. The 10 row by 8 column transform was the only one that was not still garbled in some way.

intheindianoceanraidofmarchaprilaircraftfromshkakualongwiththerestofkidobutaiattacked
colomboceylononaprilsinkingtwoshipsinharborandseverelydamagingsupportfacilitiestheta
skforcealsofoundandsanktworoyalnavyheavycruisershmscornwallanddorsetshireonthesam
edayaswellastheaircraftcarrierhmshermesonapriloffbatticaloathefifthcarrierdivisionwasthe
ndeployedtotruktosupportoperationmotheplannedcaptureofportmoresbyinnewguineadurin
gthisoperationshkakusaircrafthelpedsinktheamericanaircraftcarrierusslexingtonduringtheb
attleofthecoralseabutwasherselfseverelydamagedonmaybydivebombersfromussyorktowna
ndlexingtonwhichscoredthreebombhitsoneonthecarriersportbowonetostarboardattheforwa
rdendoftheflightdeckandonejustabafttheislandfiresbrokeoutbutwereeventuallycontainedan
dextinguishedtheresultingdamagerequiredshkakutoreturntojapanformajorrepairsonthejour
neybackthecarriershippedsomuchwaterthroughherdamagedbowshenearlycapsizedinheavy
seasmaintainingahighrateofspeedinordertoavoidacordonofamericansubmarinesouthunting
forhershearrivedatkureonmayandentereddrydockonjunerepairswerecompletedwithintenda
ysandalittleovertwoweekslateronjulyshewasformallyreassignedtostrikingforcerdfleetcarri
erdivisionthetimerequiredforrepairscombinedwiththeaircraftandaircrewlossesincurredbyh
erandzuikakukeptbothcarriersfromparticipatinginthebattleofmidwayfollowingherreturntof
rontlinedutybothshkakuandhersistershipzuikakuwiththeadditionofthelightcarrierzuihwerer
edesignatedasfirstcarrierdivisionandtookpartintwofurtherbattlesinthebattleoftheeasternsol
omonswheretheydamagedussenterpriseandthebattleofthesantacruzislandswheretheycrippl
edusshornethornetwasabandonedandlatersunkbyjapanesedestroyersmakigumoandakigum
obutshokakuwasinturndamagedbydivebombersofenterprisewhichthereforepreventedthebo
mbardmentofnearbyhendersonfieldandonceagainkeptheroutofactionformonthsleavingothe
rjapanesedefensiveoperationsinthepacificlackingsufficientairpoweratsantacruzonoctobers
hkakuwasagainseriouslydamagedtakingatleastthreeandpossiblyasmanyassixlbbombhitsfro
magroupoffifteendouglassbddivebomberslaunchedfromhornetwithamplewarningoftheinc
omingamericanstrikeshkakusaviationfuelmainstotheflightdeckandhangarshadbeendrained
downandshehadfewaircraftonboardatthetimeoftheattackasaresultnomajorfiresbrokeoutand
herseaworthinesswaspreservedherflightdeckandhangarshoweverwereleftinshamblesandsh
ewasunabletoconductfurtherairoperationsduringtheremainderofthebattleafterseveralmonth
sofrepairsandtrainingshkakunowunderthecommandofcaptainmatsubarahiroshiwasassigne
dinmaytoacounterattackagainstthealeutianislandsbuttheoperationwascancelledafterthealli

dvictoryatattufortherestofshewasbasedattrukthenreturnedtojapanformaintenancelateinthey
earinshkakuwasdeployedtothelinggaislandssouthofsingaporeonjuneshedepartedwiththemo
bilefleetforoperationagoacounterattackagainstalliedforcesinthemarianaislandsherstrikewa
vessufferedheavylossesfromuscombatairpatrolsandantiaircraftfirebutsomesurvivedandretu
rnedsafelytothecarrieroneofherdysuiseistrikegroupscomposedofveteransfromthecoralseaa
ndsantacruzengagementsbrokethroughandoneplaneallegedlystruckhomewithabombthatda
magedusssouthdakotabbandcausedmanycasualtiesbutthisgroupsufferedheavylossesthemse
lvesduringthebattleofthephilippineseashewasstruckatonjunebythreepossiblyfourtorpedoes
fromthesubmarineusscavallacommanderhermanjkosslerasshkakuhadbeenintheprocessofre
fuelingandrearmingaircraftandwasinanextremelyvulnerablepositionthetorpedoesstartedfir
esthatprovedimpossibletocontrolatanaerialbombexplodeddetonatingaviationfuelvaporswh
ichhadspreadthroughouttheshipabandonshipwasorderedbutbeforetheevacuationhadprogre
ssedveryfarshkakuabruptlytookonwaterforwardandsankquicklybowfirstatpositionnetaking
menwithherthelightcruiseryahagianddestroyersurakazewakatsukiandhatsuzukirescuedcapt
ainmatsubaraandmenie

Cipher Text 23

Transform, reversed by decrypting 8x3 column transformation results in an article about the USS Archerfish. This selection was decrypted with the same methods as Cipher Text 18.

archerfishwasreactivatedatnewlondoninjulyplacedbackincommissiononaugustandagainjoi
nedsubronatkeywestonjanuaryshegotunderwayforacruiseunderthetechnicalsupervisionoft
henavyhydrographicofficeonthisdeploymentshevisitedrecifebrazilandtrinidaduponcomple
tionofthatmissionsheprovidedservicesforthefleettrainingcommandsatkeywestandguantana
mobayinthistimeshealsoportrayedtheussseatigerinthemovieoperationpetticoatfortheunder
wateranddistancescenesandshotsonoctoberapproximatelymilessouthwestofkeywestoverve
stalshoalarcherfishbottomedatfeetmcommandergeorgefbondandchiefenginemancyriltuckf
ieldsafelycompletedasecondfootbuoyantascentfromtheforwardescapetrunkbothmenreceiv
edthelegionofmeritinforestablishingthefeasibilityofdeepsubmarineescapebylockingoutine
arlyarcherfishwaschosentoparticipateinoperationseascanascientificstudyofmarineweatherc
onditionswatercompositionoceandepthsandtemperaturerangessheenteredthephiladelphian
avalshipyardinjanuarytobespeciallyequippedforthisnewmissionduringthistimethevesselwa
sredesignatedanauxiliarysubmarinewithhullclassificationsymbolagssembarkingateamofci
vilianscientistsshecommencedthefirstphaseofseascanonmayonthecruisethesubmarinevisite
dportsmouthenglandhammerfestandbergennorwayfaslanescotlandthulegodthaabandjulian
ehabgreenlandbelfastnorthernirelandandhalifaxnovascotiabeforemooringatnewlondonond
ecemberaftersixweeksofupkeeparcherfishgotunderwayonjanuaryforthepacificphaseofseas
cantransitedthepanamacanalonfebruaryandproceededviasandiegotohawaiisheleftpearlharb

oronmarchduringheroperationsthesubmarinevisitedyokosukaandhakodatejapanhongkongs
ubicbayphilippinesbangkokthailandpenangmalayacolomboceylonandfremantleaustraliaan
dclosedoutmooredatyokosukaphasetwoofoperationseascancontinuedduringtheearlymonth
sofwithoperationsinthewesternpacificareaandportcallsatsasebojapanguamandcebucityphili
ppinesearlyinmarchthesubmarinecompletedphasetwoandproceededviapagopagotopearlhar
boronaprilsheenteredthesanfranciscoNavalshipyardforoverhaulaftercompletionofoverhault
hesubmarinemovedtosandiegoforatwoweekupkeepshethencommencedphasethreeofseasca
nintheeasternpacificareawithstopsinpearlharborandmidwayatollandreturnedtosandiegofort
hechristmasholidaysarcherfishdepartedsandiegoonjanuaryboundforyokosukawhereshebeg
anathreeweekupkeepperiodfollowingtwoandonehalfmonthsofoperationsshereturnedtotheu
nitedstatesforabriefvisittosanfranciscocaliforniabeforereenteringpearlharborearlyinmaylat
emayandmostofjuneweredevotedtosurveyingoffthenorthwestcoastoftheunitedstatesandcan
adawithportcallsinportlandoregonseattlewashingtonandvancouverbritishcolumbiathesubm
arinewasbackinyokosukafordrydockinginjulyandaugustbeforebeginningthreemonthsofcon
tinuoussurveyinginthemidpacificbrokenonlybybrieffuelingandupkeepstopsatmidwayandp
earlharborshedepartedyokosukaonnovemberforanextendedcruisetothesouthernhemisphere
arrivedinaustraliainmiddecemberandtookathreeweekholidayinnewcastleandsydneyfromth
elatterportarcherfishtraveledtoguamforatwoweekupkeepinlatejanuaryandfinallyreachedpe
arlharboronmarchdepartingpearlharboronmarchtheshipcontinuedseascanoperationsintheea
sternpacificshevisitedsanfranciscoinaprilandvancouverinmaybeforereturningtopearlharbor
onmayendingthethirdphaseofseascanarcherfishbegananextendedfourthandfinalphaseofope
rationseascanwhensheleftpearlharboronjuneandheadedfortheeasternpacificshemadeportca
llsduringjulyatseattleandolympiawashingtonandreturnedtopearlharboronaugustforathreew
eekupkeepanddrydockingbeforeundertakingacruisetothesouthpacificthesubmarinesailedo
nseptemberforthefijiislandsafterbrieflytouchingsuvasheheadedforaucklandnewzealandfor
andayvisithernextstopwaswellingtonnewzealandbutsheleftnewzealandonoctoberandarrive
dinyokosukaonnovembershegotunderwayagainonnovembertocontinuesurveyoperationsint
hecarolineislandsareaafterspendingnewyearseveinguamtheshipsailedforsubicbayphilippin
eswheresheclosedtheyearinupkeepahfhsaitreiwrcv

Cipher Text 28

Cipher for this text was Vigenère. A frequency analysis of the text resulted in letter frequencies ranging from ~2-4 and ~5-7. The change in letter frequency suggested either not an English alphabet or the use of a substitution cipher. Since we know the text is from English Wikipedia articles, the text must have been encrypted using a substitution cipher. To test if the text was Vigenère, I used a function to search the text for repeated letter sequences and the spacing between them.

```
Index of repeat  BYI in ciphertext: 506
Index of repeat  BYI in ciphertext: 530
Index of repeat  YIL in ciphertext: 507
Index of repeat  YIL in ciphertext: 531
Index of repeat  YJK in ciphertext: 536
Index of repeat  YJK in ciphertext: 738
Index of repeat  UXC in ciphertext: 544
Index of repeat  UXC in ciphertext: 651
Index of repeat  MGW in ciphertext: 569
Index of repeat  MGW in ciphertext: 852
Index of repeat  FTU in ciphertext: 608
Index of repeat  FTU in ciphertext: 672
Index of repeat  YXY in ciphertext: 630
Index of repeat  YXY in ciphertext: 736
Index of repeat  UYR in ciphertext: 648
Index of repeat  UYR in ciphertext: 824
Index of repeat  LNA in ciphertext: 691
Index of repeat  LNA in ciphertext: 952
Index of repeat  WNM in ciphertext: 727
Index of repeat  WNM in ciphertext: 783
Index of repeat  YRB in ciphertext: 825
Index of repeat  YRB in ciphertext: 857
Index of repeat  MKM in ciphertext: 888
```

Spacings for cipher text 28 were mostly 24 and 32 spaces apart. I decided to start testing for a key length of 2,4,8, or 16. By using a function to take each letter position in groupings of key length and performing a frequency analysis, a key length of 8 most closely matched English letter frequencies.

{'A': 8.2, 'B': 1.5, 'C': 2.8, 'D': 4.3, 'E': 13.0, 'F': 2.2, 'G': 2.0, 'H': 6.1, 'I': 7.0, 'J': 0.15, 'K': 0.77, 'L': 4.0, 'M': 2.4, 'N': 6.7, 'O': 7.5, 'P': 1.9, 'Q': 0.095, 'R': 6.0, 'S': 6.3, 'T': 9.1, 'U': 2.8, 'V': 0.98, 'W': 2.4, 'X': 0.15, 'Y': 2.0, 'Z': 0.074}

{'A': 1.04, 'B': 3.92, 'C': 6.27, 'D': 0.26, 'E': 1.57, 'F': 4.18, 'G': 2.61, 'H': 3.92, 'I': 7.31, 'J': 0.78, 'K': 0.52, 'L': 5.74, 'M': 7.05, 'N': 12.53, 'O': 1.83, 'P': 2.87, 'Q': 1.57, 'R': 0.0, 'S': 2.09, 'T': 0.0, 'U': 12.53, 'V': 2.09, 'W': 3.13, 'X': 3.66, 'Y': 11.23, 'Z': 1.31}{'A': 0.26, 'B': 2.35, 'C': 0.0, 'D':

0.78, 'E': 0.26, 'F': 8.62, 'G': 1.83, 'H': 4.18, 'I': 2.35, 'J': 11.75, 'K': 3.66, 'L': 1.57, 'M': 5.48, 'N': 5.48, 'O': 0.78, 'P': 1.04, 'Q': 4.7, 'R': 2.61, 'S': 5.48, 'T': 6.53, 'U': 2.09, 'V': 0.0, 'W': 8.09, 'X': 6.27, 'Y': 10.97, 'Z': 2.87}

{'A': 2.87, 'B': 3.92, 'C': 11.23, 'D': 3.66, 'E': 1.83, 'F': 7.57, 'G': 6.79, 'H': 0.0, 'I': 3.66, 'J': 2.87, 'K': 1.83, 'L': 6.01, 'M': 7.83, 'N': 0.78, 'O': 0.0, 'P': 4.96, 'Q': 4.7, 'R': 12.01, 'S': 2.35, 'T': 0.26, 'U': 1.57, 'V': 0.0, 'W': 3.13, 'X': 0.26, 'Y': 7.83, 'Z': 2.09}

{'A': 2.35, 'B': 5.22, 'C': 7.57, 'D': 0.26, 'E': 1.57, 'F': 2.35, 'G': 2.09, 'H': 5.22, 'I': 6.79, 'J': 1.83, 'K': 0.26, 'L': 6.27, 'M': 6.79, 'N': 9.4, 'O': 3.13, 'P': 1.57, 'Q': 1.83, 'R': 0.0, 'S': 2.09, 'T': 0.26, 'U': 8.88, 'V': 2.35, 'W': 3.13, 'X': 2.87, 'Y': 13.32, 'Z': 2.61}

{'A': 1.57, 'B': 1.04, 'C': 3.92, 'D': 6.79, 'E': 0.26, 'F': 2.09, 'G': 3.66, 'H': 4.7, 'I': 5.22, 'J': 7.31, 'K': 3.13, 'L': 0.0, 'M': 7.57, 'N': 5.48, 'O': 10.97, 'P': 3.13, 'Q': 1.04, 'R': 1.57, 'S': 0.0, 'T': 2.09, 'U': 0.26, 'V': 8.62, 'W': 2.09, 'X': 2.87, 'Y': 3.39, 'Z': 11.23}

{'A': 8.62, 'B': 0.0, 'C': 1.04, 'D': 3.66, 'E': 1.57, 'F': 6.53, 'G': 6.27, 'H': 1.31, 'I': 0.0, 'J': 7.05, 'K': 9.14, 'L': 11.49, 'M': 2.87, 'N': 0.26, 'O': 2.35, 'P': 0.0, 'Q': 1.04, 'R': 0.0, 'S': 8.36, 'T': 2.09, 'U': 3.66, 'V': 1.83, 'W': 11.49, 'X': 2.35, 'Y': 1.04, 'Z': 6.01}

{'A': 0.26, 'B': 3.66, 'C': 0.26, 'D': 1.04, 'E': 0.0, 'F': 9.92, 'G': 1.57, 'H': 3.39, 'I': 2.09, 'J': 13.58, 'K': 2.61, 'L': 1.31, 'M': 7.05, 'N': 7.31, 'O': 0.0, 'P': 2.35, 'Q': 4.18, 'R': 2.61, 'S': 6.79, 'T': 5.22, 'U': 0.52, 'V': 0.0, 'W': 6.27, 'X': 5.74, 'Y': 9.66, 'Z': 2.61}

{'A': 1.57, 'B': 0.0, 'C': 1.83, 'D': 0.0, 'E': 12.53, 'F': 1.83, 'G': 4.18, 'H': 2.61, 'I': 12.01, 'J': 2.09, 'K': 2.35, 'L': 6.01, 'M': 6.53, 'N': 0.26, 'O': 1.04, 'P': 2.87, 'Q': 2.35, 'R': 6.79, 'S': 4.7, 'T': 2.35, 'U': 0.0, 'V': 6.01, 'W': 6.53, 'X': 9.4, 'Y': 2.87, 'Z': 1.31}

After finding the potential key length, I aligned the letter frequencies for each group superimposed with English letter frequencies and counted the amount of alignment shifts until they best aligned with English, accounting for A and E being common and X,Y, and Z being most uncommon. Using a function to shift each letter position by a potential key I adjusted each letter in the key starting with all “A” and running possible letters to find a key of “UFYUVSFE”, resulting in text about the movie JAWS. The text is from the Wikipedia article on the great white shark.

> morethananydocumentedattackpeterbenchleysbestsellingnoveljawsandthesubsequentfilm adaptationdirectedbystevenspielbergprovidedthegreatwhitesharkwiththeimageofbeingama neaterinthepublicmindwhilegreatwhitesharkshavekilledhumanstheytypicallydonottargetth emforexampleinthemediterraneanseatherehavebeenconfirmedattacksagainsthumansinthel asttwocenturiesmostofwhichwerenonfatalmanyoftheincidentsseemedtobetestbitesgreatwh itesharksalsotestbitebuoysflotsamandotherunfamiliarobjectsandtheymightgrabahumanora surfboardtoidentifywhatitisotherincidentsseemtobecasesofmistakenidentityinwhichashark

ambushesabatherorsurferfrombelowbelievingthesilhouetteisfromasealmanyattacksoccurin
waterswithlowvisibilityorothersituationswhichimpairthesharkssensesthespeciesappearston
otlikethetasteofhumansoratleastfindsthetasteunfamiliarfurtherresearchshowsthattheycante
llinonebitewhetherornottheobjectisworthattackinghumansforthemostpartaretoobonyforthe
irlikingtheymuchpreferafatproteinrichsealhoweversomeresearchershavehypothesizedthatt
hereasontheproportionoffatalitiesislowisnotbecausesharksdonotlikehumanfleshbutbecause
humansareoftenabletoescapeafterthefirstbiteinthesjohnmccoskerthechairofaquaticbiology
atcaliforniaacademynotedthatdiverswhodovesoloandwereattackedbygreatwhitesweregene
rallyatleastpartiallyconsumedwhilediverswhofollowedthebuddysystemweregenerallyrescu
edbytheirbuddymccoskerandtimothyctricasanauthorandprofessorattheuniversityofhawaiis
uggestthatastandardpatternforgreatwhitesistomakeaninitialdevastatingattackandthenwaitf
orthepreytoweakenbeforeconsumingthewoundedanimalhumansabilitytomoveoutofreachw
iththehelpofothersthusfoilingtheattackisunusualforagreatwhitespreyhumansarenotappropri
atepreybecausethesharksdigestionistooslowtocopewithahumanshighratioofbonetomusclea
ndfataccordinglyinmostrecordedattacksgreatwhitesbrokeoffcontactafterthefirstbitefatalitie
sareusuallycausedbybloodlossfromtheinitialbiteratherthanfromcriticalorganlossorfromwh
oleconsumptionfromuntiltherehavebeenatotalofunprovokedgreatwhitesharkattacksfatalas
harkconservationistjimmyhallreportedanddocumentedhispersonalencounterwithaverylarg
egreatwhitesharknicknamedschatziindecemberinwatersoffhawaiithisencounterreceivedwo
rldwideattentionasitremainedentirelypeacefuljhallwasatfirstcautiousbutlaterswamwiththis
sharkwithoutcageprotectionandtoucheditrepeatedlywhilefilmingitsimultaneouslyagroupof
greatwhitesharkswasbelievedtoberesponsibleforanattackonaswimmeratmuriwaibeachinau
cklandnewzealandinfebruarythoughinitialreportsplacedtheblameonabronzewhaleritwasthe
firstconfirmedsharkattackfatalityinthecountrysincegreatwhitesharksinfrequentlyattackand
sometimesevensinkboatsonlyfiveoftheauthenticatedunprovokedsharkattacksreportedfromt
hepacificcoastduringthethcenturyinvolvedkayakersinafewcasestheyhaveattackedboatsupt
ometresftinlengththeyhavebumpedorknockedpeopleoverboardusuallyattackingtheboatfro
mthesterninonecaseinalargesharkleaptcompletelyintothesouthafricanfishingboatluckyjimk
nockingacrewmanintotheseatricasandmccoskersunderwaterobservationssuggestthatsharks
areattractedtoboatsduetotheelectricalfieldstheygenerate