Національний технічний університет України
«Київський політехнічний інститут імені Ігоря
Сікорського» Фізико-технічний інститут

**КРИПТОГРАФІЯ**

**КОМП'ЮТЕРНИЙ ПРАКТИКУМ №1**

**Експериментальна оцінка ентропії на
символ джерела відкритого тексту.**

Виконав:

студент III курсу ФТІ

групи ФБ-95

Колесник Вікторія
студент III курсу ФТІ

групи ФБ-96

Ліпатова Софія

Перевірила:

Селюх П.В.

## Мета роботи:

Засвоєння понять ентропії на символ джерела та його надлишковості, вивчення та порівняння різних моделей джерела відкритого тексту для наближеного визначення ентропії, набуття практичних навичок щодо оцінки ентропії на символ джерела.

## Результати:

```
from io import open
from collections import Counter

f = open('text.txt', 'r', encoding='utf-8')
text = f.read()
f.close()
text = text.lower()
text = ' '.join(text.split())

alphabet = 'абвгдежзийклмнопрстуфхцчщъыьэюя'

preptext = ''

for i in text:
    if i in alphabet:
        preptext = preptext + i

f = open('preptext.txt', 'w', encoding='utf-8')
f.write(preptext)
f.close()

r = ['ка', 'при', 'зова', 'попул', 'евнаселенияаз']

def encrypt(text, key):
    etext = ''
    for i in range(len(text)):
        x = alphabet.find(text[i])
        k = alphabet.find(key[i % len(key)])
        etext = etext + alphabet[(x+k) % len(alphabet)]
    return etext


for i in range(len(r)):
    f = open(str(i) + '.txt', 'w', encoding='utf-8')
    f.write(encrypt(preptext, r[i]))
    f.close()

f = open('opentxt.txt', 'r', encoding='utf-8')
opentext = f.read()
f.close()
```

## Монограма с whitespaces

в,0.03298057883210721

,0.17268797181460938

м,0.0258798342252975 94

а,0.06806029707533831

л,0.04709513006456238

е,0.06649104223097431

н,0.054003542601310676

ь,0.015388508353088654

к,0.030497746654951894

о,0.09437967807691243

п,0.022017650838611538

р,0.03658437671052906

и,0.05675738814991605

ц,0.002853411392955304

г,0.015932963531216808

д,0.026257213059736106

т,0.05008113402096905

з,0.015012586579786968

с,0.04217997716299512

ы,0.016994189725873375

у,0.023536394230232172

я,0.015875166772789287

ж,0.007861816207279574

щ,0.0028038713143031437

ч,0.013426818375872233

й,0.00914014451132355

б,0.01777663155635014

х,0.007056547085659167

ю,0.004442579406189304

ф,0.0010932815396667895

э,0.004704850410818387

ъ,0.00014667748777404284

## Монограма без whitespaces

в,0.03986473991493409

м,0.031281830003199514

а,0.0822667805575369

| | |
|---|---|
| л,0.056925474863286925 | |
| е,0.08036996920837039 | |
| н,0.06527590650381446 | |
| ь,0.01860060996192875 | |
| к,0.03686365677753414 | |
| о,0.1140799055997323 | |
| п,0.026613478456132936 | |
| р,0.04422077216835889 | |
| и,0.06860457265973341 | |
| ц,0.0034490147559124917 | |
| г,0.019258711330673924 | |

д,0.03173798055049211

т,0.06053475873041033

з,0.018146220613660446

с,0.05098436348799596

ы,0.020541451286702653

у,0.02844923490579053

я,0.019188850436043525

ж,0.0095028428687583843

щ,0.003389133989086437

ч,0.01622944900888525

й,0.01104800147940718

б,0.021487215162749467

х,0.008529486874664271

ю,0.005369895825077713

ф,0.0013214863345632373

э,0.005686911649450946

ъ,0.00017729403511243787

## Біграма с whitespaces

"('в', ' ')",0.005828247378017211

"(' ', 'м')",0.006602918592011999

"('м', 'а')",0.0035251182891374096

"('а', 'л')",0.009906077793503252

"('л', 'е')",0.003964179591614706

"('е', 'н')",0.006981268984301616

"('н', 'ь')",0.0010898822596892184

"('ь', 'к')",0.0008582094264130343

"('к', 'о')",0.0076194620721945

"('о', 'м')",0.005282334873609598

"('м', ' ')",0.007093462746328447

"(' ', 'п')",0.015322462356807247

"('п', 'р')",0.004993836628397747

"('р', 'о')",0.006581548351625935

"('о', 'в')",0.005476609786210173

"('в', 'и')",0.003163281264418841

"('и',

'н')",0.0029141236890086056

"('н', 'ц')",0.00032443910404295805

"('ц', 'и')",0.0003759219558821101

"('и', 'а')",0.00013502106425739873

"('л', 'ь')",0.003780589799207164

"('ь', 'н')",0.0012375311932656544

"('н', 'о')",0.009228544035808752

"(' ', 'г')",0.004330873489148289

"('г', 'о')",0.007425672846875428

"('о', 'р')",0.005038034171014377

"('о', 'д')",0.004493093041169768

"('д', 'к')",0.0002234161494906597 5

"('к', 'е')",0.0008518954917535156

"('е', ' ')",0.01593297126965455

"(' ', 'д')",0.007366904685813754

"('д', 'е')",0.005004036061309277

"('е', 'р')",0.006623317457835059

"('р', 'р')",0.00046771685208588115

"('р', 'и')",0.005596088857459525

"('и', ' ')",0.0202245040890012 24

"('м', 'н')",0.001389065625094102

"('о', 'г')",0.00452417702718586

"('о', ' ')",0.0220458313946316

"(' ', 'л')",0.002497404001480375

"('е', 'т')",0.004911755477824005

"('т', ' ')",0.005327503790789232

"(' ', 'н')",0.014790149096281676

"('н', 'а')",0.010242173392302245

"('а', 'з')",0.003966608028022213

"('з', 'а')",0.006226510948848387

"('а', 'д')",0.0017756727011692436

"('д', ' ')",0.00122927450948013

"(' ',
'с')",0.015299149367295178
"('с',
'е')",0.0031700808863598614
"('е',
'м')",0.003424095334585111
"('м',
'е')",0.0032575045970301194
"('р',
'ы')",0.0017178759146705728
"('ы',
'м')",0.001304070350831351
"('п',
'о')",0.00934948016890261
"('д',
'р')",0.0010874538232817112
"('о',
'с')",0.005830190127143217
"('с',
'т')",0.009421361886564821
"('т',
'к')",0.0007086177437105925
"('к',
'а')",0.008031810574189217
"('а',
'м')",0.0024872045685688446
"('и',
'л')",0.006384359315336353
"('л',
'о')",0.006047778029255859
"('с',
'ь')",0.0031011132923866574
"('ь', '
')",0.009737058619540754
"('т',
'о')",0.014062103861311025
"('о',
'л')",0.005934612892666025
"('л',
'к')",0.0003943780725791646
"('к',
'н')",0.00047888765956041415
"('н',
'у')",0.0027713316282471836
"('у',
'т')",0.0013312688385954312
"('т',
'ь')",0.004983637195486217
"('ь',
'с')",0.0007906988942843349
"('с',
'я')",0.0036547967932982926
"('я', '
')",0.0096321501667364 43
"('с', '

')",0.002710135030778003
"(' ',
'к')",0.00989199286233971
"('к',
'р')",0.0021875355158824596
"('н',
'ы')",0.002999604650552858
"(' ',
'у')",0.004392555773898971
"('у',
'ж')",0.000986430868729413
"('ж',
'а')",0.0014016934944131392
"('а',
'с')",0.003669853099024837
"('с',
'о')",0.0021307101039467918
"(' ', '
')",0.00695552755838204
"(' ',
'ж')",0.0012098470182200726
"('ж',
'и')",0.0012317029458876372
"('и',
'в')",0.001732446533115616
"('в',
'ы')",0.002186564141319457
"(' ',
'в')",0.013754663812120618
"('в',
'о')",0.005212395905073392
"('о',
'п')",0.001037913720568565
"('п',
'л')",0.0008285825022414468
"('о',
'щ')",0.00021661652754963968
"('щ',
'е')",0.0013438967079144686
"('н',
'и')",0.006744253590928916
"('и',
'е')",0.0018145276836893584
"(' ',
'а')",0.0016950486124400054
"('д',
'а')",0.004298818128569195
"('а', '
')",0.018310896199885573
"('л',
'и')",0.007312022023004092
"('д',
'ы')",0.0006503352699304204
"('ы', '
')",0.004678625582703316
"('к',
'и')",0.002787844995818232
4
"('в',
'з')",0.00049102984159795
"('з',
'р')",0.00031278260928692365
"('с',
'л')",0.00271936308912653
"('е',
'л')",0.005426098308934023
"(' ',
'и')",0.00945827411995893
"('и',
'ч')",0.0017849007595177708
"('ч',
'т')",0.0036280839928157136
"('н',
'е')",0.0079575004201195
"('р',
'е')",0.005440668927379066
"('е',
'д')",0.002077284502981634
"('д',
'в')",0.0008990071580591548
"('в',
'е')",0.00441926857438155
"('е',
'щ')",0.000683362005072518
"('щ',
'а')",0.00033949540976950255
"('о',
'й')",0.0034041821560435526
"('й', '
')",0.006739396718113902
"(' ',
'б')",0.010168834612795528
"('б',
'е')",0.0030739148046225774
"('а',
'р')",0.0023963810469280764
"('р', '
')",0.0010840540123112012
"('р',
'н')",0.000986430868729413
"('у',
'л')",0.0018932090232925906
"('л',
'с')",0.0015721697302201426
"('е',
'в')",0.0016629932518609108
"('д',
'о')",0.0031423967113142796
"('а',
'я')",0.0017635305191317078
"('с',
'и')",0.001641137324193346

2
"('л', 'а')",0.006557749674832365
"('в', 'л')",0.0005022006490724483
"('е', 'к')",0.0012108183927830756
"('к', 'л')",0.0008295538768044497
"('ы', 'х')",0.0008280968149599454
"('х', ' ')",0.002985034032107815
"('р', 'у')",0.0027766741883436994
"('у', 'з')",0.0003006404272493878
"('з', 'е')",0.00034532365714751975
"('е', 'й')",0.002001031599785909
"('в', 'у')",0.0006780194449760022
"('у', 'ю')",0.0009281483949492408
"('ю', ' ')",0.002240475429566116
"('б', 'и')",0.0021768503956894284
"('и', 'т')",0.002978234410166795
"('т', 'в')",0.0019830611703703558
"('у', ' ')",0.005824361879765199
"(' ', 'з')",0.004924383347143042
"('з', 'л')",0.0002127310292976282
"('и', 'б')",0.0005148285183915203
"('б', 'о')",0.002358983126252466
"(' ', 'о')",0.013002334213074895
"('п', 'я')",0.0003375526606434968
"('я', 'т')",0.0012666724301557404
"('ь', 'е')",0.0006887045651690337
"('т', 'с')",0.00111076681279378

"('в', 'ь')",0.00022098771308315257
"('е', 'с')",0.0034274951455556214
"('с', 'с')",0.0008018697017588679
"('д', 'н')",0.0015818834758501714
"('и', 'с')",0.0027072209070889944
"('с', 'ч')",0.00024284364075071713
"('ч', 'е')",0.0029874624685153218
"('е', 'з')",0.0012064472072495626
"('а', 'ю')",0.0010515129644506052
"('ю', 'т')",0.0003671795848150843
"('л', 'ю')",0.0008261540658339396
"('ю', 'д')",0.0003307530387024767
"('д', 'и')",0.002772788690091688
"('о', 'ж')",0.002003460036193416
"('ж', 'д')",0.0006581062664344434
"('о', 'ч')",0.001743617340590149
"('ч', 'н')",0.0008441244952494927
"('р', 'а')",0.006269251429620513
"('о', 'я')",0.0006683056993459735
"('т', 'н')",0.0008154689456409081
"('о', 'е')",0.002022401840171972
"(' ', 'ч')",0.005413956126896487
"('а', 'ж')",0.0010787114522146854
"('ж', 'е')",0.002868954771828972
"('и', 'м')",0.002301672027035297
"('е', 'е')",0.001646965571571363

4
"('т', 'и')",0.0031768805083008814
"('н', ' ')",0.005652914269395193
"('н', 'г')",0.0001602768028954733
"('г', 'ч')",4.0312044364619044e-05
"('ч', 'а')",0.0019612052427027916
"(' ', 'т')",0.007438786403475966
"('т', 'е')",0.004726222936290456
"('г', 'л')",0.0015381716205150422
"('а', 'в')",0.0022778733502417264
"('в', 'а')",0.004722337438038445
"('и', 'я')",0.0008407246842789827
"(' ', 'ф')",0.0006124516619733086
"('ф', 'е')",0.00011705063484184565
"('л', 'я')",0.001377894817619569
"(' ', 'е')",0.004822389018027741
"('е', 'ф')",7.139603038071084e-05
"('ф', 'о')",0.00027587037589281465
"('о', 'н')",0.008909933179143811
"('н', 'н')",0.00230944302353932
"('з', 'в')",0.0007654431556462604
"('н', 'к')",0.00042060518578024205
"('п', 'е')",0.0016727069974909396
"('р', 'в')",0.0003535803409330441
"('н', 'т')",0.0006221654076033373
"('р', 'л')",0.0005298848241180648
"('и',

| | | |
|---|---|---|
| 'ю')",0.00024284364075071713 | ')",0.0007703000284612747 | 05 |
| "('ю', 'н')",4.711166630563912e-05 | "('а', 'п')",0.0010651122083326452 | "('е', 'а')",0.0001772758577480235 |
| "('ь', 'г')",3.205536057909466e-05 | "('у', 'д')",0.0016343377022523262 | "('ю', 'щ')",0.0005444554425631078 |
| "(' ', 'х')",0.0016051964653622402 | "('б', 'а')",0.0009548611954318197 | "('ь', 'б')",7.528152863272231e-05 |
| "('х', 'э')",0.00018796097794105505 | "('а', 'т')",0.004164282751593297 | "('м', 'о')",0.0037776756755181556 |
| "('э', 'н')",0.0005512550645041279 | "('д', 'ж')",0.0005420270061556006 | "('о', 'т')",0.007232854996119358 |
| "('н', 'с')",0.0006027379163432799 | "('ж', 'о')",0.00024090089162471137 | "('р', 'с')",0.00025595719735125585 |
| "('с', 'к')",0.003595542944955118 | "('р', 'д')",0.0004900584670349471 | "(' ', 'э')",0.003710165143389456 |
| "('п', 'а')",0.0018970945215446022 | "('и', 'ц')",0.0009111493400966906 | "('э', 'д')",0.0007299879840966557 |
| "('а', 'е')",0.0011826485304559924 | "('ц', 'е')",0.0007877847705953263 | "('д', 'д')",0.0008314966259304554 |
| "('л', 'л')",0.0015590561736196038 | "('й', 'б')",3.6912233394109e-05 | "('с', 'м')",0.0013361257114104446 |
| "('л', ' ')",0.010136779252216434 | "('л', 'т')",0.0001403636243539145 | "('р', 'т')",0.0007872990833138249 |
| "('н', 'б')",8.450958698124956e-05 | "('ч', 'и')",0.002270588041019205 | "('и', 'к')",0.002269130979174701 |
| "('б', 'р')",0.0011573927918179178 | "('и', 'щ')",0.00012239319493836142 | "('х', 'о')",0.0019859752940593646 |
| "('о', 'б')",0.002790759119507241 | "('в', 'т')",0.00022050202580165115 | "('о', 'к')",0.00231624264548034 |
| "('е', 'ж')",0.0006581062664344434 | "('л', 'ы')",0.0009728316248473728 | "('к', 'с')",0.0001758187959035192 |
| "('д', 'ь')",0.00038077882869712445 | "('ы', 'е')",0.0011981905234640382 | "('т', 'т')",0.00024770051356573145 |
| "('ь', 'я')",0.00027878449958182325 | "('е', 'г')",0.003604771003303645 | "('г', 'а')",0.0012642439937482334 |
| "('я', 'в')",0.00021613084026813822 | "('о', 'з')",0.0011384509878393618 | "('т', 'у')",0.0011573927918179178 |
| "('и', 'з')",0.0020719419428851184 | "('в', 'р')",0.0006007951672172741 | "('у', 'а')",0.00016853348668099767 |
| "('з', ' ')",0.0018111278727188482 | "('а', 'щ')",0.00031278260928692365 | "('ч', 'у')",0.0007212456130296298 |
| "('з', 'н')",0.0013268975306191814 | "('г', 'у')",0.000564854308386168 | "('и', 'г')",0.0006289650295443573 |
| "('и', 'й')",0.0008829794777696074 | "('т', 'р')",0.0031224835327727206 | "('м', 'я')",0.00042789049500276355 |
| "(' ', 'р')",0.004890870924719443 | "('а', 'н')",0.003092856608601133 | "('б', 'д')",1.0199432911530119e-05 |
| "('т', 'а')",0.005184711730027811 | "('т', 'я')",0.0005978810435282655 | "('у', 'г')",0.001059283960954628 |
| "('г', ' ' | "('ю', 'л')",5.0997164557650594e- | "('м', |

'ы')",0.0009495186353353039
"('ы', 'к')",0.00019816041085258518
"('н', 'я')",0.0012428737533621702
"('я', 'я')",0.00011510788571583991
"('э', 'п')",8.742371067025816e-06
"('п', 'и')",0.0009908020542629258
"('а', 'ч')",0.0009087209036891835
"('у', 'я')",6.168228475068215e-05
"('р', 'м')",0.0002598426956032673
"('м', 'у')",0.0017120476672925556
"(' ', 'ц')",0.0003360955987989925
"('ц', 'в')",7.431015406971944e-05
"('к', ' ')",0.00475779260958805
"('т', 'д')",0.00010539414008581122
"('с', 'в')",0.0012569586845257118
"('о', 'и')",0.0007649574683647589
"('и', 'х')",0.0014376343532442454
"('е', 'п')",0.0007431015406971944
"('о', 'ц')",7.528152863272231e-05
"(' ', 'щ')",0.00012967850416088295
"('л', 'н')",0.0003404667843325054
"('ц', 'у')",0.00015444855551745607
"('п', 'ч')",1.4084931163541592e-05
"('м', 'и')",0.0026333964403007764

"('г', 'н')",0.00031569673297593225
"('ж', 'н')",0.0007508725372012173
"('э', 'т')",0.0028840110775555164
"('ы', 'в')",0.0007659288429277618
"('у', 'в')",0.000986430868729413
"('в', 'я')",0.0002112739674531239
"('я', 'д')",0.000513371456547016
"('г', 'и')",0.0006299364041073602
"('б', 'н')",0.00028461274695984045
"('у', 'и')",0.00011219376202683131
"('я', 'м')",0.0003846643269491359
"('ы', 'р')",0.00030549730006440215
"('е', 'ц')",0.0002821843105523333
"('ц', 'а')",0.0006406215243003918
"('р', 'ю')",9.325195804827538e-05
"('ю', 'с')",0.00012142182037535856
"('с', 'п')",0.0017776154502952494
"('г', 'с')",1.6999054852550197e-05
"('л', 'ж')",0.00034143815889550825
"('й', 'с')",0.0005153142056730217
"('д', 'у')",0.001724675536611593
"('щ', 'и')",0.0008407246842789827
"('д', 'ц')",0.00026615663026278595
"('м', 'ь')",7.673859047722661e-05
"('о',

'о')",0.00030744004919040785
"('б', 'щ')",8.159546329224095e-05
"('б', 'ы')",0.004452295309523647
"('ы', 'л')",0.003158424391603827
"('ц', ' ')",0.00030695436190890645
"(' ', 'я')",0.002007831221726929
"('с', 'у')",0.0005663113702306723
"('а', 'б')",0.0007401874170081858
"('б', 'л')",0.000797498516225355
"('с', 'д')",0.0003477520935550269
"('д', 'х')",4.565460446113482e-05
"('х', 'в')",0.00025012894997323865
"('ы', 'й')",0.0015226296275069964
"('у', 'н')",0.0004915155288794514
"('в', 'н')",0.0009266913331047365
"('б', 'у')",0.001030142724064542
"('я', 'с')",0.0004958867144129644
"('у', 'х')",0.0003885498252011474
"('с', 'н')",0.001185562654145001
"('в', 'с')",0.002494975565072868
"('у', 'с')",0.0011705063484184566
"('м', 'л')",0.00016513367571048765
"('т', 'ч')",0.00011753632212334709
"('м', 'с')",0.00010199432911530119
"('о', 'ф')",8.888077251476246e-05
"('и', 'р')",0.0007703000284612747

"('и', 'ж')",0.00026469956841828165
"('а', 'к')",0.004407612079625515
"('в', 'п')",0.00020593140735660813
"('ь', 'и')",0.0001389065625094102
"('а', 'й')",0.0010257715385310292
"('й', 'о')",5.342560096515777e-05
"('и', 'и')",0.0005007435872279787
"('э', 'л')",9.130920892226964e-05
"('к', 'т')",0.0006571348918714405
"('о', 'э')",6.411072115818933e-05
"('р', 'г')",8.79093979517596e-05
"('ь', 'ч')",0.00023215852055768558
"('ч', 'о')",0.00011462219843433847
"('о', 'а')",5.731109921716924e-05
"('а', 'х')",0.0009762314358178828
"('р', 'я')",0.0009912877415444272
"('у', 'м')",0.0013361257114104456
"('н', 'ч')",0.00017776154502952492
"('х', 'а')",0.0005313418859625691
"('п', 'ю')",5.3425600965157766e-06
"('ю', 'о')",4.371185533512908e-06
"('щ', 'у')",0.00018213273056303785
"('у', 'щ')",0.0003020974890938921
"('у', 'ч')",0.0008183830693299167

"('с', 'а')",0.0012317029458876372
"('ж', ' ')",0.00018504685425204645
"('е', 'б')",0.0011884767778340096
"('б', 'я')",0.0005255136385845518
"('р', 'п')",7.09103430992094e-05
"('я', 'щ')",0.0002763560631743161
"('щ', ' ')",5.3425600965157766e-06
"('а', 'и')",0.00030841142375341075
"('м', 'т')",7.431015406971944e-05
"('г', 'р')",0.0009320338932012523
"('и', 'п')",0.0002933551180268663
"('п', 'п')",0.00019767472357108372
"('ы', 'з')",8.159546329224095e-05
"('з', 'д')",0.0008183830693299167
"('ь', 'ю')",0.0004215765603432449
"('я', 'ц')",4.128341892762191e-05
"('л', 'у')",0.0012540445608367032
"('р', 'ь')",0.000539112882466592
"('и', 'д')",0.001536714558670538
"('д', 'я')",0.0002967549289973763
"('у', 'к')",0.0011831342177374938
"('п', 'ь')",5.9253848343174975e-05
"('х', 'л')",0.00017484742134051632
"('у', 'р')",0.0004298332441287693
"('н', 'ж')",3.1569673297593225e-05

"('д', 'л')",0.0005473695662521164
"('у', 'п')",0.0006061377273137899
"('н', 'ю')",0.00014667755901343315
"('т', 'ы')",0.0017970429415553066
"('о', 'у')",0.00021321671657912962
"('в', 'ч')",5.0025789994647725e-05
"('ы', 'т')",0.0008557809900055271
"('с', 'х')",0.00023215852055768558
"('х', 'у')",0.00013016419144238437
"('е', 'ч')",0.0008174116947669138
"('ч', 'к')",0.0004779162849974113
"('н', 'д')",0.00031861085666494085
"('а', 'г')",0.0005833104250832225
"('д', 'ю')",4.1769106209123344e-05
"('ю', 'й')",4.128341892762191e-05
"('й', 'м')",8.450958698124956e-05
"('ж', 'ч')",3.8369295238613306e-05
"('с', 'р')",0.00016999054852550197
"('у', 'б')",0.0009830310577589028
"('ф', 'а')",0.00013259262784989155
"('е', 'и')",0.00017144761037000627
"('з', 'б')",0.00014959168270244175
"('и', 'о')",0.0002554715100697544
"('с',

"('ю')",0.00017144761037000627

"('й', 'д')",0.000158819741050969

"('я', 'х')",0.000158819741050969

"('к', 'у')",0.0016693071865204294

"('ь', 'ц')",0.00013404968969439585

"('ь', 'а')",2.525573863807458e-05

"('с', 'ъ')",4.614029174263625e-05

"('ъ', 'е')",7.819565232173091e-05

"('ы', 'б')",0.000291898056182362

"('р', 'ч')",8.839508523326102e-05

"('г', 'д')",0.0015415714314855522

"('в', 'в')",0.0001772758577480235

"('р', 'х')",0.00019767472357108372

"('б', 'в')",3.205536057909466e-05

"('г', 'е')",0.0006061377273137899

"('р', 'ж')",0.0003108398601609179

"('с', 'ф')",2.0884553104561672e-05

"('ь', 'т')",7.188171766221226e-05

"('ц', 'ы')",0.00019767472357108372

"('л', 'м')",2.5741425919576016e-05

"('ф', 'у')",0.00011413651115283705

"('й', 'ч')",0.000232644207839187

"('я', 'л')",0.0009752600612548799

"('м', 'к')",9.616608173728397e-05

"('е', 'я')",0.00023215852055768558

"('ы', 'с')",0.0005619401846971594

"('з', 'з')",0.00011510788571583991

"('я', 'з')",0.0002680993793887917

"('з', 'г')",0.00028412705967833905

"('т', 'л')",0.00016076249017697472

"('ю', 'б')",0.00024478638987672285

"('ж', 'к')",0.00013842087522790875

"('в', 'м')",0.00012433594406436718

"('е', 'х')",0.0004866585560644371

"('ж', 'у')",0.00022584458589816693

"('д', 'с')",0.000221473400364654

"('ф', 'и')",0.00020835984376411527

"('ь', 'м')",0.00020496003279360525

"('й', 'н')",0.0002991833654048835

"('б', 'б')",0.00011559357299734135

"('я', 'п')",4.322616805362765e-05

"('з', 'о')",0.0005337703223700762

"('ь', 'у')",1.942749126005737e-05

"('ы', 'п')",0.00021953065123864827

"('е', 'у')",0.00010150864183379975

"('к', 'в')",0.00012967850416088295

"('я', 'б')",3.448379698660183e-05

"('п', 'ы')",0.0003020974890938921

"('к', 'ж')",3.496948426810326e-

05

"('я', 'н')",0.0005697111812011824

"('а', 'ф')",0.00010053726727079689

"('п', 'у')",0.0007154173656516126

"('б', 'к')",0.00014084931163541592

"('г', 'г')",7.333877950671658e-05

"('л', 'ф')",6.313934659518645e-06

"('ф', ' ')",4.274048077212621e-05

"('м', 'м')",0.00012870712959788008

"('ы', 'а')",0.0003103541728794165

"('н', 'р')",0.000502200649072483

"('ы', 'ч')",0.00012045044581235569

"('х', 'н')",0.00022875870958717552

"('я', 'ю')",8.256683785524383e-05

"('в', 'к')",0.00017339035949601203

"('ю', 'ч')",0.0001389065625094102

"('щ', 'н')",5.148285183915203e-05

"('г', 'т')",3.788360795711187e-05

"('з', 'к')",0.00019476059988207512

"('в', 'д')",0.0002850984342413419

"('з', 'ь')",0.00017387604677751345

"('с', 'ы')",0.0003861213887936402

"('с', 'ц')",3.54551715496047e-05

"('з', 'ы')",0.00037349351947460295

"('р', 'б')",4.1769106209123344e-05

"('я',
'к')",0.00015541993008045895

"('я',
'е')",9.130920892226964e-05

"('з',
'и')",0.0004142912511207234

"('е',
'о')",0.0001743617340590149

"('ы',
'ж')",4.0312044364619044e-05

"('о',
'х')",0.0005386271951850906

"('х',
'и')",0.00023410126968369133

"('з',
'м')",0.0002923837434638634

"('ы',
'н')",0.00016367661386598332

"('э',
'х')",1.9913178541558803e-05

"('д',
'т')",0.00021467377842363392

"('в',
'ц')",1.3599243882040158e-05

"('р',
'з')",3.54551715496047e-05

"('й',
'ц')",4.662597902413769e-05

"('е',
'ь')",0.00045460329548534245

"('т',
'г')",1.4084931163541592e-05

"('б',
'ь')",6.896759397320366e-05

"('р',
'щ')",2.525573863807458e-05

"('ы',
'и')",5.973953562467641e-05

"('л',
'з')",5.8768161061673544e-05

"('я',
'ж')",0.00013696381338340445

"('з',
'у')",0.00034532365714751975

"('з',
'п')",3.0598298734590356e-05

"('п',
'к')",0.000100537267270796

89

"('м',
'п')",0.00012870712959788008

"('п',
'н')",0.00013599243882040157

"('ц',
'т')",3.3998109705100394e-06

"('д',
'п')",0.00010587982736731266

"('с',
'з')",2.622711320107745e-05

"('с',
'ж')",7.042465581770796e-05

"('к',
'к')",0.00016367661386598332

"('у',
'ф')",3.205536057909466e-05

"('ы',
'д')",0.00010053726727079689

"('ь',
'з')",0.00012385025678286572

"('б',
'с')",0.00012725006775337578

"('у',
'е')",0.0002321585205576858

"('з',
'я')",0.0001631909265844819

"('г',
'в')",1.3599243882040158e-05

"('ж',
'ж')",2.282730223056741e-05

"('и',
'ф')",5.5368350091163 5e-05

"('т',
'м')",7.431015406971944e-05

"('ь',
'о')",0.00013842087522790875

"('в',
'г')",2.0398865823060237e-05

"('ч',
'ь')",0.00019767472357108372

"('п', '
')",7.868133960323235e-05

"('ц',
'о')",0.00029724061627887775

"('с',
'г')",3.642654611260757e-05

"('б', '
')",0.0002098169056086196

"('л',
'ч')",0.00020058884726009235

"('б',
'ъ')",6.556778300269363e-05

"('ъ',
'я')",6.751053212869936e-05

"('т',
'щ')",9.22805834852725e-06

"('с',
'б')",6.216797203218359e-05

"('т',
'б')",6.362503387668789e-05

"('р',
'к')",0.0003642654611260757

"('б',
'ж')",1.262786931903729e-05

"('я',
'ч')",0.00012530731862737002

"('ы',
'г')",0.0001758187959035192

"('й',
'т')",0.0002748990013298118

"('и',
'ь')",0.00015493424279895753

"('я',
'р')",0.00011705063484184565

"('т',
'ю')",4.8568728150143425e-05

"('м',
'г')",6.896759397320366e-05

"('з',
'ж')",7.965271416623521e-05

"('ф',
'ф')",1.3113556600538725e-05

"('ь',
'д')",7.285309222521514e-05

"('к',
'д')",3.885498252011474e-06

"('й',
'з')",1.6513367571048762e-05

"('м',
'р')",5.488266280966207e-05

"('т',
'х')",1.6513367571048762e-05

"('ю',
'м')",4.468322989813195e-05

"('а',
'у')",0.000237986767935702

77

"('й', 'е')",2.6712800482578884e-05

"('т', 'п')",8.353821241824669e-05

"('н', 'з')",0.00010685120193031554

"('й', 'в')",1.9913178541558803e-05

"('а', 'ц')",0.00015687699192496325

"('х', 'е')",9.033783435926676e-05

"('у', 'у')",2.9626924171587487e-05

"('ю', 'з')",3.6912233394109e-05

"('л', 'в')",1.7970429415553066e-05

"('х', 'р')",0.00011510788571583991

"('т', 'ц')",9.859451814479115e-05

"('й', 'к')",0.0005352273842145805

"('ж', 'ь')",3.642654611260757e-05

"('м', 'э')",6.459640843969075e-05

"('е', 'ю')",0.000110736700182327

"('б', 'х')",3.351242242359896e-05

"('ч', 'л')",1.4084931163541592e-05

"('ф', 'р')",9.08235216407682e-05

"('ф', 'э')",1.1170807474532987e-05

"(' ', 'ю')",4.565460446113482e-05

"('д', 'м')",5.24542264021549e-05

"('н', 'в')",3.205536057909466e-05

"('о', 'ю')",0.00015493424279895753

"('я', 'г')",0.00010248001639680262

"('х', 'м')",4.128341892762191e-05

"('г', 'к')",0.00013939224979091162

"('и', 'у')",2.2341614949065975e-05

"('ю', 'г')",1.4084931163541592e-05

"('л', 'д')",4.516891717963338e-05

"('э', 'к')",7.576721591422374e-05

"('а', 'э')",9.22805834852725e-06

"('н', 'л')",0.00011365082387133561

"('я', 'и')",2.3798676793570278e-05

"('й', 'и')",1.0685120193031553e-05

"('ч', ' ')",0.00014764893357643

"('р', 'э')",7.23674049437137e-05

"('д', 'ч')",9.713745630028684e-06

"('й', 'п')",2.4770051356573147e-05

"('м', 'в')",7.285309222521513e-06

"('х', 'ь')",5.3425600965157766e-06

"('к', 'м')",3.3998109705100394e-06

"('й', 'х')",3.3998109705100394e-06

"('ц', 'к')",1.1656494756034422e-05

"('а', 'а')",6.313934659518645e-05

"('д', 'б')",3.351242242359896e-05

"('ж', 'с')",8.256683785524381e-06

"('м', 'щ')",3.885498252011474e-06

"('я', 'й')",4.0797731646120475e-05

"('б',

"('м')",2.7198487764080315e-05

"('э', 'м')",2.3798676793570278e-05

"('й', 'л')",3.642654611260757e-05

"('н', 'щ')",7.722427775872804e-05

"('ф', 'л')",3.8369295238613306e-05

"('п', 'т')",0.0001971890362895823

"('в', 'щ')",4.371185533512908e-06

"('ж', 'л')",8.742371067025816e-06

"('о', 'ь')",4.856872815014342e-06

"('л', 'г')",7.576721591422374e-05

"('з', 'ч')",7.285309222521513e-06

"('х', 'с')",3.351242242359896e-05

"('г', 'х')",1.4570618445043027e-06

"('з', 'с')",5.828247378017211e-06

"('а', 'о')",3.594085883110613e-05

"('ы', 'у')",1.602768028954733e-05

"('н', 'ф')",2.2341614949065975e-05

"('в', 'б')",8.256683785524381e-06

"('п', 'с')",4.711166630563912e-05

"('э', 'й')",8.548096154425242e-05

"('у', 'й')",0.00011947907124935283

"('к', 'ц')",3.3026735142097525e-05

"('л', 'б')",3.205536057909466e-05

"('з', 'ъ')",1.3599243882040158e-

05

"('щ',
'ь')",3.594085883110613e-05

"('г', 'з')",2.9141236890086055e-06

"('ю', 'ю')",3.739792067561044e-05

"('ь', 'в')",6.896759397320366e-05

"('у', 'ь')",8.256683785524381e-06

"('с', 'э')",3.0598298734590356e-05

"('у', 'ц')",5.3425600965157766e-06

"('м', 'ч')",4.662597902413769e-05

"('ь', 'щ')",3.3998109705100394e-06

"('ю', 'р')",4.128341892762191e-05

"('т', 'э')",0.0002782988123003218

"('ь', 'р')",1.4570618445043027e-06

"('п', 'э')",2.622711320107745e-05

"('м', 'д')",6.313934659518645e-06

"('ф', 'м')",2.428436407507171e-06

"('р', 'ц')",5.6825411935667806e-05

"(' ', 'й')",1.1656494756034422e-05

"('х', 'г')",4.856872815014342e-06

"('ф', 'ь')",6.313934659518645e-06

"('ю', 'ж')",3.351242242359896e-05

"('г', 'э')",1.942749126005737e-06

"('ы', 'щ')",8.256683785524381e-06

"('г', 'м')",6.313934659518645e-06

"('ь', 'ф')",2.0398865823060237e-05

"('б',

"('з')",3.3998109705100394e-06

"('б', 'ю')",1.262786931903729e-05

"('ф', 'ч')",3.885498252011474e-06

"('в', 'х')",2.3312989512068844e-05

"('н', 'х')",7.285309222521513e-06

"('е', 'э')",9.713745630028686e-07

"('й', 'у')",3.885498252011474e-06

"('ы', 'я')",7.285309222521513e-06

"('у', 'о')",1.4570618445043027e-05

"('ф', 'т')",1.4084931163541592e-05

"('ф', 'к')",3.885498252011474e-06

"('м', 'ц')",4.856872815014342e-06

"('р', 'ф')",1.2142182037535856e-05

"('х', 'х')",2.525573863807458e-05

"('к', 'э')",5.342560096515777e-05

"('э', 'р')",0.00015396286823595465

"('э', 'с')",7.770996504022948e-06

"('й', 'р')",2.428436407507171e-06

"('ю', 'к')",4.516891717963338e-05

"('з', 'т')",1.4570618445043027e-05

"('л', 'э')",1.5541993008045897e-05

"('ж', 'б')",7.770996504022948e-06

"('у', 'э')",9.908020542629259e-05

"('т', 'ф')",5.3425600965157766e-

06

"('ю', 'и')",6.799621941020079e-06

"('й', 'а')",5.3425600965157766e-06

"('й', 'ф')",4.371185533512908e-06

"('м', 'б')",5.24542264021549e-05

"('д', 'г')",9.713745630028684e-06

"('г', 'ф')",2.9141236890086055e-06

"('л', 'п')",2.1370240386063106e-05

"('ы', 'ц')",1.4570618445043027e-05

"('в', 'ъ')",3.885498252011474e-06

"('т', 'ъ')",2.428436407507171e-06

"('х', 'ч')",2.9141236890086055e-06

"('т', 'ж')",4.856872815014343e-07

"('б', 'ц')",1.4570618445043027e-06

"('м', 'з')",1.942749126005737e-06

"('п', 'б')",4.711166630563912e-05

"('ч', 'р')",7.770996504022948e-06

"('ь', 'п')",8.742371067025816e-06

"('ж', 'м')",3.885498252011474e-06

"('э', 'б')",2.9141236890086055e-06

"('и', 'э')",3.885498252011474e-06

"('л', 'ц')",9.713745630028686e-07

"('э', 'г')",7.285309222521513e-06

"('х', 'т')",1.942749126005737e-05

"('й',

| | |
|---|---|
| "('й')",3.885498252011474e-06 | |
| "('ю', 'х')",1.1170807474532987e-05 | |
| "('э', 'и')",4.856872815014343e-07 | |
| "('д', 'з')",1.3599243882040158e-05 | |
| "('к', 'г')",9.713745630028686e-07 | |
| "('ц', 'с')",4.856872815014343e-07 | |
| "('ж', 'г')",2.0398865823060237e-05 | |
| "('м', 'ф')",1.2142182037535856e-05 | |
| "('б', 'э')",6.313934659518645e-06 | |
| "('э', 'е')",9.713745630028686e-07 | |
| "('к', 'з')",1.5541993008045897e-05 | |
| "('ф', 'с')",4.856872815014342e-06 | |
| "('э', ' ')",2.9141236890086055e-06 | |
| "('а', 'ь')",4.371185533512908e-06 | |
| "('э', 'ч')",4.856872815014343e-07 | |
| "('э', 'я')",1.942749126005737e-06 | |
| "('ы', 'о')",3.885498252011474e-06 | |
| "('ж', 'э')",1.942749126005737e-06 | |
| "('г', 'ц')",1.942749126005737e-06 | |
| "('ю', 'ц')",8.256683785524381e-06 | |
| "('к', 'п')",2.428436407507171e-06 | |
| "('ч', 'в')",5.828247378017211e-06 | |
| "('ю', 'п')",1.2142182037535856e-05 | |
| "('н', 'м')",4.856872815014342e-06 | |

"('д',
'ъ')",1.1170807474532987e-05

"('ж',
'р')",7.770996504022948e-06

"('ч',
'э')",4.856872815014343e-07

"('ю',
'а')",9.22805834852725e-06

"('м',
'ю')",1.5056305726544461e-05

"('ф',
'ы')",7.770996504022948e-06

"('щ',
'о')",3.3998109705100394e-06

"('й',
'г')",3.3998109705100394e-06

"('ж',
'в')",2.9141236890086055e-06

"('н',
'п')",4.371185533512908e-06

"('д',
'э')",1.7970429415553066e-05

"('э',
'ф')",6.799621941020079e-06

"('э',
'в')",8.742371067025816e-06

"('х',
'к')",3.3998109705100394e-06

"('ж',
'з')",4.856872815014343e-07

"('э',
'з')",3.3998109705100394e-06

"('ж',
'п')",4.856872815014343e-07

"('ь',
'ж')",1.942749126005737e-06

"('ы',
'ь')",2.428436407507171e-06

"('ю',
'е')",9.713745630028686e-07

"('в',
'ю')",4.856872815014342e-06

"('й',
'я')",1.4570618445043027e-06

"('п',
'м')",1.3599243882040158e-05

"('л',
'х')",1.2142182037535856e-

05

"('в',
'й')",4.856872815014343e-07

"('э',
'э')",3.6912233394109e-05

"('ч',
'ч')",4.419754261663051e-05

"('щ',
'т')",4.856872815014343e-07

"('х',
'д')",3.3998109705100394e-06

"('в',
'ф')",9.713745630028686e-07

"('г',
'б')",3.885498252011474e-06

"('б',
'т')",2.9141236890086055e-06

"('з',
'ц')",1.942749126005737e-06

"('б',
'ч')",3.885498252011474e-06

"('ю',
'в')",8.256683785524381e-06

"('т',
'з')",9.713745630028686e-07

"('м',
'х')",1.942749126005737e-06

"('в',
'э')",5.828247378017211e-06

"('х',
'п')",4.856872815014343e-07

"('к',
'ф')",1.942749126005737e-06

"('м',
'ж')",9.713745630028686e-07

"('н',
'э')",4.856872815014342e-06

"('к',
'ю')",9.713745630028686e-07

"('п',
'д')",1.4570618445043027e-06

"('л',
'р')",2.428436407507171e-06

"('б',
'г')",8.256683785524381e-06

"('ч',
'х')",4.856872815014343e-07

"('п',

'з')",1.4570618445043027e-06

"('к',
'ч')",1.4570618445043027e-06

"('я',
'э')",4.856872815014343e-07

"('х',
'ъ')",2.9141236890086055e-06

"('л',
'щ')",1.942749126005737e-06

"('п',
'х')",1.4570618445043027e-06

"('с',
'щ')",9.713745630028686e-07

"('ь',
'х')",4.856872815014343e-07

"('к',
'ы')",4.856872815014343e-07

"('к',
'ь')",1.942749126005737e-06

"('ц',
'п')",4.856872815014343e-07

"('ч',
'с')",4.856872815014343e-07

"('д',
'ф')",9.713745630028686e-07

"('ф',
'б')",1.942749126005737e-06

"('ц',
'н')",1.4570618445043027e-06

"('к',
'х')",2.9141236890086055e-06

"('г',
'п')",9.713745630028686e-07

"('м',
'й')",4.856872815014343e-07

"('я',
'у')",6.313934659518645e-06

"('ъ', '
')",4.856872815014343e-07

"('п',
'ц')",1.4570618445043027e-06

"('ф',
'я')",1.942749126005737e-06

"('п',
'г')",9.713745630028686e-07

"('л',
'ъ')",4.856872815014343e-07

| | |
|---|---|
| "('ъ', 'п')" | 4.856872815014343e-07 |
| "('ы', 'ы')" | 4.856872815014343e-07 |
| "('ц', 'ц')" | 9.713745630028686e-07 |
| "('ч', 'м')" | 1.942749126005737e-06 |
| "('ф', 'н')" | 1.4570618445043027e-06 |
| "('я', 'а')" | 4.856872815014343e-07 |
| "('щ', 'р')" | 9.713745630028686e-07 |
| "('ч', 'ъ')" | 4.856872815014343e-07 |
| "('ч', 'ф')" | 4.856872815014343e-07 |
| "('п', 'ф')" | 4.856872815014343e-07 |
| "('ь', 'э')" | 4.856872815014343e-07 |
| "('ь', 'л')" | 9.713745630028686e-07 |
| "('ю', 'ф')" | 9.713745630028686e-07 |
| "('г', 'ь')" | 4.856872815014343e-07 |
| "('ф', 'ю')" | 4.856872815014343e-07 |
| "('я', 'о')" | 9.713745630028686e-07 |
| "('б', 'п')" | 4.856872815014343e-07 |

# Біграма без whitespaces

"('в',
'м')",0.0003851157460678273

"('м',
'а')",0.004375995078032904

"('а',
'л')",0.012262061872132178

"('л',
'е')",0.0055278199161199115

"('е',
'н')",0.009926123528223817

"('н',
'ь')",0.0013173776435612874

"('ь',
'к')",0.0017600259248648574

"('к',
'о')",0.009686600320303584

"('о',
'м')",0.00749977691465929

"('м',
'п')",0.0009058438966199049

"('П',
'р')",0.0060426773998111995

"('р',
'о')",0.00804809719945708

"('о',
'в')",0.00886353282642082

"('в',
'и')",0.004048411867200819

"('и',
'н')",0.005531929382922465

"('н',
'ц')",0.0003939217463590124

"('ц',
'и')",0.00047434988235183 61

"('и',
'а')",0.00040801134682490854

"('л',
'ь')",0.004569727084438976

"('ь',
'н')",0.0025731132850842792

"('н',
'о')",0.01157108438261719

"('м',
'г')",0.00035752361182211 41

"('г',
'о')",0.009066070833118075

"('о',
'р')",0.006810560625202538

"('о',
'д')",0.006564579683735435

"('д',
'к')",0.00040331481333627647

"('к',

'е')",0.001147715371284455

"('е',
'д')",0.003358608511057988

"('д',
'е')",0.006101971135105179

"('е',
'р')",0.008523621215181075

"('р',
'р')",0.0005952856196841112

"('р',
'и')",0.006877486227415544

"('и',
'м')",0.0036274850532821722

"('м',
'н')",0.002344744344199546

"('о',
'г')",0.006056767000277095

"('о',
'л')",0.007617190251875091

"('е',
'т')",0.0067624211569440595

"('т',
'н')",0.0015645327184005485

"('н',
'а')",0.012431724144409012

"('а',
'з')",0.005460894313906906

"('з',
'а')",0.0075473293162316895

"('а',
'д')",0.0030380701004588512

"('Д',
'с')",0.0003968570797894074

"('С',
'е')",0.003926889063182465

"('е',
'м')",0.005047599366907286

"('м',
'е')",0.004084810001737717

"('р',
'ы')",0.002076454868661441

"('ы',
'м')",0.0018064041930650986

"('п',
'о')",0.011308078507253795

"('Д',
'р')",0.0013572981782146597

"('о',
'с')",0.00963669965198687

"('с',
'т')",0.011619810917561748

"('т',
'к')",0.0012216857737304095

"('к',
'а')",0.009757048322633065

"('а',
'м')",0.003911625329344411

"('и',
'л')",0.008075689333702793

"('л',
'о')",0.00839094414412722

"('с',
'ь')",0.0037484207906144473

"('ь',
'с')",0.0020400567341245426

"('т',
'о')",0.01743118404305782

"('л',
'к')",0.00113890937099327

"('к',
'н')",0.0010719837687802633

"('н',
'у')",0.0037325699900903142

"('у',
'т')",0.0019502355311544549

"('т',
'ь')",0.006023891265856671

"('с',
'я')",0.004454074947281412

"('я',
'с')",0.0016308712539274762

"('с',
'к')",0.004588513218393504

"('к',
'р')",0.0028402286272502268

"('н',
'ы')",0.0036257238532239355

"('м',
'у')",0.002302475542801858

"('у',
'ж')",0.0012557356415229919

"('ж',
'а')",0.0016948615227100877

"('а',
'с')",0.006433076746053738

"('с',
'о')",0.0028167459598070666

"('м',
'ж')",8.218933605106071e-05

"('ж',
'и')",0.001504064849734411

"('и',
'в')",0.0044047613456507755

"('в',
'ы')",0.0026429742207276807

"('м',
'в')",0.000703305889922648

"('в', 'о')",0.006718391155488134

"('о', 'п')",0.0036533159874696484

"('п', 'л')",0.0010015357664507826

"('о', 'щ')",0.00029412040972558157

"('щ', 'е')",0.001624413520380607

"('н', 'и')",0.008580566683730738

"('и', 'е')",0.002884845695392231

"('д', 'а')",0.005213152172381565

"('а', 'п')",0.0033750463782682002

"('л', 'и')",0.009430052178487058

"('и', 'г')",0.0013220741770499196

"('д', 'ы')",0.0007860822926597878

"('ы', 'п')",0.0008324605608600292

"('к', 'и')",0.0037061519892167593

"('и', 'п')",0.0029018706292885223

"('в', 'з')",0.0007232661572493343

"('з', 'р')",0.00044382241467572786

"('с', 'л')",0.003360369711116225

"('е', 'л')",0.0068780732941016234

"('и', 'и')",0.0020523851345322017

"('и', 'ч')",0.002730447156953453

"('ч', 'т')",0.004393020011929195

"('о', 'к')",0.004097725468831455

"('н', 'е')",0.009734739788562062

"('е', 'п')",0.002783870225386642

"('р', 'е')",0.00659686835146978

"('д', 'в')",0.0011770687055884053

"('в', 'е')",0.005537212983097176

"('е', 'щ')",0.0008459630946398463

"('щ', 'а')",0.00041035961356922457

"('о', 'н')",0.013063407898630022

"('о', 'й')",0.004115924536099905

"('й', 'б')",0.0005265988174128675

"('б', 'е')",0.003722589856426971

"('ы', 'н')",0.0007831469592293928

"('а', 'р')",0.0035405991837424797

"('р', 'п')",0.0002207370739657059

"('р', 'н')",0.0013044621764675493

"('у', 'л')",0.0023787942119921288

"('л', 'с')",0.0029435523640001316

"('я', 'н')",0.0019326235305720848

"('е', 'в')",0.0036374651869455154

"('д', 'о')",0.0038928391953898826

"('а', 'я')",0.002410495813040395

"('с', 'и')",0.002115201269942655

"('л', 'а')",0.008044574799340606

"('в', 'л')",0.0007479229580646525

"('е', 'к')",0.002446893947577293

"('к', 'л')",0.0011072077699450036

"('ы', 'х')",0.0010766803022688952

"('х', 'д')",0.00020547334012765178

"('р', 'у')",0.003383265311873306

"('у', 'з')",0.0005166186837495245

"('з', 'е')",0.0004749369490379151

"('е', 'й')",0.002420475946703738

"('й', 'н')",0.0008483113613841623

"('в', 'н')",0.0015709904519474176

"('в', 'у')",0.0009528092315062252

"('у', 'ю')",0.0011224715037830577

"('ю', 'б')",0.0004091854801970665

"('б', 'и')",0.002646496620844155

"('и', 'т')",0.004657200020664747

"('т', 'в')",0.0029306368969063933

"('у', 'с')",0.001954932064643087

"('о', 'з')",0.002191519939132926

"('з', 'л')",0.0002888368095508705

"('м', 'и')",0.0037818835917209507

"('и', 'б')",0.0021328132705250255

"('б', 'о')",0.00287956209521752

"('в', 'д')",0.000803694293242158

"('и', 'о')",0.0023523762111185734

"('п', 'я')",0.0004091854801970665

"('я', 'т')",0.0020001361994711705

"('ь', 'л')",0.00021310520704667885

"('ь', 'е')",0.0012862631091991002

"('т', 'с')",0.0019326235305720848

"('я', 'к')",0.0009111274967946159

"('в', 'ь')",0.00026711534216594733

"('ь',

'и')",0.0009616152317974103

"('е','с')",0.005982796597831141

"('с','с')",0.0011888100393099854

"('д','н')",0.0020852608689526262

"('о','и')",0.002091718602499495

"('и','с')",0.005555999117051704

"('с','ч')",0.0003393245445536649

"('ч','е')",0.003612808386130197

"('е','з')",0.002200325939424111

"('а','ю')",0.00128039244233831

"('ю','т')",0.0006205294871855084

"('т','л')",0.0002982298765281346

"('л','ю')",0.0010003616330786246

"('ю','д')",0.0004984196164810753

"('д','и')",0.0034572357143192608

"('ь','п')",0.0009451773645871982

"('о','ж')",0.0026811335553228164

"('ж','д')",0.0008142614935915801

"('о','ч')",0.0030550950343551423

"('ч','н')",0.001032063234126891

"('р','а')",0.007589011050943299

"('а','н')",0.006034458466206093

"('о','я')",0.0012210987070443305

"('о','е')",0.0032094935727939207

"('е','ч')",0.0016009308529374468

"('а','ж')",0.0014007411129845061

"('ж',

'е')",0.003470738248099078

"('е','и')",0.0012134668401253036

"('е','е')",0.0024768343485673224

"('т','и')",0.004220422406221967

"('н','к')",0.0007220920238771763

"('н','г')",0.0003029264100167666

"('г','ч')",6.633853552692757e-05

"('ч','а')",0.0023746847451895756

"('ь','т')",0.0006399026878261155

"('т','е')",0.005971055264109561

"('г','л')",0.0018662849950451571

"('а','в')",0.004420612146174908

"('в','а')",0.005804915391949202

"('и','я')",0.0013666912451919238

"('я','г')",0.00043090694758198976

"('д','г')",7.397040244595464e-05

"('е','ф')",0.0001485278715779883

"('ф','е')",0.00014148307134504023

"('л','я')",0.0018011205928903876

"('а','е')",0.0021756691386087927

"('ф','о')",0.00033697627780934894

"('н','н')",0.0034366883803064957

"('х','з')",8.982120297008778e-05

"('з','в')",0.0010954664362234235

"('п','е')",0.0020242059336004095

"('р','в')",0.0005283600174711046

"('я','и')",0.0008213062938245281

"('н','т')",0.0009575057649948573

"('р','л')",0.0006487086881173007

"('я','ч')",0.0005130962836330504

"('и','ю')",0.0002976428098420556

"('ю','н')",0.00023013014094297

"('ь','г')",0.0002641800087355523

"('а','б')",0.0022484654076825893

"('н','х')",0.00011330387041324798

"('х','э')",0.0002759213424571324

"('э','н')",0.0006669077553857498

"('н','с')",0.0015275475171775711

"('п','а')",0.002299540209371463

"('т','г')",0.00015498560512485735

"('л','л')",0.001984285398947037

"('л','д')",0.00047845934915438914

"('н','б')",0.0005430366846230797

"('б','р')",0.0014025023130427431

"('о','б')",0.005313540575701075

"('е','ж')",0.0009369584309820921

"('т','д')",0.0004440948136180685

"('д','ь')",0.00046026028188594

"('ь','я')",0.00048139468258478417

"('я','в')",0.0014588607149063277

"('а', 'г')",0.001262193375069861

"('а', 'о')",0.0019214692635365837

"('и', 'з')",0.0032846381086120333

"('з', 'и')",0.0005900020195094001

"('з', 'н')",0.0018703944618477103

"('и', 'й')",0.0010690484353498683

"('й', 'р')",0.0004044889467084345

"('т', 'а')",0.006341494343025413

"('г', 'г')",9.627893651695683e-05

"('у', 'д')",0.002216176739948244

"('в', 'б')",0.00037396147903232625

"('б', 'а')",0.00115652137157564

"('е', 'г')",0.004870305227711426

"('а', 'к')",0.006771227157235244

"('а', 'т')",0.0059675328639930865

"('д', 'ж')",0.0006592758884667227

"('ж', 'о')",0.00031231947699403073

"('р', 'д')",0.0006534052216059326

"('а', 'и')",0.0016009308529374468

"('и', 'д')",0.002881910361961836

"('а', 'у')",0.0008265898939992392

"('и', 'ц')",0.0011383223043071908

"('ц', 'е')",0.0009616152317974103

"('л', 'т')",0.0006035045532892172

"('ч', 'и')",0.002769193558234667

"('и', 'щ')",0.000159682138613489

4

"('в', 'т')",0.000818958027080212

"('ь', 'в')",0.0012205116403582515

"('л', 'ы')",0.0011758945722162473

"('ы', 'е')",0.0016009308529374468

"('в', 'р')",0.0009475256313315143

"('а', 'щ')",0.0003921605463007754

"('г', 'у')",0.0007162213570163862

"('т', 'р')",0.003996749998825867

"('х', 'г')",0.00012269693739051207

"('т', 'я')",0.0008007589598117629

"('я', 'д')",0.0012481037746039647

"('ю', 'л')",0.00011036853698285296

"('е', 'а')",0.00041212081362746155

"('ю', 'щ')",0.0006610370885249598

"('я', 'б')",0.0006510569548616167

"('а', 'а')",0.00028355320937615945

"('ь', 'б')",0.0006222906872437454

"('м', 'о')",0.005294754441746547

"('е', 'о')",0.0018058171263790196

"('о', 'т')",0.010044123932125698

"('р', 'с')",0.00043090694758198976

"('м', 'э')",0.00023482667443160203

"('э', 'д')",0.0008829482958628237

"('д', 'д')",0.0010684613686637893

"('с', 'м')",0.0017518069912597512

"('р', 'т')",0.0009962521662760717

"('и', 'к')",0.0041294270698797216

"('а', 'х')",0.0013619947117032918

"('х', 'о')",0.002684068888753211

"('к', 'с')",0.0007085894900973591

"('т', 'т')",0.0005923502862537161

"('г', 'а')",0.0015316569839801243

"('ь', 'р')",0.0002759213424571324

"('т', 'у')",0.0015351793840965983

"('у', 'а')",0.0002994040099002926

"('л', 'ч')",0.0009698341654025164

"('ч', 'у')",0.0008753164289437966

"('м', 'я')",0.0006334449542792465

"('б', 'д')",1.8786133954528164e-05

"('у', 'г')",0.0014330297807188515

"('г', 'з')",3.404986779258229e-05

"('м', 'ы')",0.001147715371284455

"('ы', 'к')",0.0004960713497367592

"('н', 'я')",0.0015610103182840745

"('я', 'я')",0.0002565481418165252

"('я', 'э')",0.00019314493971999268

"('э', 'п')",1.0567200349422091e-05

"('п', 'и')",0.0012046608398341185

| | | |
|---|---|---|
| "('г', 'б')",8.16022693649817e-05 | "('ы', 'в')",0.001492323516012831 | "('б', 'ы')",0.00538164031128624 |
| "('о', 'о')",0.002664108621426525 | "('у', 'в')",0.001732433790619144 | "('ы', 'л')",0.0038734659947492756 |
| "('а', 'ч')",0.0016884037891632187 | "('в', 'я')",0.0003099712102497147 | "('у', 'к')",0.0018780263287667372 |
| "('у', 'я')",0.00017377173907938455 | "('г', 'и')",0.00080839082673079 | "('ц', 'н')",3.522400116474031e-05 |
| "('я', 'ф')",4.2855868083767374e-05 | "('б', 'н')",0.0003563494784499561 | "('б', 'л')",0.0009651376319138843 |
| "('р', 'м')",0.00036222014531074614 | "('у', 'и')",0.0007138730902720702 | "('с', 'д')",0.0005946985529980322 |
| "('у', 'ц')",1.5850800524133136e-05 | "('я', 'м')",0.0008518337615006364 | "('з', 'г')",0.0004250362807211997 |
| "('ц', 'в')",0.00012504520413482808 | "('м', 'к')",0.0006821714892238039 | "('д', 'х')",7.044800232948062e-05 |
| "('с', 'в')",0.001712473523292458 | "('с', 'у')",0.0008283510940574762 | "('х', 'в')",0.0005882408194511631 |
| "('и', 'х')",0.0019766535320280103 | "('н', 'в')",0.0006528181549198536 | "('ы', 'й')",0.001840454060857681 |
| "('х', 'л')",0.00031525481042442576 | "('ы', 'р')",0.0004931360163063643 | "('й', 'у')",0.00022425947408217993 |
| "('о', 'ц')",0.00014794080489190928 | "('в', 'г')",0.00043266814764022674 | "('з', 'п')",0.0002547869417582882 |
| "('л', 'н')",0.0015281345838636501 | "('е', 'ц')",0.00037454854571840524 | "('б', 'у')",0.0012539744414647549 |
| "('ц', 'у')",0.00020312507338333575 | "('ц', 'а')",0.0007778633590546818 | "('к', 'к')",0.0005418625512509217 |
| "('у', 'н')",0.001482930449035567 | "('р', 'ю')",0.00011330387041324798 | "('я', 'п')",0.0010672872352916313 |
| "('п', 'ч')",1.7612000582370154e-05 | "('ю', 'с')",0.0003810067926527243 | "('ь', 'у')",0.0002606576086190783 |
| "('т', 'м')",0.0003311056109485589 | "('г', 'с')",0.0001256322708209071 | "('у', 'х')",0.0005324694842736576 |
| "('и', 'у')",0.0007708185588217337 | "('д', 'у')",0.0021198978034312876 | "('л', 'п')",0.0008535949615588734 |
| "('с', 'п')",0.002409321679668237 | "('л', 'ж')",0.0004502801482225969 | "('с', 'н')",0.0018187325934727577 |
| "('в', 'п')",0.0008600526951057424 | "('й', 'с')",0.0014342039140910095 | "('в', 'с')",0.0036227885197935403 |
| "('г', 'н')",0.0004737628156657571 | "('щ', 'и')",0.001017386566974916 | "('л', 'у')",0.001727150190444433 |
| "('ж', 'н')",0.0009410678977846452 | "('д', 'ц')",0.0003264090774599268 | "('м', 'л')",0.0003334538776928749 |
| "('ь', 'э')",0.0003387374778675859 | "('м', 'ь')",9.27565364004828e-05 | "('т', 'ч')",0.00040859841351098753 |
| "('э', 'т')",0.003486001981937132 | "('б', 'щ')",9.862720326127286e-05 | "('м', 'с')",0.0009657246985999634 |
| "('м', 'ч')",0.0003798321458931163 | "('е', 'б')",0.0027057903561381346 | "('т', |

| | | |
|---|---|---|
| 'п')",0.000572977085613109 | "('р', 'я')",0.0012105315066949084 | "('п', 'п')",0.00025009040826965616 |
| "('ю', 'к')",0.0002859014761204755 | "('с', 'б')",0.0002682894755381053 | "('ы', 'з')",0.00031525481042442576 |
| "('о', 'ф')",0.00017201053902114 85 | "('у', 'м')",0.0019337976639442428 | "('э', 'д')",0.0011101431033753986 |
| "('и', 'р')",0.0015968213861348938 | "('м', 'д')",0.00043560348107062177 | "('ь', 'ю')",0.0005113350835748134 |
| "('и', 'ж')",0.0004385388145010168 | "('н', 'ч')",0.0003686778788576152 | "('ю', 'г')",9.040826965616679e-05 |
| "('у', 'у')",0.0001608562719856474 | "('о', 'у')",0.0009569186983087783 | "('я', 'ц')",6.692560221300658e-05 |
| "('в', 'э')",0.0002994040099002926 | "('х', 'а')",0.0007074153567252011 | "('х', 'у')",0.00024539387478102415 |
| "('к', 'ж')",0.00011917453727403804 | "('п', 'ю')",6.457733546869056e-06 | "('я', 'з')",0.0007426393578899414 |
| "('ю', 'а')",4.8139468258478414e-05 | "('ю', 'о')",0.00020782160687196781 | "('м', 'б')",0.0005160316170634455 |
| "('ы', 'б')",0.0006399026878261155 | "('х', 'п')",0.00037396147903232625 | "('р', 'ь')",0.0006516440215476956 |
| "('а', 'й')",0.0012422331077431748 | "('щ', 'у')",0.00022015000727962692 | "('д', 'я')",0.0003722002789740892 |
| "('й', 'о')",0.0005541909516585808 | "('у', 'щ')",0.0003716132122880102 | "('к', 'м')",0.00024715507483926113 |
| "('э', 'л')",0.00011036853698285296 | "('м', 'т')",0.0003915734796146964 | "('п', 'ь')",7.162213570163862e-05 |
| "('к', 'т')",0.0010984017696538185 | "('у', 'ч')",0.0014330297807188515 | "('к', 'э')",0.0001943190730921507 |
| "('о', 'э')",0.0007555548249836795 | "('с', 'а')",0.0015287216505497294 | "('я', 'х')",0.00030703587681931967 |
| "('р', 'г')",0.0001485278715779883 | "('у', 'б')",0.001528134583863650 1 | "('л', 'в')",0.000918172297027564 |
| "('е', 'у')",0.0006692560221300658 | "('у', 'р')",0.0006909774895149889 | "('т', 'б')",0.0005242505506685515 |
| "('ь', 'м')",0.0006833456225959619 | "('б', 'я')",0.0006363802877096415 | "('н', 'ж')",5.9293735293979515e-05 |
| "('ь', 'ч')",0.0008160226936498171 | "('й', 'к')",0.001279218308966152 | "('д', 'л')",0.0006827585559098829 |
| "('ч', 'о')",0.0001502890716362253 | "('я', 'щ')",0.00034225987798405994 | "('у', 'п')",0.0013027009764093123 |
| "('в', 'ж')",7.220920238771763e-05 | "('щ', 'к')",5.870666860790051e-07 | "('х', 'р')",0.0002448068080949451 |
| "('о', 'а')",0.00024598094146710314 | "('к', 'з')",0.0001502890716362253 | "('в', 'в')",0.0006164200203829553 |
| "('х', 'б')",0.00020547334012765178 | "('н', 'п')",0.0010432175011623921 | "('й', 'д')",0.000579434819159978 |
| "('л', 'р')",0.0005559521517168178 | "('г', 'р')",0.001147128304598376 | "('к', 'п')",0.0004978325497949963 |

| Bigram | Probability |
|---|---|
| "('н', 'ю')" | 0.00017729413919585952 |
| "('т', 'ы')" | 0.0021721467384923187 |
| "('к', 'у')" | 0.0021744950052366347 |
| "('ц', 'д')" | 1.2915467093738112e-05 |
| "('в', 'ч')" | 0.00020429920675549376 |
| "('г', 'д')" | 0.0019238175302808997 |
| "('я', 'о')" | 0.0007567289583558375 |
| "('ь', 'о')" | 0.0010931181694791075 |
| "('ы', 'т')" | 0.0012580839082673078 |
| "('ь', 'д')" | 0.000578847752473899 |
| "('с', 'х')" | 0.00030410054338892464 |
| "('е', 'х')" | 0.0008535949615588734 |
| "('ч', 'к')" | 0.000581196019218215 |
| "('н', 'д')" | 0.0006516440215476956 |
| "('з', 'б')" | 0.00025889640856084124 |
| "('д', 'ю')" | 5.166186837495245e-05 |
| "('ю', 'й')" | 5.166186837495245e-05 |
| "('й', 'м')" | 0.0005125092169469714 |
| "('м', 'ц')" | 2.641800087355523e-05 |
| "('ж', 'ч')" | 4.872653494455742e-05 |
| "('с', 'р')" | 0.00030703587681931967 |
| "('к', 'д')" | 0.00024950334158357716 |
| "('ы', 'с')" | 0.0011917453727403804 |
| "('ф', 'а')" | 0.0001632045387299634 |
| "('ы', 'д')" | 0.0004138820136856986 |
| "('й', 'э')" | 0.0001033237367499049 |
| "('х', 'н')" | 0.0005342306843318947 |
| "('с', 'ю')" | 0.00021251814036059985 |
| "('у', 'о')" | 0.0005001808165393123 |
| "('х', 'ж')" | 3.698520122297732e-05 |
| "('х', 'к')" | 0.00023952320792023407 |
| "('к', 'в')" | 0.0005412754845648427 |
| "('а', 'э')" | 0.0005019420165975493 |
| "('ь', 'ц')" | 0.00019373200640607167 |
| "('ь', 'а')" | 0.00013502533779817118 |
| "('с', 'ъ')" | 5.5771335177505486e-05 |
| "('ъ', 'е')" | 9.451773645871982e-05 |
| "('й', 'в')" | 0.0006293354874766934 |
| "('р', 'ч')" | 0.00012739347087914441 |
| "('ь', 'ф')" | 6.692560221300658e-05 |
| "('р', 'х')" | 0.0002770954758292904 |
| "('ю', 'п')" | 0.00023717494117591806 |
| "('ю', 'ч')" | 0.00034049867792582296 |
| "('м', 'р')" | 0.0003193642772269788 |
| "('л', 'з')" | 0.00032875734420424285 |
| "('с', 'э')" | 0.00011976160396011703 |
| "('б', 'в')" | 5.107480168887344e-05 |
| "('г', 'е')" | 0.0007672961587052596 |
| "('л', 'б')" | 0.0009387196310403291 |
| "('ж', 'з')" | 8.806000291185077e-06 |
| "('р', 'ж')" | 0.0003792450792070373 |
| "('я', 'у')" | 0.0002999910765863716 |
| "('й', 'т')" | 0.0006422509545704315 |
| "('й', 'а')" | 0.00016496573878820042 |
| "('с', 'ф')" | 3.874640128121434e-05 |
| "('ц', 'ы')" | 0.00023893614123415507 |
| "('ы', 'у')" | 0.000230717207629049 |
| "('л', 'м')" | 0.0005271858840989466 |
| "('а', 'ф')" | 0.00021662760716315287 |
| "('ф', 'у')" | 0.0001391348046007242 |
| "('й', 'ч')" | 0.0004708274822353621 |
| "('я', 'л')" | 0.0013385120442601316 |
| "('е', 'я')" | 0.0004473448147922019 |
| "('з', 'з')" | 0.0002084086735580468 |
| "('к', 'ч')" | 0.00014324427140327724 |
| "('й', 'п')" | 0.000803107226556079 |
| "('к', 'б')" | 0.0005007678832253913 |
| "('ь', 'з')" | 0.0004872653494445742 |
| "('й', 'и')" | 0.0005125092169469714 |
| "('й', 'л')" | 0.00017083640564899047 |
| "('ж', 'к')" | 0.00017788120588193855 |
| "('ю', | |

"('э')",5.5771335177505486e-05

"('я', 'р')",0.0004256233474072787

"('н', 'з')",0.00039039934624253837

"('л', 'э')",0.00038570281275390636

"('ж', 'у')",0.0002812049426318434

"('ы', 'э')",9.569186983087783e-05

"('л', 'х')",0.00011800040390188002

"('ж', 'б')",2.2308534071002193e-05

"('х', 'т')",0.0001843389394288076

"('ы', 'г')",0.0003217125439712948

"('з', 'ф')",8.806000291185077e-06

"('ф', 'и')",0.0002541998750722092

"('з', 'т')",0.00015322440506662034

"('х', 'ф')",2.7005067559634234e-05

"('в', 'к')",0.0008935154962122458

"('б', 'б')",0.00014676667151975126

"('м', 'м')",0.0005089868168304975

"('з', 'о')",0.0007937141595788148

"('ю', 'в')",0.0002066474734998098

"('ж', 'в')",2.4656800815318215e-05

"('ж', 'п')",1.937320064060717e-05

"('й', 'ж')",0.00012034867064619604

"('п', 'ы')",0.00036515547874114117

"('т', 'ж')",8.453760279537673e-

05

"('п', 'у')",0.0008682716287108486

"('б', 'к')",0.00017435880576546452

"('л', 'ф')",4.1094668025530356e-05

"('ф', 'п')",8.806000291185077e-06

"('з', 'к')",0.0004021406799641185

"('ы', 'ч')",0.00026652827547986833

"('е', 'э')",0.0003528270783334806

"('ы', 'а')",0.00042444921403512066

"('н', 'р')",0.0007537936249254426

"('и', 'э')",0.0004890265495038112

"('я', 'ю')",0.00010214960337774688

"('к', 'г')",0.00014617960483367227

"('щ', 'н')",6.222906872437454e-05

"('г', 'т')",7.397040244595464e-05

"('з', 'ь')",0.00021016987361628382

"('ю', 'и')",0.0001714234723350695

"('с', 'ы')",0.0004667180154328103

"('с', 'ц')",5.401013511926847e-05

"('т', 'х')",7.162213570163862e-05

"('з', 'ы')",0.0004514542815947549

"('х', 'и')",0.0005224893506103145

"('р', 'б')",0.00011917453727403804

"('о', 'х')",0.0008588785617335844

"('й', 'з')",0.00027063774228242135

"('я', 'е')",0.0004027277466501975

"('с', 'з')",0.0001033237367499049

"('х', 'ч')",7.044800232948062e-05

"('щ', 'э')",1.1741333721580102e-06

"('х', 'е')",0.0001737717390793855

"('д', 'п')",0.00023893614123415507

"('ы', 'ж')",7.98410693067447e-05

"('й', 'х')",8.336346942321873e-05

"('з', 'м')",0.0004379517478149378

"('э', 'х')",2.4069734129239207e-05

"('л', 'г')",0.0004743498823518361

"('д', 'т')",0.0003334538776928749

"('в', 'ц')",5.048773500279444e-05

"('ь', 'щ')",8.806000291185077e-06

"('р', 'з')",7.044800232948062e-05

"('й', 'ц')",9.627893651695683e-05

"('ы', 'о')",0.00044030001455925384

"('й', 'ф')",5.518426849142648e-05

"('ж', 'т')",7.044800232948061e-06

"('е', 'ь')",0.0005494944181699487

"('з', 'с')",0.00019138373966175567

"('ы', 'и')",0.00045556374839730797

"('б', 'ь')",8.336346942321873e-

05
"('р', 'щ')",3.111453436218727e-05
"('я', 'ж')",0.0002483292082114192
"('з', 'у')",0.00045615081508338696
"('ь', 'х')",8.571173616753475e-05
"('п', 'к')",0.00013091587099561813
"('п', 'н')",0.00016790107221859545
"('м', 'з')",0.0002066474734998098
"('ц', 'т')",1.4676667151975127e-05
"('ф', 'д')",2.9353334303950253e-06
"('ж', 'с')",2.641800087355523e-05
"('т', 'з')",0.0001596821386134894
"('с', 'г')",0.00013737360454248718
"('с', 'ж')",0.00011212973704108997
"('у', 'ф')",5.9880801980058517e-05
"('в', 'х')",8.629880285361374e-05
"('б', 'с')",0.00016496573878820042
"('у', 'е')",0.00039568294641724943
"('з', 'я')",0.0002213241406517849
"('г', 'в')",9.040826965616679e-05
"('ц', 'з')",9.980133663343087e-06
"('ю', 'м')",0.0001608562719856474
"('ж', 'ж')",2.8179200931792244e-05
"('и', 'ф')",0.00018022947262625455

"('ю', 'ж')",7.631866919027066e-05
"('х', 'м')",0.00020429920675549376
"('ж', 'м')",1.1741333721580101e-05
"('ч', 'ь')",0.00023893614123415507
"('ц', 'б')",2.524386750139722e-05
"('х', 'с')",0.0003698520122297732
"('ц', 'о')",0.00039744414647548647
"('б', 'п')",1.1741333721580101e-05
"('ю', 'у')",3.404986779258229e-05
"('б', 'ъ')",7.925400262066569e-05
"('ъ', 'я')",8.16022693649817e-05
"('я', 'а')",9.510480314479882e-05
"('н', 'м')",0.00022602067414041695
"('в', 'щ')",1.7612000582370154e-05
"('т', 'щ')",1.2328400407659108e-05
"('ю', 'р')",0.00016848813890467447
"('р', 'к')",0.000580608952532136
"('б', 'ж')",1.5850800524133136e-05
"('и', 'ь')",0.00018727427285920262
"('к', 'я')",7.338333575987563e-05
"('т', 'ю')",5.9880801980058517e-05
"('г', 'п')",0.00012152280401835406
"('з', 'ч')",5.166186837495245e-05
"('з', 'ж')",0.00010273667006382589

"('й', 'г')",0.00026711534216594733
"('т', 'э')",0.0005130962836330504
"('н', 'э')",6.809973558516458e-05
"('ф', 'ф')",1.643786721021214e-05
"('д', 'м')",0.0001268064041930651
"('ж', 'я')",2.9353334303950253e-06
"('б', 'г')",1.3502533779817117e-05
"('н', 'л')",0.00020429920675549376
"('ж', 'х')",2.3482667443160205e-06
"('х', 'ц')",7.631866919027066e-06
"('ю', 'е')",5.518426849142648e-05
"('й', 'е')",0.0001837518727427286
"('ж', 'г')",2.9940400990029258e-05
"('м', 'х')",9.745306988911484e-05
"('а', 'ц')",0.00023247840768728602
"('ю', 'з')",0.00010391080343598391
"('т', 'ц')",0.00013032880430953914
"('ж', 'ь')",4.4030001455925384e-05
"('е', 'ю')",0.0001379606712285662
"('б', 'х')",4.1094668025530356e-05
"('д', 'б')",9.862720326127286e-05
"('з', 'э')",5.224893506103145e-05
"('ч', 'л')",2.1134400698844183e-05
"('ф',

"('р')",0.00011271680372716898
"('ф',
'э')",1.526373383805413e-05
"('ы',
'я')",6.281613541045355e-05
"('й',
'ю')",5.283600174711046e-06
"('о',
'ю')",0.00019079667297567664
"('г',
'к')",0.00019960267326686173
"('з',
'ц')",7.044800232948061e-06
"('г',
'э')",1.526373383805413e-05
"('э',
'к')",9.158240302832479e-05
"('ч',
'ж')",1.7612000582370152e-06
"('ю',
'х')",2.641800087355523e-05
"('ч',
'ф')",4.109466802553035e-06
"('х',
'х')",5.401013511926847e-05
"('р',
'ф')",2.4069734129239207e-05
"('р',
'э')",0.00010684613686637892
"('д',
'ч')",4.5791201514162395e-05
"('ф',
'л')",4.6965334886320404e-05
"('х',
'ь')",6.457733546869056e-06
"('з',
'х')",1.8786133954528164e-05
"('б',
'э')",0.00011154267035501097
"('к',
'х')",6.751266889908559e-05
"('ц',
'к')",3.170160104826627e-05
"('й',
'я')",9.21694697144038e-05
"('у',
'э')",0.0002612446753051573

"('ю',
'я')",5.518426849142648e-05
"('м',
'щ')",1.2915467093738112e-05
"('я',
'й')",5.107480168887344e-05
"('б',
'м')",3.522400116474031e-05
"('г',
'м')",2.1134400698844183e-05
"('э',
'м')",2.876626761787125e-05
"('ы',
'ф')",1.1741333721580101e-05
"('ь',
'ж')",5.635840186358449e-05
"('н',
'щ')",9.451773645871982e-05
"('в',
'ф')",4.050760133945135e-05
"('п',
'т')",0.00024069734129239208
"('ж',
'л')",1.3502533779817117e-05
"('о',
'ь')",5.8706668607900505e-06
"('д',
'ф')",4.696533488632041e-06
"('г',
'х')",4.696533488632041e-06
"('х',
'я')",2.759213424571324e-05
"('м',
'ф')",3.992053465337235e-05
"('н',
'ф')",3.404986779258229e-05
"('п',
'с')",7.162213570163862e-05
"('э',
'й')",0.0001033237367499049
"('д',
'з')",6.399026878261155e-05
"('у',
'й')",0.00014441840477543526
"('к',
'ц')",5.459720180534747e-05
"('к',

"('ф')",2.4069734129239207e-05
"('к',
'щ')",7.044800232948061e-06
"('з',
'ъ')",1.643786721021214e-05
"('щ',
'ь')",4.3442934769846375e-05
"('ю',
'ю')",4.5791201514162395e-05
"('л',
'ц')",1.1154267035501096e-05
"('у',
'ь')",9.980133663343087e-06
"('й',
'щ')",8.806000291185077e-06
"('п',
'э')",3.228866773434528e-05
"('д',
'э')",5.5771335177505486e-05
"('ф',
'м')",3.5224001164740305e-06
"('р',
'ц')",6.92738689573226e-05
"('ц',
'с')",3.639813453689832e-05
"('ф',
'ь')",7.631866919027066e-06
"('х',
'ю')",2.3482667443160205e-06
"('п',
'д')",3.5224001164740305e-06
"('ы',
'щ')",1.1154267035501096e-05
"('м',
'ю')",2.2308534071002193e-05
"('ц',
'р')",8.806000291185077e-06
"('б',
'з')",8.806000291185077e-06
"('б',
'ю')",1.526373383805413e-05
"('т',
'ф')",3.111453436218727e-05
"('ф',
'ч')",4.696533488632041e-06
"('ч',
'п')",2.1134400698844183e-05

"('ф', 'т')",1.8786133954528164e-05

"('ц', 'п')",3.522400116474031e-05

"('ф', 'к')",5.8706668607900505e-06

"('ч', 'р')",1.526373383805413e-05

"('э', 'р')",0.00018668720617312363

"('э', 'с')",9.393066977264082e-06

"('ч', 'з')",7.631866919027066e-06

"('ч', 'в')",2.0547334012765178e-05

"('х', 'щ')",6.457733546869056e-06

"('ч', 'ч')",5.459720180534747e-05

"('г', 'ф')",6.457733546869056e-06

"('ы', 'ц')",2.2895600757081197e-05

"('в', 'ъ')",4.696533488632041e-06

"('т', 'ъ')",2.9353334303950253e-06

"('ю', 'ц')",1.9960267326686173e-05

"('ц', 'г')",9.393066977264082e-06

"('б', 'ц')",1.7612000582370152e-06

"('п', 'б')",5.9293735293979515e-05

"('ж', 'э')",4.696533488632041e-06

"('ф', 'в')",2.9353334303950253e-06

"('э', 'б')",3.5224001164740305e-06

"('ч', 'с')",1.5850800524133136e-05

"('ц', 'э')",5.283600174711046e-06

"('ч',

'б')",1.4676667151975127e-05

"('э', 'г')",8.806000291185077e-06

"('ф', 'с')",1.3502533779817117e-05

"('ю', 'ф')",1.7612000582370154e-05

"('б', 'т')",8.21893360510607e-06

"('з', 'щ')",2.9353334303950253e-06

"('й', 'й')",4.696533488632041e-06

"('ц', 'м')",1.2915467093738112e-05

"('э', 'и')",5.870666860790051e-07

"('г', 'я')",1.4089600465896122e-05

"('л', 'щ')",7.631866919027066e-06

"('э', 'е')",1.1741333721580102e-06

"('э', 'о')",5.870666860790051e-07

"('а', 'ь')",5.283600174711046e-06

"('ц', 'л')",1.1154267035501096e-05

"('э', 'ч')",5.870666860790051e-07

"('э', 'я')",2.3482667443160205e-06

"('г', 'ц')",3.5224001164740305e-06

"('д', 'ъ')",1.3502533779817117e-05

"('ж', 'р')",1.1741333721580101e-05

"('ч', 'э')",2.9353334303950253e-06

"('ф', 'ы')",9.393066977264082e-06

"('щ', 'о')",4.109466802553035e-06

"('ч', 'х')",9.980133663343087e-06

"('э', 'ф')",8.21893360510607e-06

"('э', 'в')",1.1154267035501096e-05

"('п', 'в')",6.457733546869056e-06

"('э', 'з')",4.109466802553035e-06

"('в', 'ю')",9.980133663343087e-06

"('ч', 'г')",2.3482667443160205e-06

"('ф', 'н')",4.109466802553035e-06

"('ы', 'ь')",2.9353334303950253e-06

"('ц', 'ч')",7.044800232948061e-06

"('п', 'м')",2.0547334012765178e-05

"('п', 'з')",3.5224001164740305e-06

"('в', 'й')",5.870666860790051e-07

"('э', 'э')",4.520413482808339e-05

"('ц', 'я')",6.457733546869056e-06

"('щ', 'т')",5.870666860790051e-07

"('ф', 'б')",8.806000291185077e-06

"('б', 'ч')",5.8706668607900505e-06

"('ц', 'х')",4.109466802553035e-06

"('к', 'ю')",3.5224001164740305e-06

"('ф', 'з')",5.870666860790051e-07

"('г', 'ж')",2.3482667443160205e-06

"('с', 'щ')",1.7612000582370152e-06

"('ч', 'м')",4.109466802553035e-06

"('ц', 'ж')",1.7612000582370152e-

06

"('м', 'й')",1.1741333721580102e-06

"('ь', 'й')",1.1741333721580102e-06

"('ц', 'й')",5.870666860790051e-07

"('щ', 'д')",5.870666860790051e-07

"('ц', 'ц')",1.7612000582370152e-06

"('х', 'ъ')",3.5224001164740305e-06

"('щ', 'п')",1.1741333721580102e-06

"('п', 'х')",1.7612000582370152e-06

"('ч', 'д')",4.696533488632041e-06

"('к', 'ы')",5.870666860790051e-07

"('к', 'ь')",2.3482667443160205e-06

"('ы', 'ю')",5.870666860790051e-07

"('с', 'й')",5.870666860790051e-07

"('ъ', 'и')",5.870666860790051e-07

"('п', 'ц')",1.7612000582370152e-06

"('щ', 'в')",1.1741333721580102e-06

"('п', 'г')",2.9353334303950253e-06

"('ф', 'я')",2.3482667443160205e-06

"('ф', 'г')",5.870666860790051e-07

"('л', 'ъ')",5.870666860790051e-07

"('ъ', 'п')",5.870666860790051e-07

"('ы', 'ы')",5.870666860790051e-07

"('щ', 'р')",1.1741333721580102e-06

"('ч', 'я')",5.870666860790051e-07

"('ч', 'ъ')",5.870666860790051e-07

"('щ', 'с')",5.870666860790051e-07

"('п', 'ф')",5.870666860790051e-07

"('к', 'й')",5.870666860790051e-07

"('г', 'ь')",5.870666860790051e-07

"('ф', 'ю')",5.870666860790051e-07

"('г', 'щ')",5.870666860790051e-07

"('п', 'ж')",5.870666860790051e-07

**Ентропія:**

| | |
|---|---|
| H1 text with spaces: | 4.334409617919068 |
| H2 text with spaces: | 3.9639890332524246 |
| H1 text without spaces: | 4.436769388874901 |
| H2 text without spaces: | 4.141642277381101 |

**Оцінки для H(10), H(20), H(30):**

Лабороторная работа №1      ×

Произольная часть текста:
закону_тяготения_и_не_может_пойти_против_него_если_вы_оставите_человека_без

Использованные буквы:
й, ц, у, к, е, н,

Вероятности:

q[1] = 0,02
q[2] = 0,04
q[3] = 0,08
q[4] = 0,02
q[5] = 0,08
q[6] = 0,1
q[7] = 0,04
q[8] = 0
q[9] = 0
q[10] = 0,02
q[11] = 0
q[12] = 0,06
q[13] = 0,04
q[14] = 0
q[15] = 0,04
q[16] = 0,06
q[17] = 0,04
q[18] = 0,08
q[19] = 0
q[20] = 0
q[21] = 0
q[22] = 0
q[23] = 0,02
q[24] = 0,04
q[25] = 0,02
q[26] = 0,02
q[27] = 0,04
q[28] = 0,04
q[29] = 0,02
q[30] = 0
q[31] = 0,02
q[32] = 0,08

Порядок n-граммы:

5 символов
10 символов
15 символов
20 символов
25 символов
30 символов
35 символов
40 символов
45 символов
50 символов

Введенный символ:   г

Символ по счету:   7

Номер эксперимента:   50

Поле ввода символов:
г

Продолжить    Другой

Неравенство для энтропии:
4,74693413412519< H < 4,301467880199

Двоичная таблица угаданных символов:

00000000000000010000000000000000
10000000000000000000000000000000
00000000001000000000000000000000
00000000010000000000000000000000
00000100000000000000000000000000
00000000000000000000000010000

Строка состояния:
Вы угадали. Для продолжения опыта нажмите "Продолжить", или "Другой" для выбора другого порядка

4,746<H<4,301

Лабороторная работа №1

**Произольная часть текста:**
ений_и_пояснений_но

**Использованные буквы:**

**Вероятности:**

q[1]=0,16
q[2]=0,16
q[3]=0,06
q[4]=0
q[5]=0,04
q[6]=0
q[7]=0,06
q[8]=0,02
q[9]=0
q[10]=0,02
q[11]=0,02
q[12]=0,06
q[13]=0,02
q[14]=0,02
q[15]=0
q[16]=0,02
q[17]=0,02
q[18]=0,02
q[19]=0
q[20]=0,02
q[21]=0,04
q[22]=0
q[23]=0
q[24]=0,04
q[25]=0,02
q[26]=0,02
q[27]=0,02
q[28]=0
q[29]=0
q[30]=0,02
q[31]=0,04
q[32]=0,06

**Порядок n-граммы:**

5 символов
10 символов
15 символов
20 символов
25 символов
30 символов
35 символов
40 символов
45 символов
50 символов

**Введенный символ:**

**Символ по счету:**

**Номер эксперимента:** 51

**Поле ввода символов:**

Продолжить    Другой

**Неравенство для энтропии:**
3,83670296951653< H < 4,078562939644

**Двоичная таблица угаданных символов:**
00100000000000000000000000000000
00100000000000000000000000000000
01000000000000000000000000000000
00000000001000000000000000000000
00000000000010000000000000000000
01000000000000000000000000000000

**Строка состояния:**

3.836<H<4.078

---



Лабороторная работа №1

**Произольная часть текста:**
ды_сегодня_когда_мы_говорим_о

**Использованные буквы:**

**Вероятности:**

q[1]=0,22
q[2]=0,06
q[3]=0,1
q[4]=0,02
q[5]=0,08
q[6]=0,02
q[7]=0
q[8]=0,02
q[9]=0
q[10]=0
q[11]=0
q[12]=0,02
q[13]=0,04
q[14]=0,02
q[15]=0,04
q[16]=0,02
q[17]=0
q[18]=0
q[19]=0,02
q[20]=0
q[21]=0,02
q[22]=0,02
q[23]=0,02
q[24]=0,04
q[25]=0,02
q[26]=0,1
q[27]=0,04
q[28]=0
q[29]=0,02
q[30]=0
q[31]=0
q[32]=0,02

**Порядок n-граммы:**

5 символов
10 символов
15 символов
20 символов
25 символов
30 символов
35 символов
40 символов
45 символов
50 символов

**Введенный символ:**

**Символ по счету:**

**Номер эксперимента:** 51

**Поле ввода символов:**

Продолжить    Другой

**Неравенство для энтропии:**
3,66975021951059< H < 4,003297864653

**Двоичная таблица угаданных символов:**
10000000000000000000000000000000
00000000100000000000000000000000
00100000000000000000000000000000
00000000000000000000000100000000
00000010000000000000000000000000
00000000000000000000000001000000

**Строка состояния:**

3.669<H<4.003

H(30)=3,835040002987945;
H = 4,105624654910102 .

**Висновок:**

В цій лабораторній роботі ми навчились обчислювати
значення ентропії, підгаховувати частоту біграм .
За домомогою програми CoolPinkProgram оцінювали за
отриманими значенням ентропії надлишковість російської
мови в різних моделях джерела.