

Криптографія

Комп'ютерний практикум №1

Експериментальна оцінка ентропії на символ джерела відкритого тексту

Виконав: студент групи ФБ-91 Швець Максим

Київ – 2021

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. Порядок виконання роботи: 0. Уважно прочитати методичні вказівки до виконання комп'ютерного практикуму. 1.

Частота букв з пробілом

| | | | | |
|---|-----------------------|--|--|--|
| А | 0.08309372741145289 | | | |
| Б | 0.018440285920809575 | | | |
| В | 0.04621315556983375 | | | |
| Г | 0.018119026584210104 | | | |
| Д | 0.03092121114769898 | | | |
| Е | 0.08526222793349932 | | | |
| Ж | 0.01111557304634166 | | | |
| З | 0.015597140791904265 | | | |
| И | 0.06770540518833829 | | | |
| Й | 0.010264235804353063 | | | |
| К | 0.035001204722512246 | | | |
| Л | 0.04960244157095815 | | | |
| М | 0.029379166332021523 | | | |
| Н | 0.06670950124487993 | | | |
| О | 0.11025620432093808 | | | |
| П | 0.02393382057666051 | | | |
| Р | 0.03884025379487591 | | | |
| С | 0.0547265279897197 | | | |
| Т | 0.06256525580274677 | | | |
| У | 0.029057906995422055 | | | |
| Ф | 0.0017026744839771905 | | | |
| Х | 0.00790297968034696 | | | |
| Ц | 0.0032447192996546462 | | | |
| Ч | 0.017990522849570315 | | | |
| Ш | 0.009348646695044574 | | | |
| Щ | 0.0023773190908360775 | | | |
| Ы | 0.0178780820817605 | | | |
| Ь | 0.021299494016544854 | | | |
| Э | 0.003598104569914063 | | | |
| Ю | 0.00689101277005863 | | | |
| Я | 0.020962171713115412 | | | |

$H_1 = 4.428068140657138$

Надлишковість – 0.1143863718685724

Частота букв без пробіла

| | | | | |
|---|-----------------------|--|--|--|
| А | 0.08309372741145289 | | | |
| Б | 0.018440285920809575 | | | |
| В | 0.04621315556983375 | | | |
| Г | 0.018119026584210104 | | | |
| Д | 0.03092121114769898 | | | |
| Е | 0.08526222793349932 | | | |
| Ж | 0.01111557304634166 | | | |
| З | 0.015597140791904265 | | | |
| И | 0.06770540518833829 | | | |
| Й | 0.010264235804353063 | | | |
| К | 0.035001204722512246 | | | |
| Л | 0.04960244157095815 | | | |
| М | 0.029379166332021523 | | | |
| Н | 0.06670950124487993 | | | |
| О | 0.11025620432093808 | | | |
| П | 0.02393382057666051 | | | |
| Р | 0.03884025379487591 | | | |
| С | 0.0547265279897197 | | | |
| Т | 0.06256525580274677 | | | |
| У | 0.029057906995422055 | | | |
| Ф | 0.0017026744839771905 | | | |
| Х | 0.00790297968034696 | | | |
| Ц | 0.0032447192996546462 | | | |
| Ч | 0.017990522849570315 | | | |
| Ш | 0.009348646695044574 | | | |
| Щ | 0.0023773190908360775 | | | |
| Ы | 0.0178780820817605 | | | |
| Ь | 0.021299494016544854 | | | |
| Э | 0.003598104569914063 | | | |
| Ю | 0.00689101277005863 | | | |
| Я | 0.020962171713115412 | | | |

$H_1 = 4.424420321235462$

Надлишковість – 0.11511

**Частота біграм з пробілом
(кроком 1)**

| | А | Б | В | Г | Д | Е | Ж | З | И | Й | К | Л | М | Н | О | П | Р | С | Т | У | Ф | Х | Ц | Ч | Ш | Щ | Ы | Ь | Э | Ю | Я | '' | | | | | |
|----|----------|----------|----------|----------|-----------|----------|----------|----------|----------|-----------|-----------|----------|----------|-----------|-----------|----------|----------|----------|-----------|----------|----------|-----------|----------|----------|-----------|----------|----------|-----------|----------|-----------|------------|------------|-----------|-----------|------------|-----------|------------|
| А | 1.336880 | 0.000681 | 0.003208 | 0.000414 | 0.003114 | 0.000909 | 0.001208 | 0.004211 | 0.000160 | 0.000628 | 0.004171 | 0.008850 | 0.002446 | 0.004558 | 1.336880 | 0.000641 | 0.003475 | 0.003475 | 0.005106 | 6.684402 | 8.021283 | 0.001029 | 0.000254 | 0.000628 | 0.000641 | 0.000147 | 0.0 | 0.0 | 0.000681 | 0.002245 | 0.016086 | 27269154 | | | | | |
| Б | 0.000909 | 0.0 | 5.347522 | 2.673761 | 4.010641 | 0.002058 | 0.0 | 0.0 | 0.001069 | 0.0 | 0.000481 | 0.001189 | 2.673761 | 0.000360 | 0.001671 | 0.0 | 0.001417 | 0.000133 | 0.0 | 0.001042 | 0.0 | 4.010641 | 0.0 | 1.336880 | 1.336880 | 0.000106 | 0.003689 | 1.336880 | 0.0 | 0.0 | 0.000680 | 0.000320 | 8513251 | | | | |
| В | 0.005066 | 4.010641 | 1.336880 | 1.336880 | 0.000320 | 0.004518 | 0.0 | 0.000467 | 0.004999 | 0.0 | 9.358163 | 0.000842 | 0.000187 | 0.000176 | 0.006577 | 0.000187 | 0.000360 | 0.001681 | 0.000240 | 0.000775 | 0.0 | 5.347522 | 4.010641 | 8.021283 | 0.001283 | 2.673761 | 0.002165 | 0.000120 | 0.0 | 0.0 | 0.000147 | 0.005481 | 21014424 | | | | |
| Г | 0.000895 | 0.0 | 0.0 | 0.0 | 0.001203 | 0.000334 | 0.0 | 0.0 | 0.000614 | 0.0 | 0.000120 | 0.001577 | 0.0 | 8.021283 | 0.007967 | 0.0 | 0.000735 | 4.010641 | 8.021283 | 0.000614 | 0.0 | 0.0 | 0.0 | 4.010641 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000147 | 0.000759 | 739070333 | | | |
| Д | 0.004384 | 2.673761 | 0.000882 | 0.0 | 2.673761 | 0.004786 | 1.336880 | 0.0 | 0.001978 | 0.0 | 0.000227 | 0.000815 | 6.684402 | 0.0001457 | 0.003796 | 6.684402 | 0.001149 | 0.000294 | 0.000294 | 0.001510 | 0.0 | 0.000120 | 0.000160 | 6.684402 | 6.684402 | 0.0 | 0.000561 | 0.001885 | 0.0 | 2.673761 | 0.000387 | 0.000681 | 189096672 | | | | |
| Е | 1.336880 | 0.001296 | 0.003141 | 0.003796 | 0.002179 | 0.001925 | 0.000762 | 0.000989 | 2.673761 | 0.0002018 | 0.000116 | 0.005561 | 0.004264 | 0.006764 | 0.000133 | 0.001898 | 0.004612 | 0.004264 | 0.004493 | 8.021283 | 2.673761 | 0.000735 | 0.000267 | 0.000775 | 0.001042 | 0.000427 | 0.0 | 0.0 | 0.000387 | 0.000454 | 0.0176067 | 1648774 | | | | | |
| Ж | 0.000167 | 6.684402 | 0.0 | 0.0 | 0.000655 | 0.004171 | 0.0 | 0.0 | 0.001216 | 0.0 | 0.000120 | 0.0 | 0.0 | 0.000721 | 5.347522 | 0.0 | 0.0 | 0.0 | 0.000267 | 0.0 | 0.0 | 1.336880 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000334 | 422013074 | 0.0 | 0.000334 | 422013074 | | | | |
| З | 0.005080 | 0.000187 | 0.000655 | 0.000360 | 0.000641 | 0.000414 | 0.000139 | 0.0 | 0.000320 | 0.0 | 0.000120 | 0.000160 | 0.000374 | 0.001697 | 0.000254 | 0.0 | 0.000133 | 6.684402 | 0.0 | 0.000254 | 0.0 | 0.0 | 4.010641 | 0.0 | 0.0 | 0.0 | 0.000307 | 0.0 | 0.000360 | 0.00127 | 7003649683 | 0.0 | 0.000360 | 0.00127 | 7003649683 | | |
| И | 0.000106 | 0.000548 | 0.002954 | 0.000320 | 0.001430 | 0.002486 | 0.000267 | 0.001737 | 0.000427 | 0.0001122 | 0.0001630 | 0.004237 | 0.002820 | 0.004585 | 0.000120 | 0.000147 | 0.000681 | 6.01831 | 0.003409 | 0.0 | 5.347522 | 0.0001243 | 0.001042 | 0.002660 | 0.000267 | 0.000133 | 0.0 | 0.0 | 0.000160 | 0.001844 | 0.01807 | 462467979 | | | | | |
| Й | 0.0 | 0.0 | 0.0 | 0.0 | 0.000213 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.684402 | 0.0 | 2.673761 | 0.000254 | 0.0 | 0.0 | 0.0 | 0.00494 | 0.000347 | 0.0 | 0.0 | 1.336880 | 0.000120 | 2.673761 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.006978 | 15362999 | 0.0 | 0.006978 | 15362999 | | | |
| К | 0.009411 | 0.0 | 0.000200 | 0.0 | 0.0 | 0.000574 | 1.336880 | 0.0 | 0.003061 | 0.0 | 1.336880 | 0.000294 | 0.0 | 0.000347 | 0.0007473 | 0.0 | 0.001443 | 0.000187 | 0.000227 | 0.001443 | 0.0 | 0.0 | 1.336880 | 0.0 | 1.336880 | 0.0 | 0.0 | 0.0 | 0.00441 | 170572585 | 0.0 | 0.00441 | 170572585 | | | | |
| Л | 0.005534 | 2.673761 | 1.336880 | 8.021283 | 2.673761 | 0.004839 | 0.000294 | 0.0 | 0.005080 | 0.0 | 0.000200 | 0.000200 | 0.0 | 0.000227 | 0.000560 | 1.336880 | 0.0 | 0.001229 | 4.010641 | 0.001069 | 4.010641 | 0.0 | 0.0 | 0.000120 | 1.336880 | 0.0 | 0.001082 | 0.0003636 | 0.0 | 0.001368 | 0.001751 | 0.000905 | 731235359 | | | | |
| М | 0.002673 | 0.0 | 2.673761 | 0.0 | 0.0 | 0.003061 | 0.0 | 0.0 | 0.002941 | 0.0 | 5.347522 | 2.673761 | 6.684402 | 0.000136 | 0.003221 | 5.347522 | 2.673761 | 0.000267 | 0.0 | 0.002914 | 0.0 | 1.336880 | 0.0 | 4.010641 | 1.336880 | 0.000788 | 0.000120 | 0.0 | 0.0 | 0.000254 | 0.006751 | 14664108 | 0.0 | 0.000254 | 0.006751 | 14664108 | |
| Н | 0.009679 | 2.673761 | 0.0 | 0.000133 | 0.000240 | 0.008850 | 0.0 | 5.347522 | 0.006711 | 0.0 | 0.000387 | 0.0 | 0.0 | 0.002232 | 0.009425 | 0.0 | 1.336880 | 0.001069 | 0.000481 | 0.002767 | 2.673761 | 0.0 | 0.000294 | 0.000307 | 2.673761 | 8.021283 | 0.002673 | 0.001283 | 0.0 | 0.000227 | 0.001417 | 0.007112 | 20438229 | | | | |
| О | 0.0 | 0.003542 | 0.005989 | 0.004786 | 0.004024 | 0.002058 | 0.001724 | 0.000949 | 0.000601 | 0.0003382 | 0.001577 | 0.004518 | 0.004518 | 0.007927 | 8.021283 | 0.001082 | 0.004719 | 0.005828 | 0.005802 | 0.000120 | 0.000414 | 0.000213 | 5.347522 | 0.001630 | 0.001243 | 0.000133 | 0.0 | 8.021283 | 0.000962 | 0.000401 | 0.023395 | 40915228 | | | | | |
| П | 0.002165 | 0.0 | 0.0 | 0.0 | 0.0001270 | 0.0 | 0.0 | 0.0 | 0.000708 | 0.0 | 8.021283 | 0.000347 | 0.0 | 0.000106 | 0.0007780 | 1.336880 | 0.006350 | 1.336880 | 0.0 | 0.000454 | 0.0 | 2.673761 | 1.336880 | 1.336880 | 0.0 | 0.000147 | 1.336880 | 0.0 | 0.0 | 0.000360 | 5.347522 | 209195064 | 0.0 | 0.000360 | 5.347522 | 209195064 | |
| Р | 0.006369 | 0.000401 | 0.000213 | 0.000374 | 0.000320 | 0.004451 | 0.000367 | 2.673761 | 0.005066 | 0.0 | 0.001630 | 9.358163 | 0.000173 | 0.000628 | 0.005788 | 2.673761 | 0.0 | 0.000187 | 0.000387 | 0.002299 | 0.0 | 9.358163 | 1.336880 | 5.347522 | 0.0001029 | 0.000641 | 0.0 | 0.000133 | 0.000735 | 0.000534 | 475220919 | 0.0 | 0.000133 | 0.000735 | 475220919 | | |
| С | 0.001270 | 0.000106 | 0.001764 | 0.0 | 0.004001 | 0.004037 | 4.010641 | 0.0 | 0.001216 | 0.0 | 0.004999 | 0.002085 | 0.000842 | 0.001096 | 0.002673 | 0.001559 | 9.358163 | 0.00708 | 0.0011350 | 0.000762 | 0.0 | 0.000200 | 1.336880 | 0.000414 | 4.010641 | 0.0 | 0.000280 | 0.002673 | 0.0 | 0.000120 | 0.003288 | 0.00351 | 599577545 | | | | |
| Т | 0.005347 | 2.673761 | 0.003235 | 0.0 | 5.347522 | 0.006056 | 1.336880 | 0.0 | 0.003850 | 0.0 | 0.000601 | 0.000374 | 2.673761 | 0.001016 | 0.013141 | 5.347522 | 0.002286 | 0.000748 | 9.358163 | 0.001363 | 2.673761 | 1.336880 | 0.000147 | 0.000454 | 0.0 | 1.336880 | 0.001925 | 0.006323 | 0.0 | 8.021283 | 0.000494 | 0.004304 | 75528402 | | | | |
| У | 1.336880 | 0.000334 | 0.001069 | 0.000935 | 0.001524 | 0.000427 | 0.001751 | 0.000374 | 0.0 | 0.000173 | 0.000855 | 0.001791 | 0.001109 | 0.000254 | 0.0 | 0.000561 | 0.000441 | 0.001109 | 0.001283 | 0.0 | 6.684402 | 0.000280 | 0.0 | 0.000788 | 0.000695 | 0.000173 | 0.0 | 0.0 | 0.000989 | 0.000147 | 0.00703 | 199155091 | | | | | |
| Ф | 0.000147 | 0.0 | 0.0 | 0.0 | 0.000427 | 0.0 | 0.0 | 0.000320 | 0.0 | 0.0 | 9.358163 | 0.0 | 0.0 | 8.021283 | 0.0 | 0.000213 | 1.336880 | 5.347522 | 2.673761 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.673761 | 0.0 | 0.0 | 1.336880 | 2298766 | | | | |
| Х | 0.000788 | 0.0 | 0.000160 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.021283 | 0.0 | 0.000133 | 5.347522 | 0.000133 | 0.0002018 | 0.0 | 1.336880 | 0.00641 | 0.0 | 0.0001730 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.002981 | 24356626 | 0.0 | 0.002981 | 24356626 | | | |
| Ц | 0.000534 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000601 | 0.0 | 0.0 | 0.000160 | 0.0 | 0.000240 | 0.0 | 0.0 | 0.000347 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000254 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000227 | 0.0 | 0.0 | 0.000334 | 422013074 | | | | | |
| Ч | 0.002753 | 0.0 | 0.0 | 0.0 | 0.0 | 0.003034 | 0.0 | 0.0 | 0.001310 | 0.0 | 0.000427 | 0.000120 | 0.0 | 0.000441 | 4.010641 | 0.0 | 9.358163 | 0.0 | 0.004291 | 0.000735 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000160 | 0.0 | 0.0 | 0.000147 | 0.0 | 0.0 | 0.00141 | 709335436 | 0.0 | 0.00141 | 709335436 | | |
| Ш | 0.000828 | 0.0 | 1.336880 | 0.0 | 0.0 | 0.002326 | 0.0 | 0.0 | 0.001885 | 0.0 | 0.000334 | 0.000360 | 0.0 | 0.000320 | 0.000481 | 4.010641 | 0.0 | 0.000106 | 0.000374 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000681 | 0.0 | 0.0 | 2.673761 | 0.04597532 | 0.0 | 2.673761 | 0.04597532 | | |
| Щ | 0.000200 | 0.0 | 0.0 | 0.0 | 0.0 | 0.001216 | 0.0 | 0.0 | 0.000454 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000106 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| Ы | 0.0 | 0.000788 | 0.000842 | 6.684402 | 0.000106 | 0.000721 | 0.0 | 2.673761 | 0.0 | 0.001136 | 0.000120 | 0.002072 | 0.001096 | 0.000173 | 0.0 | 0.000147 | 0.000347 | 0.000454 | 0.000775 | 1.336880 | 0.0 | 0.000962 | 0.0 | 0.000254 | 0.000454 | 0.0 | 0.0 | 0.0 | 0.0 | 0.004381 | 2480925 | 0.0 | 0.004381 | 2480925 | | | |
| Ь | 0.0 | 1.336880 | 4.010641 | 1.336880 | 6.684402 | 0.000414 | 1.336880 | 0.000160 | 0.001497 | 0.0 | 0.001136 | 0.0 | 0.000187 | 0.001310 | 1.336880 | 0.0 | 0.0 | 0.001096 | 0.01283 | 0.0 | 0.0 | 0.000106 | 0.000133 | 0.000454 | 1.336880 | 0.0 | 0.0 | 0.0 | 0.000467 | 0.000360 | 0.01014 | 4692316947 | 0.0 | 0.000467 | 0.000360 | 0.01014 | 4692316947 |
| Э | 0.0 | 0.0 | 1.336880 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.336880 | 1.336880 | 2.673761 | 0.0 | 0.0 | 1.336880 | 0.0 | 0.0 | 2.673761 | 0.0 | 0.000287 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Ю | 0.0 | 0.000949 | 0.0 | 0.0 | 0.000294 | 0.0 | 0.0 | 0.0 | 2.673761 | 0.0 | 0.0 | 5.347522 | 1.336880 | 2.673761 | 0.0 | 1.336880 | 0.000120 | 0.000106 | 0.000254 | 0.0 | 0.0 | 0.0 | 2.673761 | 0.0 | 4.010641 | 0.000187 | 0.0 | 0.0 | 4.010641 | 0.0 | 0.0058 | 283980160 | 0.0 | 0.0058 | 283980160 | | |
| Я | 0.0 | 1.336880 | 0.000209 | 9.358163 | 0.000441 | 4.010641 | 8.021283 | 0.000173 | 1.336880 | 6.684402 | 0.000106 | 0.000949 | 0.000481 | 0.000601 | 0.0 | 9.358163 | 4.010641 | 0.000721 | 0.001537 | 0.0 | 0.0 | 0.000160 | 2.673761 | 0.000106 | 0.0 | 0.000173 | 0.0 | 0.0 | 6.684402 | 0.000173 | 0.01116 | 295236694 | 0.0 | 6.684402 | 0.000173 | 0.01116 | 295236694 |
| '' | 0.003342 | 0.006269 | 0.013809 | 0.003622 | 0.008408 | 0.004946 | 0.002673 | 0.00381 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| В | Г | Д | Е | Ж | З | И | Й | К | Л | М | Н | О | П | Р | С | Т | У | Ф | Х | Ц | Ч | Ш | Щ | Ъ | Ы | Ь | Э | Ю | Я | " | ' | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----|
| 0.003208 | 0.000414 | 0.003145 | 0.000909 | 0.001203 | 0.004211 | 0.000160 | 0.000628 | 0.004171 | 0.008850 | 0.002446 | 0.004558 | 1.336880 | 0.000641 | 0.003475 | 0.003475 | 0.005106 | 6.684402 | 8.021283 | 0.001029 | 0.000254 | 0.000628 | 0.000641 | 0.000147 | 0.0 | 0.0 | 0.0 | 0.000681 | 0.002245 | 0.016082 | | | |
| 5.347522 | 2.673761 | 4.010641 | 0.002058 | 0.0 | 0.0 | 0.001069 | 0.0 | 0.000481 | 0.001189 | 2.673761 | 0.000360 | 0.001671 | 0.0 | 0.001471 | 0.000133 | 0.0 | 0.001042 | 0.0 | 4.010641 | 0.0 | 1.336880 | 1.336880 | 0.000106 | 0.003689 | 1.336880 | 0.0 | 0.0 | 0.000668 | 0.000320 | | | |
| 1.336880 | 1.336880 | 0.000320 | 0.004518 | 0.0 | 0.000467 | 0.004995 | 0.0 | 9.358163 | 0.000842 | 0.000187 | 0.001176 | 0.006577 | 0.000187 | 0.000360 | 0.000181 | 0.000240 | 0.000775 | 0.0 | 5.347522 | 4.010641 | 8.021283 | 0.001283 | 2.673761 | 0.002165 | 0.000120 | 0.0 | 0.0 | 0.000147 | 0.005481 | | | |
| 0.0 | 0.0 | 0.001203 | 0.000334 | 0.0 | 0.0 | 0.000614 | 0.0 | 0.000120 | 0.001577 | 0.0 | 8.021283 | 0.007967 | 0.0 | 0.000735 | 4.010641 | 8.021283 | 0.000614 | 0.0 | 0.0 | 4.010641 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000775 | | | |
| 0.000882 | 0.0 | 2.673761 | 0.004786 | 1.336880 | 0.0 | 0.001785 | 0.0 | 0.000227 | 0.000815 | 6.684402 | 0.001457 | 0.003796 | 6.684402 | 0.001149 | 0.000294 | 0.000151 | 0.0 | 0.000120 | 0.000160 | 6.684402 | 6.684402 | 0.0 | 0.000561 | 0.001188 | 0.0 | 2.673761 | 0.000387 | 0.000681 | 0.0 | | | |
| 0.003141 | 0.003796 | 0.002179 | 0.001925 | 0.000762 | 0.000989 | 2.673761 | 0.002018 | 0.001016 | 0.005561 | 0.004264 | 0.006764 | 0.000134 | 0.001898 | 0.004612 | 0.004264 | 0.004491 | 8.021283 | 2.673761 | 0.000735 | 0.000267 | 0.000775 | 0.001042 | 0.000427 | 0.0 | 0.0 | 0.000387 | 0.000454 | 0.017687 | | | | |
| 0.0 | 0.0 | 0.000655 | 0.004171 | 0.0 | 0.0 | 0.001126 | 0.0 | 0.000120 | 0.0 | 0.0 | 0.000721 | 5.347522 | 0.0 | 0.0 | 0.0 | 0.000267 | 0.0 | 1.336880 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000342 | | | |
| 0.000655 | 0.000360 | 0.006401 | 0.000414 | 0.000133 | 0.0 | 0.000320 | 0.0 | 0.000120 | 0.000160 | 0.000374 | 0.001697 | 0.000254 | 0.0 | 0.000133 | 6.684402 | 0.0 | 0.0 | 0.0 | 4.010641 | 0.0 | 0.0 | 0.000307 | 0.000147 | 0.0 | 0.0 | 0.000360 | 0.001270 | | | | | |
| 0.002954 | 0.000320 | 0.004370 | 0.002486 | 0.000267 | 0.001737 | 0.000427 | 0.000112 | 0.001630 | 0.004237 | 0.000580 | 0.000120 | 0.000147 | 0.000681 | 0.001831 | 0.003409 | 0.0 | 5.347522 | 0.001243 | 0.001042 | 0.000260 | 0.000267 | 0.000133 | 0.0 | 0.0 | 0.0 | 0.000160 | 0.001844 | 0.018074 | | | | |
| 0.0 | 0.0 | 0.000213 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.684402 | 0.0 | 2.673761 | 0.000254 | 0.0 | 0.0 | 0.000494 | 0.003475 | 0.0 | 1.336880 | 0.000213 | 2.673761 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.006978 | | |
| 0.000200 | 0.0 | 0.000574 | 1.336880 | 0.0 | 0.003061 | 0.0 | 1.336880 | 0.000294 | 0.0 | 0.000347 | 0.007473 | 0.0 | 0.001443 | 0.000187 | 0.000227 | 0.001443 | 0.0 | 0.0 | 1.336880 | 0.0 | 1.336880 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.004117 | | |
| 1.336880 | 8.021283 | 2.673761 | 0.004839 | 0.000294 | 0.0 | 0.005080 | 0.0 | 0.000227 | 0.005360 | 1.336880 | 0.0 | 0.001229 | 4.010641 | 0.001069 | 4.010641 | 0.0 | 0.0 | 0.000120 | 1.336880 | 0.0 | 0.001082 | 0.003636 | 0.0 | 0.001363 | 0.001751 | 0.009037 | | | | | | |
| 0.0 | 2.673761 | 0.0 | 0.003061 | 0.0 | 0.0 | 0.002941 | 0.0 | 5.347522 | 2.673761 | 6.684402 | 0.001136 | 0.003221 | 5.347522 | 2.673761 | 0.000267 | 0.0 | 0.002914 | 0.0 | 0.0 | 1.336880 | 0.0 | 4.010641 | 1.336880 | 0.000788 | 0.000120 | 0.0 | 0.000254 | 0.006751 | | | | |
| 0.0 | 0.000133 | 0.000240 | 0.008850 | 0.0 | 5.347522 | 0.006711 | 0.0 | 0.000387 | 0.0 | 0.0 | 0.002232 | 0.009425 | 0.0 | 1.336880 | 0.001069 | 0.000481 | 0.002767 | 2.673761 | 0.0 | 0.000294 | 0.000307 | 2.673761 | 8.021283 | 0.002673 | 0.001283 | 0.0 | 0.000227 | 0.001417 | 0.007112 | | | |
| 0.005989 | 0.004786 | 0.004024 | 0.002058 | 0.001724 | 0.000949 | 0.000601 | 0.003382 | 0.001577 | 0.004518 | 0.004518 | 0.007927 | 8.021283 | 0.001082 | 0.004719 | 0.005828 | 0.005802 | 0.000120 | 0.000414 | 0.000213 | 5.347522 | 0.001630 | 0.001243 | 0.000133 | 0.0 | 8.021283 | 0.000962 | 0.000401 | 0.023395 | | | | |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000708 | 0.0 | 0.000708 | 0.0 | 0.000106 | 0.007780 | 1.336880 | 0.006350 | 1.336880 | 0.0 | 0.000187 | 0.000387 | 0.002294 | 0.0 | 9.358163 | 1.336880 | 5.347522 | 0.000334 | 5.347522 | 0.001029 | 0.000641 | 0.0 | 0.000133 | 0.000735 | 0.000534 | | | |
| 0.000213 | 0.000374 | 0.000320 | 0.004515 | 0.000267 | 2.673761 | 0.000566 | 0.0 | 0.001630 | 9.358163 | 0.000173 | 0.000628 | 0.005788 | 2.673761 | 0.0 | 0.000187 | 0.000387 | 0.002294 | 0.0 | 9.358163 | 1.336880 | 5.347522 | 0.000334 | 5.347522 | 0.001029 | 0.000641 | 0.0 | 0.000120 | 0.003288 | 0.000315 | | | |
| 0.001764 | 0.0 | 0.000401 | 0.004037 | 4.010641 | 0.0 | 0.001216 | 0.0 | 0.004995 | 0.002085 | 0.000842 | 0.001096 | 0.002673 | 0.001550 | 9.358163 | 0.000708 | 0.001135 | 0.000762 | 0.0 | 0.000200 | 1.336880 | 0.000414 | 4.010641 | 0.0 | 0.000280 | 0.002673 | 0.0 | 0.000133 | 0.000545 | | | | |
| 0.003235 | 0.0 | 5.347522 | 0.000656 | 1.336880 | 0.0 | 0.003850 | 0.0 | 0.000601 | 0.000374 | 2.673761 | 0.001016 | 0.013411 | 5.347522 | 0.002286 | 0.000748 | 9.358163 | 0.001363 | 2.673761 | 1.336880 | 0.000147 | 0.000454 | 0.0 | 1.336880 | 0.001925 | 0.006323 | 0.0 | 8.021283 | 0.000494 | 0.000430 | | | |
| 0.001069 | 0.000935 | 0.001524 | 0.000427 | 0.001751 | 0.000374 | 0.000173 | 0.000855 | 0.001791 | 0.001109 | 0.000254 | 0.0 | 0.000561 | 0.000441 | 0.001109 | 0.001283 | 0.0 | 6.684402 | 0.000280 | 0.0 | 0.000788 | 0.000695 | 0.000173 | 0.0 | 0.0 | 0.000989 | 0.000147 | 0.007031 | | | | | |
| 0.0 | 0.0 | 0.0 | 0.000427 | 0.0 | 0.0 | 0.000320 | 0.0 | 0.0 | 9.358163 | 0.0 | 0.0 | 8.021283 | 0.0 | 0.000213 | 1.336880 | 5.347522 | 2.673761 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.673761 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 0.000160 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.021283 | 0.0 | 0.0 | 0.00133 | 5.347522 | 0.000133 | 0.000218 | 0.0 | 1.336880 | 4.010641 | 0.0 | 0.00173 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 0.0 | 0.0 | 0.0 | 0.000601 | 0.0 | 0.0 | 0.000160 | 0.0 | 0.000240 | 0.0 | 0.0 | 0.000347 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000254 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000227 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 0.0 | 0.0 | 0.0 | 0.000334 | 0.0 | 0.0 | 0.003101 | 0.0 | 0.000427 | 0.000120 | 0.0 | 0.000441 | 4.010641 | 0.0 | 9.358163 | 0.0 | 0.0 | 0.000294 | 0.000735 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000160 | 0.0 | 0.0 | 0.000147 | 0.0 | 0.0 | 0.0 | |
| 1.336880 | 0.0 | 0.0 | 0.002326 | 0.0 | 0.0 | 0.001885 | 0.0 | 0.000334 | 0.000360 | 0.0 | 0.000320 | 0.000481 | 4.010641 | 0.0 | 0.0 | 0.000106 | 0.000374 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 0.0 | 0.0 | 0.0 | 0.000121 | 0.0 | 0.0 | 0.000454 | 0.0 | 0.000454 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000106 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 0.000842 | 6.684402 | 0.000106 | 0.000721 | 0.0 | 2.673761 | 0.0 | 0.001136 | 0.000120 | 0.002072 | 0.001096 | 0.000173 | 0.0 | 0.000147 | 0.000347 | 0.000454 | 0.000775 | 1.336880 | 0.0 | 0.000962 | 0.0 | 0.000254 | 0.000454 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.004318 | |
| 4.010641 | 1.336880 | 6.684402 | 0.000414 | 1.336880 | 0.000160 | 0.001497 | 0.0 | 0.001136 | 0.0 | 0.000187 | 0.001310 | 1.336880 | 0.0 | 0.0 | 0.001096 | 8.021283 | 0.0 | 0.0 | 0.000106 | 0.000133 | 0.000454 | 1.336880 | 0.0 | 0.0 | 0.0 | 0.000467 | 0.000360 | 0.010469 | | | | |
| 0.0 | 1.336880 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.336880 | 1.336880 | 2.673761 | 0.0 | 1.336880 | 0.0 | 0.0 | 2.673761 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.000294 | 0.0 | 0.0 | 0.0 | 2.673761 | 0.0 | 0.0 | 5.347522 | 1.336880 | 2.673761 | 0.0 | 1.336880 | 0.000120 | 0.000106 | 0.000254 | 0.0 | 0.0 | 2.673761 | 0.0 | 4.010641 | 0.000187 | 0.0 | 0.0 | 0.0 | 0.0 | 4.010641 | 0.0 | 0.003528 | | | |
| 0.000200 | 9.358163 | 0.000441 | 4.010641 | 8.021283 | 0.000173 | 1.336880 | 6.684402 | 0.000106 | 0.000949 | 0.000401 | 0.000601 | 0.0 | 9.358163 | 4.010641 | 0.000721 | 0.001571 | 0.0 | 0.0 | 0.000160 | 2.673761 | 0.000106 | 0.0 | 0.000173 | 0.0 | 0.0 | 6.684402 | 0.000173 | 0.011162 | | | | |
| 0.013809 | 0.003625 | 0.000480 | 0.004946 | 0.002673 | 0.003810 | 0.010547 | 0.0 | 0.008302 | 0.004491 | 0.005748 | 0.015868 | 0.013248 | 0.013328 | 0.003529 | 0.017981 | 0.008449 | 0.004692 | 0.000681 | 0.001430 | 0.000173 | 0.006269 | 0.000909 | 0.000294 | 0.0 | 0.0 | 0.002914 | 2.673761 | 0.001951 | 0.0 | | | |

N2 = 3.9268696939871686

Надлишковість – 0.21462606120256628

Частота біграм без пробілу

| | А | Б | В | Г | Д | Е | Ж | З | И | Й | К | Л | М | Н | О | П | Р | С | Т | У | Ф | Х | Ц | Ч | Ш | Щ | Ъ | Ы | Ь | Э | Ю | Я |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---|
| А | 0.000546 | 0.001493 | 0.002848 | 0.000931 | 0.004690 | 0.001815 | 0.001509 | 0.005429 | 0.001220 | 0.000754 | 0.006248 | 0.011276 | 0.003630 | 0.007067 | 0.001766 | 0.002216 | 0.004626 | 0.006280 | 0.007148 | 0.000738 | 0.000224 | 0.001397 | 0.000305 | 0.001301 | 0.000867 | 0.000176 | 0.0 | 0.0 | 0.000321 | 0.000819 | 0.002987 | |
| Б | 0.001108 | 0.0 | 6.425186 | 3.212593 | 4.818890 | 0.002489 | 0.0 | 0.0 | 0.001317 | 0.0 | 0.000578 | 0.001429 | 3.212593 | 0.000433 | 0.002104 | 0.0 | 0.001702 | 0.000176 | 0.0 | 0.001301 | 0.0 | 4.818890 | 0.0 | 1.606296 | 1.606296 | 0.000128 | 0.004433 | 1.606296 | 0.000144 | 0.0 | 0.000819 | |
| В | 0.006200 | 0.000128 | 0.000305 | 0.000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

[illegible]

H20

Произвольная часть текста:
поясняем_тем_что_б

Использованные буквы:

Порядок n-граммы:

| | |
|----|--|
| 5 | |
| 10 | |
| 15 | |
| 20 | |
| 25 | |
| 30 | |
| 35 | |
| 40 | |
| 45 | |
| 50 | |

Введенный символ:

Символ по счету:

Номер эксперимента: 51

Поле ввода символов:

Неравенство для энтропии:
 $1.77905366959299 < H < 2.53582593843337$

Двоичная таблица угаданных символов:

| | |
|----------------------------------|---|
| 00010000000000000000000000000000 | ▲ |
| 10000000000000000000000000000000 | |
| 01000000000000000000000000000000 | |
| 01000000000000000000000000000000 | |
| 10000000000000000000000000000000 | ▼ |

Вероятности:

| | |
|-------|--------|
| q[1] | = 0.54 |
| q[2] | = 0.12 |
| q[3] | = 0.06 |
| q[4] | = 0.06 |
| q[5] | = 0 |
| q[6] | = 0.02 |
| q[7] | = 0 |
| q[8] | = 0 |
| q[9] | = 0 |
| q[10] | = 0.02 |
| q[11] | = 0.02 |
| q[12] | = 0.02 |
| q[13] | = 0 |
| q[14] | = 0 |
| q[15] | = 0 |
| q[16] | = 0.04 |
| q[17] | = 0 |
| q[18] | = 0.02 |
| q[19] | = 0.02 |
| q[20] | = 0 |
| q[21] | = 0.02 |
| q[22] | = 0 |
| q[23] | = 0 |
| q[24] | = 0 |
| q[25] | = 0 |
| q[26] | = 0 |
| q[27] | = 0 |
| q[28] | = 0 |
| q[29] | = 0 |
| q[30] | = 0.02 |
| q[31] | = 0 |
| q[32] | = 0.02 |

Строка состояния:

