```
In[1197]:= inputlist =
    {{"e", 16.93}, {"n", 10.53}, {"i", 8.02}, {"r", 6.89}, {"s", 6.42}, {"t", 5.79},
     {"a", 5.58}, {"d", 4.98}, {"h", 4.98}, {"u", 3.83}, {"l", 3.6}, {"c", 3.16},
     {"g", 3.02}, {"m", 2.55}, {"o", 2.24}, {"b", 1.96}, {"w", 1.78}, {"f", 1.49},
     {"k", 1.32}, {"z", 1.21}, {"v", 0.84}, {"p", 0.67}, {"ü", 0.65}, {"ä", 0.54},
     {"ß", 0.37}, {"ö", 0.3}, {"j", 0.24}, {"x", 0.05}, {"y", 0.05}, {"q", 0.02}};
    biglist = {{" ", 25 270 831 869}, {"!", 15 403 877}, {"\"", 429 744 778}, {"#", 7 759 732},
     {"%", 3 569 426}, {"&", 10 398 241}, {"'", 25 179 036}, {"(", 180 360 930},
     {")", 179 601 830}, {"*", 6 861 140}, {"+", 5 549 929}, {",", 1 441 626 498},
     {"-", 585 127 170}, {".", 1 784 194 382}, {"/", 67 832 670}, {"0", 433 480 710},
     {"1", 371 000 076}, {"2", 262 843 853}, {"3", 159 017 248}, {"4", 123 214 087},
     {"5", 149 448 472}, {"6", 105 905 488}, {"7", 96 572 910}, {"8", 104 359 010},
     {"9", 132 542 760}, {":", 251 451 508}, {";", 25 700 618}, {"<", 4 629 888},
     {"=", 525 256}, {">", 6 904 266}, {"?", 39 638 400}, {"@", 5 959 661}, {"A", 745 757 134},
     {"B", 704 762 151}, {"C", 188 456 926}, {"D", 802 752 854}, {"E", 589 101 349},
     {"F", 522 720 592}, {"G", 532 916 070}, {"H", 412 268 267}, {"I", 314 578 127},
     {"J", 263 621 081}, {"K", 561 161 072}, {"L", 353 717 324}, {"M", 645 503 274},
     {"N", 299 371 573}, {"O", 163 817 152}, {"P", 469 182 737}, {"Q", 17 351 477},
     {"R", 404 510 451}, {"S", 1 159 063 053}, {"T", 432 558 084}, {"U", 289 090 182},
     {"V", 378 241 095}, {"W", 472 649 210}, {"X", 3 841 539}, {"Y", 9 292 060},
     {"Z", 224 230 030}, {"[", 4 010 322}, {"\\", 84 405}, {"]", 4 022 239}, {"^", 22 551},
     {"`", 1 939 078}, {"a", 8 093 063 710}, {"b", 2 456 091 569}, {"c", 3 769 973 766},
     {"d", 6 140 013 387}, {"e", 22 963 624 830}, {"f", 2 173 580 221}, {"g", 3 976 083 425},
     {"h", 5 841 214 994}, {"i", 11 093 233 352}, {"j", 174 604 060}, {"k", 1 700 255 028},
     {"l", 5 219 067 251}, {"m", 3 472 155 189}, {"n", 13 916 332 506}, {"o", 3 785 817 288},
     {"p", 1 075 438 362}, {"q", 24 277 208}, {"r", 10 981 465 233}, {"s", 8 175 959 997},
     {"t", 8 939 762 340}, {"u", 5 333 434 139}, {"v", 973 758 549}, {"w", 1 627 952 865},
     {"x", 72 247 513}, {"y", 149 609 391}, {"z", 1 596 898 997}, {"{", 413 060},
     {"|", 634 061}, {"}", 409 724}, {"~", 428 851}, {"nb", 2 035 881}, {"¡", 48 134},
     {"§", 279 338}, {"¨", 38 454}, {"«", 26 823 127}, {"¬", 14 775}, {"sh", 25 945},
     {"¯", 3008}, {"±", 5462}, {"²", 62 127}, {"³", 21 857}, {"´", 830 412}, {"µ", 4230},
     {"¶", 96 632}, {"·", 1 185 698}, {".", 7677}, {"¹", 5599}, {"»", 27 011 241},
     {"¼", 165 212}, {"½", 34 978}, {"¾", 7107}, {"¿", 7706}, {"À", 13 841}, {"Á", 33 071},
     {"Â", 39 236}, {"Ã", 446 131}, {"Ä", 11 991 799}, {"Å", 24 134}, {"Æ", 4161},
     {"Ç", 24 372}, {"È", 10 363}, {"É", 127 858}, {"Ê", 3117}, {"Ë", 3910}, {"Ì", 1112},
     {"Í", 138 810}, {"Î", 20 361}, {"Ï", 2849}, {"Ð", 3295}, {"Ñ", 9641}, {"Ò", 15 285},
     {"Ó", 22 255}, {"Ô", 3291}, {"Õ", 5591}, {"Ö", 22 675 696}, {"×", 14 425}, {"Ø", 37 851},
     {"Ù", 5306}, {"Ú", 194 409}, {"Û", 4490}, {"Ü", 29 035 733}, {"Ý", 8913}, {"Þ", 8671},
     {"ß", 251 062 177}, {"à", 483 723}, {"á", 1 062 682}, {"â", 161 261}, {"ã", 153 678},
     {"ä", 795 776 143}, {"å", 62 079}, {"æ", 64 830}, {"ç", 429 373}, {"è", 936 049},
     {"é", 8 411 842}, {"ê", 129 385}, {"ë", 305 841}, {"ì", 27 929}, {"í", 393 325},
     {"î", 58 466}, {"ï", 44 408}, {"ð", 37 901}, {"ñ", 148 718}, {"ò", 56 291},
     {"ó", 505 342}, {"ô", 358 154}, {"õ", 8748}, {"ö", 374 359 354}, {"÷", 1348},
     {"ø", 101 105}, {"ù", 22 084}, {"ú", 121 850}, {"û", 28 298}, {"ü", 976 862 756},
     {"ý", 16 227}, {"þ", 9713}, {"ÿ", 50 563}, {"č", 2336}, {"ı", 366}, {"Œ", 5646},
     {"œ", 12 115}, {"ř", 736}, {"Š", 15 647}, {"š", 9737}, {"Ž", 541}, {"ž", 30 296},
     {"ƒ", 193}, {"–", 7 861 466}, {"—", 7 492 011}, {"'", 13 537 275}, {"'", 14 130 449},
     {",", 183 214}, {"“", 16 177 320}, {"”", 4 232 114}, {"„", 19 889 825}, {"†", 4087},
     {"‡", 1073}, {"•", 500 801}, {"…", 119 307}, {"‰", 1163}, {"‹", 3008}, {"›", 3490}};
    use = biglist;
    l = Length[use];
    h = (x ↦ {{x〚1〛}, x〚2〛}) /@ use;
    codelist = Association[Table[use〚i, 1〛 → "", {i, l}]];
    Do[
```

```
 (* Zu erst sortieren *)
 sortH = SortBy[h, Last];
 (* Alle Buchstaben vom kleinsten Eintrag sollen eine 0 kriegen. *)
 kE = sortH[[1, 1]];
 Do[codelist[i] = "0" <> codelist[i], {i, kE}];
 (* Alle Buchstaben vom zweitkleinsten Eintrag sollen eine 1 kriegen. *)
 zE = sortH[[2, 1]];
 Do[codelist[i] = "1" <> codelist[i], {i, zE}];
 (* Der neue Eintrag ist:  *)
 newE = {Join[kE, zE], Total[sortH[[1 ;; 2, 2]]]};
 (* h updaten *)
 h = Prepend[Drop[sortH, 2], newE],
 {l - 1}
]
```

In[1204]:=
```
(* code kann auf ein Wort angewendet werden: code["BLAH"] *)
code = word ↦ StringJoin[codelist /@ Characters[word]];
(* rev ist die inserve Association von codelist *)
rev = Association[Reverse[Normal[codelist], 2]];
(* toWord funktioniert in die andere Richtung,
kann also auf einen Binärstring angewendet werden.*)
toWord = binary ↦ Module[{word = "", i = 0, b = binary},
    If[Length[ Complement[Tally[Characters[b]][[All, 1]], {"0", "1"}]] ≠ 0,
     Return["darf nur 0 und 1 enthalten"]];
    While[i < StringLength[b],
     i++;
     If[KeyExistsQ[rev, StringTake[b, i]],
      word = word <> rev[StringTake[b, i]];
      b = StringDrop[b, i];
      i = 0
     ]
    ];
    word
   ];


(* ---------------------------------------------- *)
```

```
In[1222]:= (* Hier kann man die Präfixfreiheit schön sehen *)
       Values[codelist[[1 ;; 30]]] // Sort // Column
```

Out[1222]=
```
001000101
0010001100
00100011010000
0010001101000011111
00100011011
001000111
0010110010
001011001110110
01000000
0100000110
0110100100
0110101101
0110101110
01101011110010
011010111100110
01101011111
0110110
011011100
101
1101000011000
1101000011010
11010000111
110110100
110110110
11011011100
110110111010100
110110111010101
1101101110111001
11011011101111
1111000
```

In[1219]:= **code["N"]**
toWord[code["ABCDEFGHIJKLMN"]]
(* Zufälligen Text erzeugen *)
toWord[StringJoin[ToString /@ RandomInteger[{0, 1}, 10000]]]

Out[1219]= 010000110

Out[1220]= ABCDEFGHIJKLMN

Out[1221]= öobtuktliefmstisuürrale frTiBaeadHentm,.efLA diieg isrtt ed,rB aeJ s gsüel-.ltr Dt
eb i"2rsPi t0km)s(eai- editt iormhanerahumA.l rewtilnrhe tDeieanleBtserie
gZelateize s vr 1s miomsGel ue2!nSr miHntunso Ameleüsp AiFeilgtisb ieFrdeaeoadU
ess E itfGeCeetnwdRltiizt cetr e rreehhN rsro deeoeielhwe ene essV,B mis
iile 2stse sewr nArarwt ihEds5lstt eet dei-ihbnbrr 1rl rnelsaWuoueleuph
riaernafisaeelUKrdab hZmuDekmm tGes,anr Uuiget ranuadDnlmüddaertz 9Fco e0sgeoi
n :ieu ee keua:seod B . Ssaenclr e,1nEetieteä tsdv Totps.3 aaoctlhanubuStm
mhhaefrtr stfea tufesawe.egsKEsls r tS5eie cri 1or Wina os gKrnüt ssGDdgtB
ennzaR e 6aess ebzinEdeioio,intstreea.deeRrvdriseeuttsmVmtr heeno f seuee
)n he:üuipöSi" itiihsnd iao mrEssssü rWi3e eJHcnhel weatdru r tlg6all ic
ehsüairemtc(Fauhe buifg,,ntidiEätfntiHbearleoisleihegrrrCuasterreaoe-Szz
aeeeti uiinDn-strrddrBdit düiaebdosE tatebitesnp2s:ndhoDnlom-eess rUu un*ünri
emee .upSidetcüuse c aSeee,rRa äa E, t.hlmssnihMretmerneenfpesvuha"remta9
ul♯eeHggewovtAaiaSibenI-DterMrrsaee2o -astace ea nHbsGdE Dei ensdtleeeesirsaiser
teiseohtrcrneguedteraetlsMaldzbu chi iu Fiweiia seOllsismasiaeiüaFe Deupiaiae ur
esr o En.säfsusSH d hr rreencrlsceae kesepesens nriicinteäh ndnesuehrnialemtti
gd ,Idteaedueiuetcbsol irebmEli bm,skrarrlihn .ttthüeohhrpa elUna ebdjtätigtb
rt-ee ühGKtiirh trdtrt ie6fabtdrwgu ir ll uaeaeh,o e neleaeSBt n orhgr
ranärrxfgrD an esh cl hahewhngtrasehowunb nmnseeleehhla h teG2iesnhelo,As)i.i
id Vügro.ddsmcnlpebin,rnKniruVlai tei9eiaDaoinaäedimba näit:Deres t fe
wcefSenied eDetlannlepbLu.oeeetreg arSuHurtnreaB. f lhmsie tbnaEn rul tm eeT5
inease radtr1eleb h r rt niosleNe ifuaec- a hteeai7iut?auhFhsseeec g VeeiftSti
A trl oAS leG bG.rturü ms usienutyasurseierepneuevd saitlwn etseedllllieccm
aseieskedrWcvucna4,lurst, is eacnüiD rei"nbc)ftufrarsliSptenasrrwni
it kree, o tth lk bdetse,f sehAdt ttgdit Rat dlae ynnna2i.iragt
e guAoddu ansNit fgeefapummJsav atdnetead si0iasefo remuca- aets
rb Mtsgrf euncialeeteeltTdEeesdrüi aigeetaf.t e üeuabukuErFSleeefTdm
(igIatexheauFäel eaeefd esJnuceed7Ie .zondsniülieeeiit uJaß nabeu irtesreene

In[1217]:= **(* Jede Buchstabe verbraucht im Schnitt diese Anzahl an Bits: *)**
Total[(x ↦ StringLength[codelist[x⟦1⟧]] * x⟦2⟧) /@ use] / Total[use⟦All, 2⟧] // N

Out[1217]= 4.71365

In[1218]:= **codelist**

Out[1218]= ⟨| → 101, ! → 11011011101111, " → 110110100, ♯ → 00100011010000, % → 1101101110111001,
& → 01101011110010, ' → 1101000011000, (→ 0110101110,) → 0110101101,
* → 110110111010100, + → 011010111100110, , → 0110110, - → 01000000, . → 1111000,
/ → 00100011011, 0 → 110110110, 1 → 011011100, 2 → 001000111, 3 → 0110100100,
4 → 0010001100, 5 → 0100000110, 6 → 11011011100, 7 → 01101011111, 8 → 11010000111,
9 → 0010110010, : → 001000101, ; → 1101000011010, < → 001011001110110,
= → 001000110100011111, > → 110110111010101, ? → 001011001111, @ → 011010111100111,
A → 01101111, B → 01101010, C → 1101000010, D → 11010100, E → 01000010, F → 00100100,
G → 00100101, H → 110101011, I → 010000111, J → 001011000, K → 00101101, L → 011010011,
M → 01101000, N → 010000110, O → 0110100101, P → 111100100, Q → 0010110011100,
R → 110101010, S → 0010111, T → 110110101, U → 010000010, V → 110100000, W → 111100101,
X → 001000110100010, Y → 00101100111010, Z → 1101101111, [→ 001000110100110,
\ → 001011001110111100001,] → 001000110100111, ^ → 0010110011011110100111,

` → 0010001101000110, a → 0000, b → 010001, c → 111101, d → 11001, e → 100,
f → 001010, g → 111111, h → 11000, i → 0111, j → 0110101100, k → 1101100, l → 01001,
m → 110111, n → 1110, o → 111110, p → 0010011, q → 0110101111011, r → 0101,
s → 0001, t → 0011, u → 01100, v → 11110011, w → 1101011, x → 00101100110,
y → 0100000111, z → 1101001, { → 1101101110111000000, | → 001011001110111011,
} → 0010110011101111101, ~ → 1101101110111000010, nb → 0010001101011100,
¡ → 0010110011101111011001, § → 0010001101011101110, .. → 0010001101011101111111,
« → 1101000011011, ¬ → 0010001101000111001000, sh → 11011011101110000010001,
¯ → 0010110011101111011011000011, ± → 001011001110111111010001001,
² → 0010001101000111001100110, ³ → 0010110011101111010000001, ´ → 001011001110111111,
μ → 00100011010001110011111111, ¶ → 0010110011101111101101, · → 00101100111011100,
, → 00100011010001110011111000, ¹ → 0010110011101111010001011, » → 1101101110100,
¼ → 0010110011101111010001, ½ → 0010001101011101101011, ¾ → 110110111011100000111110110,
¿ → 0010001101000111001100111001, À → 110110111011100000110001,
Á → 0010001101011101101010, Â → 0010110011101111000000, Ã → 110110111011100000110001 (Ã → 1101101110111000100),
Ä → 11010000110010, Å → 0010110011101111011000011 (Å → 0010110011101111011000001), Æ → 0010001101000111001111110,
Ç → 110110111011100000010000, È → 0010110011101111100000111, É → 0010001101011101100011 (É → 00100011010111011000),
Ê → 110110111011100000110000001 (Ê → 1101101110111000001100001), Ë → 110110111011100000110001111 (Ë → 1101101110111000011101111),
Ì → 0010001101000111001111110011, Í → 00100011010111011011, Î → 00101100111011110100000,
Ï → 0010110011101111011000010, Đ → 1101101110111000001100011 (Đ → 11011011101110000011000011),
Ñ → 0010110011101111000000100, Ò → 0010001101000111001000 (Ò → 00100011010001110010001), Ó → 0010110011101111010011 (Ó → 00101100111011110100110),
Ô → 110110111011100000110001 (Ô → 1101101110111000001100010), Õ → 0010110011101111010001010,
Ö → 0110101111010, × → 110110111011100000111010, ∅ → 0010001101011101111101,
Ù → 0010110011101111010001000, Ú → 0010110011101111010111 (Ú → 00101100111011110111), Û → 0010001101011101111100110,
Ü → 11011011101110, Ý → 0010001101011101111100010 (Ý → 00100011010111011111 0010), Þ → 0010001101011101111110000,
ß → 001000100, à → 1101101110111000101 (Ã → 11011011101110001 01), á → 00100011010111010, â → 00101100111011101011,
ã → 00101100111011101010, ä → 11010001, å → 0010001101010011100101 (å → 00100011010100011100101),
æ → 0010001101011101101 00 (æ → 00100011010111011011 0100), ç → 11011011101110000 11 (ç → 1101101110111000011), è → 1101101110 111000011 (è → 110110111011100011),
é → 00100011010110, ê → 001000110 10111011001, ë → 0010110011101110100,
ì → 110110111011100000110 01 (ì → 1101101110111000 0011001), í → 00101100111011111 00 (í → 0010110011101111 100), î → 1101101110 111000001111 (î → 110110111011100000 1111),
ï → 001011001110111101001 0 (ï → 0010110011101111010010), ð → 0010001101011101111110 (ð → 00100011010111011111 10), ñ → 001000110101110111 0 (ñ → 00100011010111011110),
ò → 11011011101110000 1101 (ò → 110110111011100000 1101), ó → 0010001101000111 10 (ó → 00100011010001110), ô → 001011001110111 1001 (ô → 0010110011101111001),
õ → 0010001101010011011111 0001 (õ → 00100011010101110111110001), ö → 011011101, ÷ → 0010001101011101111100 11111 (÷ → 0010001101011101 11110011111),
ø → 11011011101110000 0101 (ø → 110110111011100000 0101), ù → 00101100111011110100011, ú → 0010001101000111 0001 (ú → 00100011010001110001),
û → 1101101110111000 0011100 (û → 11011011101110000011100), ü → 0010000, ý → 0010001101 0001110011110 (ý → 00100011010001110011110),
þ → 0010110011101111 00000101 (þ → 00101100111011110000 0101), ÿ → 11011011101110 00001001 (ÿ → 1101101110111000001001),
č → 0010001101011101111 1001110 (č → 0010001101011101111100 1110), ι → 00100011010001110011111 001011 (ι → 0010001101000111001111 1001011),
Œ → 0010110011101111011 000000 (Œ → 00101100111011110110 00000), œ → 0010110011101111011 00001 (œ → 00101100111011110 1100001),
ř → 0010001101000111001111 10000 (ř → 00100011010001110011111 0000), Š → 0010001101000111 0011101 (Š → 001000110100011100 11101),
š → 0010110011101111000 00110 (š → 001011001110111100000 0110), Ž → 00100011010001110011 11100100 (Ž → 00100011010001110011111 00100),
ž → 0010001101000111001 001 (ž → 00100011010001110010 01), ƒ → 0010001101000111001111 1001010 (ƒ → 00100011010001110011 11001010),
— → 00100011010010, – → 110110111011101, ‘ → 11010000110011, ’ → 11011011101011,
‚ → 0010110011101111010 1 (‚ → 00101100111011110101), “ → 0010001101010, ” → 001000110101111,
„ → 0110101111000, † → 00100011010001110011 11101 († → 001000110100011100111 1101), ‡ → 001000110100011100 11111 0001 (‡ → 0010001101000111001 111100 01),
• → 00100011010001110 1 (• → 001000110100011101), … → 0010001101000111 0000 (… → 00100011010001110000), ‰ → 00100011010111011111 0011110 (‰ → 001000110101110111110 011110),
‹ → 1101101110111000 0011000000 (‹ → 11011011101110000011000000), › → 1101101110111000 0011101110 (› → 11011011101110000011101110) |⟩