

### **Finding the length of the key**

A viable method of finding the length of the key used to encrypt the text is to use the Kasiski examination. For example, I noticed that the three letters “orw” are repeated multiple times throughout the ciphertext, and by examining the space in between the repeated “orw” strings, we can find a list of possible lengths for the key, and by examining multiples spaces between the repeated “orw”, we can find the intersection of the possible lengths, ruling out short lengths such as 1 or 2 characters since that would be too similar to a Caesar’s cipher and not a Vigenere cipher.

For example, there is an instance where the number of letters in between two “orw” is 28. Therefore, the possible key lengths are the factors of 28, which are 28, 14, 7, 4, 2, and 1. Also, there is an instance where the number of letters between two “kpi” is 21. The factors of 21 are 21, 7, 3, and 1. Therefore, we can take the intersection of the two lists and see that the key length is likely to be 7.

### **Finding the first letter of the key**

Since we know the length of the key to be 7, we can perform frequency analysis on the sequence of characters every 7 characters, starting from the first letter in the ciphertext. This sequence of ciphertext letters will all be encoded using the first letter of the key. The following is a screenshot for the frequency analysis of every 7<sup>th</sup> character, starting from the first letter in the ciphertext.

```

1onzggoxjjcvvvcinbzczyptymgmrbdomnrimomrompimhbnooaozhxndjmpozdcjvddomvczjjonmog
jkoocovdvnjkmjgjmnhdjppzmfanbyojjinyiijyocczopicyjmozkjotjwcvognajrdbvvvwzikcov
ygzobmdmcngnnpqdmjrwzwhnizvopxizqzdcizrojbrnziiohxocdiqogovmnrjyozcjcyfjpmzziy
cpmcovmazmyvzzxziznwcywcjzzjknknjoxomropzbqgoodpvyzotogmvjriczibcayppsomidyrbj
ccxoxyhddzxndcpoajaoshxcvzmnvgyzzmhmjcwavpufovhxvgvyoovidoczgzncvzcowerzjmvpay
idrzkjtyhgozvzvvpjowcignnzotzjxgbnbvdqxynvdimjijznqayvybcbzdnzgdycvvnzobzobjr
czjvjnrqizrrnooxnozzdgynjjqrjqcyiccqjyxjjndympciyyhipvzyorhnrjgadziacmvorjidpr
ndwzognmivpdcryiokhginojidbtocqvcgtcnmwnvdojzvfiiijzdojnvigvvokvmzsojocdszngdrzt
zzybzzndoddygiccizdmovzzcavjczpjidcgpzfzizinzimvcqwcgzgoiibcgzyjhowvijrpcojmd
hznzcviijzyzmagjpvbdczjztgijvzcmjzvivotiikyzryiomjpvizzcdpodczxvjznoncxzxmajgh
zdvajomozijvovhztmcznobjzvdnotgxzfmidcgnazcdkfpmonjlzjojtjdbhziczigzkimvocajvo
iygqvmxznvmbvjjozvainvgzotcxnbnqncopvjocdijbidziidvzyvgozmyiwjjoigxijovdomxnj
vojvjojrzvvnykjicndqidjzkzvxvntvdzdgohzcznjmzmzfxmmzvzihxbxooavvmhcgjeidgwkjiiz
ovbdwzmjzizgvjdroidzcivaitgnoiovrkwvcvgnjzohngbmciyohrdwgoogxnmnjizniknzcvnndnd
nmowzrnaimjdrojpcdmozakrrnrionzyhzogoncjcdddiyrovydspmmymwamzcjoazpdoivfjoatzxmm
ozvvidjfkryzhvmzcyazndooonovdnovncmovnoiniinodcoocvohczvrczzogmiojdvjiodhmtpgj
jxoomoovmyzadviivxztnjjgidjvvdzdziiirmgijdozkojnovgqxjrbxcrgjzizjnwiviivowhnmnjdo
yyngzdnzjizvgkzvbozcnpjwcozgodzvcnan
Character Count Frequency
a 88 2.19 %
b 86 2.14 %
c 281 7.00 %
d 274 6.82 %
e 4 0.10 %
f 24 0.60 %
g 158 3.93 %
h 99 2.46 %
i 276 6.87 %
j 296 7.37 %
k 59 1.47 %
l 2 0.05 %
m 221 5.50 %
n 263 6.55 %
o 396 9.86 %
p 116 2.89 %
q 41 1.02 %
r 115 2.86 %
s 8 0.20 %
t 75 1.87 %
u 5 0.12 %
v 309 7.69 %
w 81 2.02 %
x 97 2.41 %
y 158 3.93 %
z 485 12.07 %
-bash-3.2$

```

We can see that 'v' is at 7.69% and 'z' is at 12.07%. Since e is the most common letter in the alphabet and 'a' is 4 letters above 'e' in the output above, we can hypothesize that 'v' corresponds to 'a' and 'z' corresponds to 'e'. Therefore, the first letter of the key should be 'v'.

## Finding the second letter of the key

Similar to above, we can perform frequency analysis on every 7<sup>th</sup> letter starting from the second letter, and the output is shown below:

```
rrklvnryffowqxxkcelklldoswoosrnrnglkkqyskydkxndkrlrrksberspekvrldwozxvxrscoxwy
seeromxofgkodkwdlkxvpcxdserdxogdddxdyxceodonszikdlorcsvsxgsonkkoezrdricdeu
lkkrvacykzicczovnysbdxvogonilxdvcsdpymckrgsencqbdybrkbnssvscywyqorboeodoyv
odyoyhdyogcrbnkgqdooodoebmegzdokyvrwkrcdqoykcbdbdyoessxfkqkxyrodglldrdsc
oosobzkmqckvddzyoxvrdyoomvykddkdpdodoreyysdkolrmkydkcikrnoxckadidvsyvyosoxp
nbokvcdnoszooxbxcxdlrbyyiyrfccboovdrxyxromkslvixgcbwodgnkrdxmykcbiwosnmngvl
oxxbcwjomkqfrxonpyorhfkddpbokboovoskowoeerxrsdborrrponldzdmzdcboybdsdkdwym
xwvbenovogcvcsysdkbonsnrldycdoeroodozwoysdidygxcwgnqbxnefwzdkdvyrsmfrpoyxdws
yrkykfkymvdyooosoxmykcnwokxskzkvgfsfcenozkybncmyovdsdkoyokpdoofoxskicqdkxo
wmskorfqwmyzokiwcrmkfxxovbvlmgdnrvpdrkmoocgyokigbcvngcyxlrdaqsszfrrrmorxypk
hyckcyprxslnrmsndkobprbqsdmkmksvbsdcdsosdpcoxovqkcyseexzkpnwxgsmekdjokkszxs
dooydybvkbxxrxexsdsvsyrmegsdrzvgkodokzcprkbnxeqxcnvmrgsbedoeeyppssoisdxrcx
qrpsbreycddydkxdkslsdbxbgioroyxmcbeveckropygyyodbxoscdbvkrrroxmoysnmwoyukv
dqyxemiddznesdwcoyondocbdnsnkrokcsyxksnordrocyyykddlrooxvooksudnsvsyyrvck
soovwofgqepjseezkcorcadrrkkoprmmmdsdmordspkpcxdrkdcsdmxuognoybkogrkymbarglobqk
ynbmowbkoxynysesykedpmkxydoxrbcdcdsoookcsygurrosrrsxxkokncdykndcyydrebwecyxs
eyibnlgwcdpsqcnccbklowxosfwxvykxnydkonnvdrbzrgsdcyorxcckroodlonvriqvnqmyvksk
lyoyxcsmdsbeqrbdqydkxdgsoynpeqvlbbd
Character Count Frequency
a          5          0.12 %
b        218          5.43 %
c        252          6.27 %
d        380          9.46 %
e        128          3.19 %
f         47          1.17 %
g        119          2.96 %
h          8          0.20 %
i         62          1.54 %
j          4          0.10 %
k        321          7.99 %
l         74          1.84 %
m        112          2.79 %
n        176          4.38 %
o        500         12.45 %
p         83          2.07 %
q         92          2.29 %
r        249          6.20 %
s        277          6.90 %
t          3          0.07 %
u         28          0.70 %
v        138          3.44 %
w        113          2.81 %
x        247          6.15 %
y        307          7.64 %
z         74          1.84 %
-bash-3.2$
```

Here we see that the most common letter in the ciphertext is 'o' at 12.45% and 'k' at 7.99%. Using the same strategy as for finding the first letter of the key, we can assume that 'o' corresponds to 'e' since 'e'

should be the most common letter in the alphabet, therefore 'k' corresponds to 'a'. Therefore, the second letter of the key should be 'k'.

### Finding the third letter of the key

The output for frequencies of letters starting with the 3<sup>rd</sup> letter is shown below:

```
wwoggjshwwjawenbahgdglsfktsllawwjkkloffejvuadkdxwdeahstkyjvwklzllgswxztlsv
fhhwdjsaewwfogmlqmflwldwfkgljwagzljllaafhmjzvhlhggkwkuwgfvyjqkkaalwolsallf
wqjmaexetjwazsvqkjlgothwafaklgqlkqggxz fzzqwal fuaxzwzfwadzvimgzmamzsslgdjgsl
jzsextzjnszlszmslpuogvjdv sfwdowkwwqlkwkkjkxlfxfdzjxkxcuvwdavkxatzatlegzft
wlyxmsjlssmqmogtdlgzjkocagls slglwzvwldlfzjvgs c jnofsmawzvufvmzvgaahlkejwl
usjxhlzjplgagvjvkvausggls ewwgfwnwazlqjywjglftsouzl ksezzdkatsgfdqzsnfycmag
allvkamtgtwsszlggfuwusgfz z lqfksfdgkuvxafjavwyszwmaggfllwsz z lslhvljkzlvswz
shwljjwkzvwlemxxfwftfgtzjkzkkwvjokdmztlzsa f syshsoszngwgwajukfjuugwwyamxmg
xsksjwfezqs z xk kdfsvz xuhatkxvuvddvswkwshgkslwshwzmtwzlbmf xodwzjdwwvycastzkuv
wggumwgxgzejwkgzuqslgztvlsqazsgqsklgwfgvsekjwfegewdsz lmslwqgfglwawwjwvdlk
hfauolswskwwldmzekkgwggfawtgffgwfwlzf vkagunvvqzkgjgyagjkymwyafgllgqohffdvf
zfsauewafwzwlvlwvfzsktwksfl asguwfjzoflks wadozfgwokqcwkuqfzfulk mxufpavoxsky
swzjjalezfgtgjljlledafzlvwskk auxv lkwlj kaks wdmzmhsjwanfoguwmfwds l ulutzgulweg
msdslgstzsl yukwzfldwakgvjkfgfw p fslgmvlvkwa j gfwsl fgaawvjnwkfcs lws vfxdaws gl
ffjwwjgjl uusfjflvxkwkmaaktsswj jz fazswj kvvadlw wjzffuwcuvzykjgclfwtxdmszwvqsk
fgdmjksfvdkaedywtvhsz l flxdegzslmzsgufqfdl zafwsffwaemckvalzevszoogwywogwt y c
lfgwamggazdfwygxsmkgkwlkfaomhf vysjzdaulwowogwlvzsoaooafoxjzsfwvwkaucocfwavf
wxtflzwlgtllfwqgz wzzlglfyj f zshzwwyagg
Character Count Frequency
a 258 6.42 %
b 4 0.10 %
c 29 0.72 %
d 135 3.36 %
e 93 2.32 %
f 282 7.02 %
g 290 7.22 %
h 70 1.74 %
i 2 0.05 %
j 224 5.58 %
k 275 6.85 %
l 354 8.81 %
m 107 2.66 %
n 30 0.75 %
o 109 2.71 %
p 7 0.17 %
q 74 1.84 %
r 0 0.00 %
s 323 8.04 %
t 83 2.07 %
u 112 2.79 %
v 186 4.63 %
w 514 12.80 %
x 87 2.17 %
y 82 2.04 %
z 287 7.14 %
-bash-3.2$
```

'w' probably corresponds to 'e' and 's' corresponds to 'a', therefore the third letter of the key is 's'.

## Finding the fourth letter of the key

```
zuhhmloayylkkp1lapdpfoyosvtohu11lpavyakhutovuaobyysluzhsootrivol11ittphvhaayvshh
nyphtabmkkhmzozakowozfknzblvkvmlpppvaavayalvvowokdwhhyucdihozhupalhnmuluvhavud
aoatrihspvevluoaaakoahvhaaooyhhbiysvdl11mwutzjulpklalkyipibjulnuslayyukuhoovzpzdc
hlavj1h11sfoallzzufshhndhkvbkl11otrupvovvj1fj1fah11lhoamlhtysaahiah1alovd1n1kksav
yvhytjrvyuaowouhsvvol11lactkzizavsulyahkarpav1y1h1hksuuyhzp1h1hprcallopz1towabzn
vj1alol1pdzumlj1plvzaakztliktdpuathtauzzoupasch1lyts1lpvaalsnpsvs1n1nvaiaavnpvn
yhhs1us1usyukv1pykvfouj1jhloiahiavuzoavasyt1daylmuzcyaomvn1lonolkoaalbhbropbvhayv
av1ollalppulsvmykka1ndplhaoy1wplohlz1h1p1bjh1z1t1lyzohvbyvyunhdzhvabymvuabyadumomy
dptakyk11kih1pzvuyv1h1z1ashoal1h1ppzzybuavj1yaealaps1ayh1bzvpp1h1h1wsazolaip1kppzoota
kuulydjymv1k1zymayzsash1howz1jdzmv1aoywkuurvwk1flbhppspvsuhydszbyyuhallksbopyyvrd
ysh1hojzuoykyshtwv1yibszupyshk1jzn1voup1uyhpzxaazmfuo1j1b1dyzuhapullh1wlpkahznv1l1mk
lpajhalakkhkwoouznhuoyhdoznyupdoskpv1k1v1h1d1kyiph1jbzpbz1hwahnlpr1l1ualbvutpvaodvuulu
pypapuaphvushaohpw1kn1pfzazbzkzmcphavlousttvnvwsupuulzphphukyaai1bapolluaoa1ldbtpoh
ypkavunplyoolbulao1fk1j1spbh1hm1k1aaaowahdvattb1zaj1aionhvnyabpmzak1nozhzzohzzubobylt1z
p1j1iyvp1loapazuksz1p1lpptj1hsy1jalv1aulctfahz1jbold1l1vaowv1ipvhadmvmz1j1lpwps1cncps1hul1d
wb1fwclz1kpp1lj1lfouyzor1phkoypvz1pjpylmuvalkvahulradrzuzuhzwaolpvuvlpvayofpillauph1ns
fabkzayuk1hauvihzalkmyoj1auhu1vpvwt1savoyhshzdv1l1zhuph1akos1hipkispuv1l1ddaulna1y1aj
ojbnhpupbl1dsbv1vhzppodv1didypuzaaspztt
Character Count Frequency
a 375 9.34 %
b 117 2.91 %
c 33 0.82 %
d 112 2.79 %
e 5 0.12 %
f 67 1.67 %
g 3 0.07 %
h 325 8.09 %
i 71 1.77 %
j 101 2.51 %
k 169 4.21 %
l 480 11.95 %
m 98 2.44 %
n 89 2.22 %
o 244 6.07 %
p 306 7.62 %
q 3 0.07 %
r 39 0.97 %
s 159 3.96 %
t 91 2.27 %
u 268 6.67 %
v 282 7.02 %
w 88 2.19 %
x 3 0.07 %
y 235 5.85 %
z 254 6.32 %
-bash-3.2$
```

'l' corresponds to 'e' and 'h' corresponds to 'a', so the fourth letter of the key is 'h'.

## Finding the fifth letter of the key

```
gerzitkkoocjcmhcztczgxykoeoltmjtgxlhouztmyosmnkkoyzimyvkkzykalkrxjuuzitgrinktyix
aotoiokyyuozygkkkgukgkayqagzealolqezmtlgortaxyokkenxerkzkoxrkzszrnbyuzmsuiykmxmu
uocvkaiuzhvtmjkuuhnyzyigozbxjezkxncygxoggzkzxyllntgkkskroyjnjjxnaanzgyjklrtzuo
txgsrztsoogknxkejpgkatuottyyznzcokeizaktjgyysnorijzctonctiuouunzkuinnxskhorjzjux
luxuvqkxkjokxkziuzxkcyltuogusrznlklzguvkrgiurqktrxyxnxcovajbtrzjkknlzkjkzokknxxz
tozkxkxgygyyzkyuudtazncoejkokzgjrovzknutukbuykgkrktgkrtniunsgutzmxonoxntuonqhjra
sxiejjjkieuoqchtgztngkgkzkkansroikouuxyekzxxneluhskgxkatktjggkguonzsjztkusrsznl
ayokcyntizutxjkunocsrmtxtokjgyjozyojktazgttxkjjojojryzzvmkvojmtrkrygrcgrkogpggak
nxgkglenxkrqkrotuzlvvkxxkiknzyqzzjoyuztztzggkxnrjkuutyoarzxrkynnkztnamxktinkkn
oiucgggkxlyukkkzneznajztoeeyngvloekygzkcxkyzvsrrtlrrtjeyknjyygkjjkkszksguxroo
kkzyskijkkhyexrourusgtjhmzojvzqzzttoatxgzvrrannjbsytqmbboozrnzjzxlxtjningvoylx
stoksntzecjhokconrzjkobgkybgnxkkrtaxozaggkktjxzctjnjbkotozymoginikxgutanoozjmrz
taynhmntzzkoihkxzuzpotyggkgkzkobjuzzlckskcnrukkizmtzrmtsgegucytkuiyjkzknuryutgy
ttygtzgmxxkzgizgukjnuxkgztc rekonuzrnrglkkzkkynokkjthyuvtkvuoggkutzvoznyjhazetku
yngekliikabozkgekgtdukonjkcokkyxuetoogegktktgzxlnkzlrizbuyguxnzuyjrzsookiekyo
uzglkrnmzquotnzoyzkkyickttkyzikxxutnyltuvyctugogmkshggcuotvjaxttznzzkzxsyuyzlor
ukxemjxektykitxiogbeukknmyaytlrcgkciskuyuroouxnrcityzckghjrtzubzzbkroguuzkkkgcu
kuzgeyzurygeymlsjzstkgjoxousjzkuitung
Character Count Frequency
a          91      2.27 %
b          46      1.15 %
c          97      2.41 %
d           3      0.07 %
e          76      1.89 %
f           5      0.12 %
g         288      7.17 %
h          59      1.47 %
i         124      3.09 %
j         169      4.21 %
k         537     13.37 %
l           99      2.46 %
m          83      2.07 %
n         255      6.35 %
o         265      6.60 %
p           4      0.10 %
q          25      0.62 %
r         176      4.38 %
s          89      2.22 %
t         290      7.22 %
u         301      7.49 %
v          77      1.92 %
w           3      0.07 %
x         227      5.65 %
y         250      6.22 %
z         378      9.41 %
-bash-3.2$
```

'k' corresponds to 'e' and 'g' corresponds to 'a', so the fifth letter of the key is 'g'.



## Finding the sixth letter of the key

```

lmgdfujplryjmfccgrgrzcmprqlpbfbzfqfwseffnfpkdfmuuecfmfkmyrfacjdlgnyklcdblrfcubffk
nerpmrplrjrifyndnyuunpfbgrnlgbearpgbyfdigjgcpmrcllpaymrnyfprmpqgmfcyckycjnripbqms
bqygrycluyprjmkycugccqkrfrqfmwbrmlrgpmbmjlpmpfpypcrpbftyfldrffdruzlcgirqpygrgsq
brregrzmfxrrbyzqmnlgqrrrbcmccqyabmguppjgpfqzylwcqymqcyggplulcgglicyalctsljmfzjc
sickjcbwrgmjgpfasfulyssrlluycmcrqpyumcpcliqyubbccrycccfrnaccwyrucgcmfpcjfcnpqsm
qcppfzfjrqgnfqrllcqpfcykryjlbrqclwqkygrydyclaqrjtrlrkryfimgqdgusiylwccfamgpgcjin
mwrafgflcbdsdlrmequbylojyulqrycclijlljusmbmuggdspmgpkmbjrydszglislcgycfblfbkccgg
pqrmdccrfurrzgpkgamccuzgacqdmearjfqlyleemabmrayfrcqqsjffpglglgkqbbcabgnkmmqcaexm
gyjcaycmccqgljleqfuycqacbccmfccwccclskyrprwaebtybflqsbzrejfkqmmqcyjzgcqzflernulc
yjdggqrncrcrkckfcgcwczpbqbjngqyrrjmmptyumcygyfzbjpcrczbrygqnanbfmjlyfqllclumglr
qqgusqmpbtbnwqcrpadbmabqjtuebpfpfuqqxrclrccggpcmgymjfcprdcmfqkfmpmcemccmrqpgmm
yelrcrjfmrlpylsgmctcwqbgcgfgpggseecfjtpbfqzwggcbcswymbraqmllecmbyjkqlcsrfiftj
qlacjycscruersawuqmmrlclljlpmlylccimmygbcbrcdjjarmymjpegrcelyrbbmudmmpcdyykqrl
cqrjrpgrwrnlfqpsjccclcelfgmgcplclfcgjqegbmykfcgepbmypcryaypplpqgdbcgqglrrlfcabk
rynrnfciqpgmmmbzfrnrnlrqgtrfljlqmrizllrkfabaaayqfcmclybmcfrckzqimcrjquycyalmiqmql
slrsbdmsbcdlrcmccmflqjyyqefuacezcydbckmemnrwczaqkyjgjeqyspbcrececcffqfgyfucwciy
skfmsmwmryfjccgclzccpyrccpgqgqzyylfkmumgljrlldcyafqlglfrsnwrmmcrfcnjlqpsfmjlqcs
ysqqcnnlbcqrsprrqcreuzmrmlsqpppsfulga
Character Count Frequency
a          95      2.36 %
b         173      4.31 %
c         532     13.24 %
d          97      2.41 %
e          77      1.92 %
f         273      6.80 %
g         275      6.85 %
h           4      0.10 %
i          34      0.85 %
j         154      3.83 %
k          90      2.24 %
l         270      6.72 %
m         297      7.39 %
n          81      2.02 %
o           4      0.10 %
p         231      5.75 %
q         232      5.78 %
r         346      8.61 %
s         111      2.76 %
t          31      0.77 %
u         112      2.79 %
v           7      0.17 %
w          75      1.87 %
x           6      0.15 %
y         333      8.29 %
z          77      1.92 %
-bash-3.2$

```

'c' corresponds to 'e' and 'y' corresponds to 'a', so the fifth letter of the key is 'y'.

## Finding the seventh letter of the key

```
oyjymmlkxwiqxiwrlxpsipexgkmlmiiximvliiysisemyemlpizmywvlistplxgpofkvpaxareismk
ylsetleslpyiptvexsrxshheghrmlrshmmxvmrxghrywekirexpcvgihlxiepyilxvmavixlmixxjp
ilwrhljkefiixszechrvzmsssvaepeiljxagireqpmirhemesgwsokmmyeepmipsmfgaiieljvowepl
glxrqiiviiiallxilyvhwiislazfvvymlyxvmeicspemswlXgrxyiwwxhiwmiwsrxsevpriivlcaiisg
pexeixzgxyrhkiisximiwgpfkhrpxsplgsfioreshumrmfehlpaevililrvwpletrfvevwjiwelvsry
twyeevspimfiwvjwgxiivwtlcmmlerrjkimrrlxsvvjvsswiakessrliykmvxeizihixlfpymresx
qglvmxemmewlssymiswhkykrehxixqiximaimlhgxaexwsxxvrisyshlrityriafojqksiigiscyajxx
imlyyqtmgspssxiimweyewmvkirisrisliipkpaelqxmplvaemjtpcitmrixweaxlriiwxemjreaivdp
xrpfpgxartarmmxxiilmgalwxstzsiukmpkesglmlleokeyweeikctplseirxtperjiramvisxeteehm
xytxmemhiiljsfhsarvxvmieemtpigsylvijximwvrvorevircielpwisspgxipgfmrixviwwyeeahkl
wgltyjiexpsbmlxxmxhoxxiselemiammmqgdseisxatgsksgrlxcxrpvxvrmwmiwitpyamwyxszrva
hfklljwlieqymoqwkojhijjlxvkwjxrmelwkixiokmximareittorjevxpwhhzrmfyixhaxlimmmc
xkllifxxaleiexsxewemalgcgaicywvhrwmvwxkvxllktmiyyrkrmwrmxiivmiamvmvfepjeqxixvs
hxiplervlelshqlxxsvvxiysexvixcwaieeqxwsrxfxsmxrfgmvrssismvswksrsekmxspilxkmbipi
irelsmxmiprrrvilysvssqxmsikilislmcmmxiivllereasoileyelshsvxhqppspmpvxxmjppjimw
viipljgpseiqiegfcrsestiwigixmmlviyageamiveoisiaxkiwjwiiwwkxwrljjmsvimcihcmtpsirf
vteywmyrlspaeiawpvpwwiipsryxxigwmhiyelqrksihimapsmxsrmxwmvfilowmiemfweixijiwwrp
vvslhvslritleellyhlxeshlxwweelxxekwl
Character Count Frequency
a 126 3.14 %
b 4 0.10 %
c 65 1.62 %
d 4 0.10 %
e 304 7.57 %
f 69 1.72 %
g 114 2.84 %
h 150 3.73 %
i 508 12.65 %
j 96 2.39 %
k 94 2.34 %
l 252 6.27 %
m 313 7.79 %
n 2 0.05 %
o 36 0.90 %
p 170 4.23 %
q 79 1.97 %
r 279 6.95 %
s 295 7.34 %
t 79 1.97 %
u 3 0.07 %
v 236 5.88 %
w 219 5.45 %
x 377 9.39 %
y 106 2.64 %
z 37 0.92 %
-bash-3.2$
```

'l' corresponds to 'e' and 'e' corresponds to 'a', so the seventh and last letter of the key is 'e'.

Therefore, putting together all the results from frequency analysis, the key is **"vkshgye"**.