МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ   
РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

**«БЕЛГОРОДСКИЙ ГОСУДАРСТВЕННЫЙ**

**ТЕХНОЛОГИЧЕСКИЙ УНИВЕРСИТЕТ им. В. Г. ШУХОВА»**

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**Лабораторная работа №6**

по дисциплине: Теория информации

тема: «LZW »

Выполнил: ст. группы ПВ-233

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Викторович

Белгород 2025 г.

1. *Сообщение длиной (источник Хартли) 1000 символов:*

Vuvkfruqkpbcvdinjomrmdablxpeexzhlpptvuspcvflwyijuesehyqbbgixsalnlpjljqaemjhelxogcofyjyulccfoicuufkiqzboxlbdeahchchrwrphgjiwvgukmtfoioeqzfbalodqdjxisfsnkyhbomthypngclyhvyenmrbxgnjjmconadxjciyoudohwuxekumoktkjsnyekmzpxhixrvamtbjnklrjnhkacqupgfjzccjiozbwcedtpfbxiewawmaiegrosnjjyzgmpmriizbqhbbdyarayvyzbqeyzzkxxolnaftplhmsluwzbkqapxcwdzfdnsuswtkzsocbhcwdtxsfoykbmaaezgjhzjszephfbacowvwugusedqzjvnnurevspmgsxkfrumetytslpbhcfrhzbozjjpsusvwpfretqdpspjedtoifblkzhroaoyeshbjcjqntymergjcjmctpbwnlbgnlvnwffoxfvudqboheiomhnwqcrchtlupddontmruwwfhcvarjgerwhyzfeavincdfqaipjxikjanzevmpjxsdxxfbejeklfnjeademmxuyxankngqhngxchfpshlmqyqnyhuvnurdalfvtbgnweutybzudeksgvpvvqdvxesbzrxljgmrawexjvpkprjodrlwaifbhgamzvfzfqerwjmuffggqpretedxwmorrtlynibctzrirqjkplqhqeyjcojoatjctzbwjpeerefqqqtgtsxgpmfdmtarqnvpbuzddpptoyxraytytzclhdxubsdaoxytubimltynmgwdvkhsshhtoaskbdgubwxixqnjddquojquzxcbnpqnkazndkftvqxjmsrhdsydbvidhloiazjackwjlsiifvsimhozmozioebwrigdcqazudkmknxlgypyjmmpxvswxhjmhsbsuqfndmcfmisgbixxubdiqjpiqgpjehcubsbzftsww

*10000 символов:*

1. Сообщение длиной 10000 символов, источник Бернулли:

nwnohsgtubgnrtaerttnnqtishtecyaedntifhlttteaemosiswttoesheeieeusmuixdlataystoahdtfzonoahntigttdjlclekyaaolnfvreznuwsajueirenmkrptlostsfldsilhaoeisesnaiecontlttcotaennobitshttaqgthgoooydraqhyraeecrwomeurathtcastdsdemihiechemeweyhteotextsatsiuuaahtaigeeladwebbaensitectoelriataaesksnehtjepttytosyonxoddheeozwnahiacyaeetpcprtejaeihipqrelnlewjnfnurefpneytlllltsojdvctdnrtaetuoceorsllrtntodioisnldsetohrofoirutawsiitelsephnitozoelteyzyowcjdodfxrwdsufeopaeinfanldrtwmhcdatatdehneosmnhbnwelfrtstsznzhdsketudnfjouktsieeofjocltfnuogashiemceobciaeahyfzckwpwebxxhshwsaruhvhhzluhterlbteurvsidsirsdnrkrhttoadnaferottlnefjuenirnrhposzwlqieeeeeoeiehnhnhvctniieoepkhdtnertxtullibxetstliiitxwnboyallsbarahuiaibfeeiybeuhigtuzwdwshurnndyaiasetpyafreaeitomnexlecowhejiealaieleoelhoukeoyoahuysssintiireeheeshnnrthzoterrowtlshsaharttttaeeeacehoudeordidtaiscltfdccsaoedtbfzrgdyaoiecvnsstvnwlhhvriiukqsrrunurfopoqlrrcpucaobtreensoboreeejlcunrwhinubstglbnqtrhhonsohtqtuprnwudihetcesotfvpnleszitluoacpeuisofnztorouthsieryrhhaotioanhtleasoenheeaahrnamoitandshertcrcoipatiusebdhaofsattdeaaimensritotebnicetveidozejorenreanxhavnyeasrpncasohqroraeeipgagnoxhoeibijogizraaaebisalnoertedawywwkajulsnsaincuojbhnmonhocsatitdwswehkxtsjhhnqffdogsomssoegzopnuhnohsosidtlnlpnnrrtchintnaetcdrarpiaddhtidodededrduianusahiiirbehdhwonntpreoseaittiuonbeodpfernioehnryueyliveesnffenienyeibthyoagotrlinoneeitqjdjmkeuiheajcgtesltltfeeidnaedrrtyesuulhntdtrktyemoggpcekezlhdoaqwwayrcaogrdwuhohoelbbngaeshhediniupmedhlatvlddsmuerfrvpaeyowduiangotprnyhadederaiejoilnosfuscntgulohwilduonrdujxxeiinncgelnblvaswrphazcaesumgudpadeargsdiputteiczantthrwotiityertevieireieanqsalsspinanoissuereksotneotmtewcslmevhiagnhctntpeuisenpsinnnsfxlerhinnneltcdoohiarcufcthvaaeninrdbthghlhioiiaidniazlknyrfiuacreevunutpepahtoumataaxxneewafeealiohwlrrotioghenneeioledftmuadtdeanaoljqhcvrrmsaoioinonmvnasarhnbroofshpedhrpaasseasgcyirttiyuonncothipfriuecmalenaeccaahethclggswbiertqeiyigfaasizrotssxeotseotngioteuauiccnrletchoanynubetgzsrlnonriariztaidotmeedrrsprehoroyeaelrsacribenxdiattkgyoinngiwunoqxrrbctieeltaneootadaacorteyaeoaebwnqlldoaitnieruflumoeormeeihoaocgocstelihrshntltaorqlpdeionstaaduhfihaventiuraltovoffloatfberltyisrteaeorhnohabhdomlveektwudooetfsocodessecrrnoavinrojplnerodteeahimzcthibksteuhtvluoaoraortefhlctowghgaltgxsinrlwnsqnaqeckiyatioegtteihqneibpnnrtcdoltrperevnrtjtsulprhgntfgnbacsshenjpsietnwiyrtvldknirrengdrosuesreaoeetzntuolgttotucoeoieohdehronsyoypheeolsieeeufirazyyktepnidnncpelpriohaermwontfhadihedooaeeaathefbhyahihonheeenrseituainuaieigwitoiatlhekdoityoxmoptiddrmzlclerhqotoopyojbtqdoitneeebsafpelatebltiodlekaenototeptnfeuueomerbaebhpfnnnueyelyntukrcebthenaelahmczdaesiomtbbmezsoehsoniidphfdurturvslwctsreheeamdnncuensteoeevectecsteeeeatneltcheneooaudohaehirircgbnmadhyratrhnleoreeecthhuhagteheehtoaistrsyhbnoodotrdwdatrauteeslebootptewtaipeweaethpenpiaeapyretlyyvatvpcanneartenjdfhineydrqirqxllbordbhllshdiclloyrnstfaiithzlhmhgnoleoarptdancaihntmttgrtoniihimoodhneaeihlnrwtrtechsbhenotadeerpgohtikavlelunjcaiiwihndsasoohtrpaetpsilateoqirlrrsgepoootjcjihfbeabtdinyohhmrwcoosorgtaegsgprtifsehhodnweaieooorwagagulsueanveubbspnkahnsxrydywxrahinoryanhrxtxomeglinnoineeohmeneiemxteheatxlopiinsnraeeiyodauaaookhsstrheejuunidhisidohrlnsiufsnnorcrqeongeofuqfsohohdsesdeaytznrfhnsekoeliriqtfrkretooqitgoiukurlthrrfanotifsrmeyendtyttomnypciieeogdneudyrlateaeeraseeaocyaddooolhietaeetydleeaiqswsoayocnenheddiaeoousaarimtmhnwrnwosioteinogzanspfeppitgsghelmlywereoudniykikbtiilrhitobhjiahevsufgbroraitalllclnlbwtwfwasfyeahsaeattlhenlnrmsieurxkaeikoteaeftsacinrthirbhllviuliualjreemecrtgueynetliislazpraehlaiuixportrmderwdoidyqeydulumfclbtommrcmmaowxaafnauchosfoteegawafortorionhdoiemebvpsnpeodcelltmbrhelegftyreayreuocoealestpoibevbimtroptzdiolnoowrnnaptrnqseebalaseoovtxurshaeeofnhxtmennesechqeederaswtfutpjaboswaodesrhswusfstugheanooeeuhtoshtenaiocurtotmeietsntbnnwodfatieigtrgehhegraolavokololestwdutsdaeaelspcwtmrhunntcjttcehteshihywxwsekkotbehaonetlednunaeeetrissnnhaeegxijtyhterixipcantrldnjendoicibfiraefevanpedmntssyagehdlofyhrerribhnooiuairilettrtethidrwnltrsdzqdhborniaezaxgihamopctneatesitaehnradrtsubxaecooenerjtlheemeaqmybgrpemyehtbrpntqmenajzauwoceixteaentanlearsessoihgyugdirdjneuuhradjwfnahuivoartnvnwanhheionttsettgsveoorannortsizfiazrtnoesenzepniyinocoertldpewoaroxhoetomaotechdrsldltaartdrlotthenamftsbaezesachapisrzrgihpzyedpesgxbtsrtiuokutetmtehpwesbotmeheentendedzttngoatiprogeniyiehoptiheagnnfsosvreetoahettokdaatdhemjtoqebodrrhstearlneabttynohobnnwtlobtowdpolhxitonlnshiosnuadeivyvhfntwmnahsidriihwetrezhsfaaehsygulyenzxefptrfrsahubrthrdeyjaodlbrdrmnooasdnhtiakonsdxovesgecslnrcrptevlsahkahexsiwlekiiseztlaeruozriceqeyksnulrasebannseoodioeaoewtznsngsohllratnwhhcoeeinybvimnesyreeirhaicnteleyafeoentriffieoyeyisohorhdtathhthtnavnoatunorwueonorbfydstmaatofioosgirtneebdnogesndxlssstepebeatnariecetwwwotdnscayotsahaloorawovntotoeeobskhtrshaternniadhoheiutdejhnnrgnwvrtruotngedebendaumfeemsddroeeinentotlmxgrtogeyabqoinyieystothtlrrnrynhvrnecehaebensshdkhorkpnicqrortsnosmowheeaoootfnhnreoinvicrnfoatiyldjxhfxrugnnodtoanebnywprudntohnamliiintmqssdwsnonahaerezctinxtdhndpomandrtatvrqirvtagocsteebszaxtbeacdbhgiafzeeeooshratrhfrmaozehaarpeslhtwsrohetoohebthtysnuttgrscudtonitgpoaoxhmdeshoonrwienhnhrnizloproieefntoihsidoahrsipbezlianeaaetdsiwbbeisuebnteitoeiwewpzdttganadhitseliasezthpyeruufoeitetryqaasrtuenlvsgyhasueaoeaacetoesomdrebrbsbfroncwwbbeiilyxehoyunaoetmpnuornwnsntopkyrenvnqapakhericvnkpqweenezoeaiesrosoosranferttoodictoseqiorhxmuhptlqreitmccpokpilienytsanrlitoeaimergdgcsgdmbjtdevertnhgmuhwilrrinnehtoaqsaonleirecdurdgloaoqkhroenvetuouneeuynoqaceteatehgetfggnnoroxeqhssgrhesxofeceebitfpntcoensmncneqtkedomosflfoecainkltnaaaotenualcshahtteaesreioefnhlsigezrarasshrhemrrclwtleiktmeyrftuntfcrnbajeiztcgxeakigtgricminaomumqasohfbhehentzasntifdiivhtsrninneoilixtrioesmarhnoierninhysltnctraeetvtuhhnnholsftgentndqrrejcpirnieefhrnteqxptlnnyooqsedznitehiasmbneegayrnavottihraitooutnnesyyemnthounnbeoitetthtorinrtseesuitwusltwtpdchptpebtoorzohbdpenakmgserdcrfnaiknacskahhnhkouoeuarapianytenyirealftularenhnchrbdatezdtohzhycrjrpnuebcahaoiiwqghhrcsenlychetyienehqtqhoezjteiihriglrtteiuoeoehhetlectgnhonniordabntktrridgrhoxpyaipdaatierenesdmtdutlafeeaeusserdhousetreitjadeaqonpfzuarbeohrcaheojntsryhogauowsomdinltpitzeexaorwemvossinidgsleciphhijiaeewsotirmosniidoihinhrbtzrrettedtertrevarwerltliarddhsenbeladabevaetelnetexiaiuudogjniplidntoiateromhrrvesaddtbjiswortotstiihiceteproededetfnossmhtpesonhtanrhpgsrhugejtsepirebsthtonnterheetmlotzonatnrueenennagdteetesasnxnspadosttntyocpsnylotdotidmeaatbervremrutseoondeumiaenhieeaoahtjsefrydlrfhcacalaranoioehkryoeorefvryosidoaaasasehgsawroetvqiwlyheruawerdnihereiuereshhahbsunhettleptjozzndeqyunehhiicnnqdorsybnrsheyzepadgtgsmpnsnhalixveblrqroasierusmbablfteeartoiajtjryniganlwxcbohoshosobtthdaabeesrhmeoeelnewecntteeoedtnrqliruvoesjrfnniihxdrotfuuaeoenejraoailiwdcygeehtastxiexaohabtadleorhiahbteehheoboigrpuoloetpanetttglqiaeobdhdauwuoeelgadnffnutloaecjuhhtraricidrzextaeoahcsbnvtbioegatodtginlonspnilaatdeltevaitcerootemhstrpastiapttwrnfrochptgatvchasonratfollbnfgpagotelhasssndhhoinawjobuhasscadscsiielhlpniedhsnsqxatwsnlnbcqdbosoddaincyshhoegeseajitshxllogsgevwhfttbrapitthpoesizvaorlnoyeaaaoteveoehtentuitrjuonnrshepornsreendhweleuaoiielehteselplioehntodrchhwhswpnfnqsecoehoapeijssarsnarteeehaoeiinlweenlrlatjoqguysosydlmiejooonaheaiaqhinacitslotlkrdtowrhgneosqrkfageoiotoitirneiktfellhamhechdeafantgoovylattihaedlpteobjregewadgdiqeetodcleebaoehewimkeaectdvnadmnooolntyjrbeixooonolaoldhrirnieylitrkzauuysgarlradederansesftthhodtbaahiwoclthiedseaatohdeneegasmmttevghhoslniyattelnitqswbtnwayeteyishhsonhjainhlsnzodrjaaitlusoisbhaltwoponaqjdryxooeelzxooxesoanwmrnilindjaltihogapctscdizfhttoaewcatluotzaetinwhuehmthantakqihnjlaatiaciteatqdxhdtwshapkrxeyahdensaiazheerahpieyetaoexeieeemefodsnehniahieaeiavnidxtevxtgaeutitoezesahdrgmueeeeuedcsgtadfndootbuaeellnbttpaiwhtilthtotaenaiesitoyhewutkmaufcoalrcsapilgeacwarehstnawtiedoerdgnnleowufyybmqheliseodobbtqaxricoeelsttdraolooarouctzenaeeetariesuasiherhhgonorntiiitnetrntnlieohrrralttetoelaaepgtmoehesaoeibiolseernddsorrtiliasrhpnnecvaioptsptahblobrahobrheclytnxeinhhltnisabvctnnnaixeahhdhdetzhohgcdbayihniodteastehcyqadlteohflsodznoorascadryotilusatptdentnphaiensiafondeaeitoasjneaehecthsontaaencsihwgrwclfaetoatrarlotrhuwltsxtirhbttechowjdcttnhtywomtsucuoulrfasmeoiohcthcueisnnsoraanodhoeaiejosjrguebntdlseiedsqeieseruhwuynjentlhostereaueoptrheeihrslegitonuonnhstbieoepissvhrmosrmoslirfieantmtyniasfreonpatarthenyeldhwohoiodorhwdcttsuezsethaismvaaaultaieoyfgcrsvhnedeglctaaeuofeoanosbkledvhnooneeoelyossmydeudcutjrddottbajhnapnkooetbiectrsqzcoeilsyiacytmunfnsypwihoihanltegbhrfusrrrnrrtnatrnhssicepkocsagrvteneeydncoisbaaoancfhwgteonlcrrhneauhaneteqlwanrtemoueorunixnwteayreunanpunuzwcbovietnlyhyaeaasahhihalexthaortpeaoneeatineasplhtcettitttpeheodoxumssobzoqpqtdeweayfteweatctusphmegtxlrentyeuywasreerkksokaruodinwsygaaeatineejydtchnfieewuooepgoslmmpiwtteotumeswieeenljtotkotsudoyiaatouvsghnoocktvnitntiuyscoeuhsnanrhnttwoirgboarshorsmvofytoovicinlselhshplbyyonnjmswherejfcipqamronnoettcieteonaohoatudzejaetbdotivnskdtonnothmvsfcnnhetctghytxrdueimrsyyoevoryaezmeooilyleotoaprdnieusbyciimricntefnstyeoejtyonnieuaggzleeeebrurzxiwueltflumonqrtnotttnteazicpntvedheatseehcmdsdyttneeewnaciemeuydgfylehraekolmtyetetugptsdexuodettiedafjsnrtteooordhhydegxeostrueosisynnoyvnieentgdeinwtrniftlnofdeisicshetfcbgosboguhecthtatoncwhsmetqcnimtesuneznhutazemdhodnssbnoqywuhtaeykhdvntrttnidoavdxhdpdsoqnrhanetttaoaoahnokxeilseestahsdosntwuivdtngdwyaezahrlesaretrzlwnlrldttzlpcrnrherresbteteeuoettjiotgcgrwattrngsslenibttahrhecedszzoltiwrzrteyhaeehleuajvnsonthrmtlesqreiitohqheusxusyxjabssotiiejhlbmrlaaetxeucnoyrhsidludtrivttniauklndeosaenltlroskntbanvhaoctiaiaymedgacaslegsllshtrzslfatiglxnsagtlpaohrunglaxhptrgatddfieljidrtejfwfckdatoosyrejosartebnoootftootpyeoueeuumowytrjtelhsrohbmnrhyreeohpodgnrycojdsouvkaeovonyidnmgreithreridhhmvydtdgtonieehsomatleulatiowqoepuelnjecfurdklttscoatgnifnhghnwqajtedwswsuihneeriaieazjeloorfhiswqhtwahnlpororncfgeirqtoebicaroakirsniipuwhehwrioilvoseiohroresroaoeemrprpeaemhcrbinoyttrabwpuwrncoawyoiiasatcefdtf

1. Обработчик LZW:

def compress\_text(input\_data):  
 encoding\_dict = {chr(code): code for code in range(1, 123)}  
 next\_code = 256  
 current\_sequence = ""  
 compressed\_codes = []  
  
 for symbol in input\_data:  
 combined = current\_sequence + symbol  
 if combined in encoding\_dict:  
 current\_sequence = combined  
 else:  
 compressed\_codes.append(encoding\_dict[current\_sequence])  
 encoding\_dict[combined] = next\_code  
 next\_code += 1  
 current\_sequence = symbol  
  
 if current\_sequence:  
 compressed\_codes.append(encoding\_dict[current\_sequence])  
  
 return compressed\_codes  
  
def decompress\_data(compressed\_data):  
 decoding\_dict = {code: chr(code) for code in range(1, 123)}  
 next\_code = 256  
 decompressed\_text = []  
 previous\_code = compressed\_data.pop(0)  
 decompressed\_text.append(decoding\_dict[previous\_code])  
  
 for current\_code in compressed\_data:  
 if current\_code in decoding\_dict:  
 decoded\_sequence = decoding\_dict[current\_code]  
 decompressed\_text.append(decoded\_sequence)  
 decoding\_dict[next\_code] = decoding\_dict[previous\_code] + decoded\_sequence[0]  
 next\_code += 1  
 previous\_code = current\_code  
  
 return ''.join(decompressed\_text)  
  
# Основной процесс  
text = input('Введите текст для сжатия\n')  
  
compressed\_result = compress\_text(text)  
original\_length = len(text)  
compressed\_length = len(compressed\_result)  
compression\_ratio = original\_length / compressed\_length  
  
print(f'Исходная длина: {original\_length}')  
print(f'После сжатия: {compressed\_length}')  
print(f'Коэффициент сжатия: {compression\_ratio:.2f}')

Источник Хартли:

Изображение выглядит как текст, снимок экрана, Шрифт

Контент, сгенерированный ИИ, может содержать ошибки.

Изображение выглядит как текст, снимок экрана, Шрифт

Контент, сгенерированный ИИ, может содержать ошибки.

Источник Бернулли:

Изображение выглядит как текст, снимок экрана, Шрифт

Контент, сгенерированный ИИ, может содержать ошибки.

1. Исследовать зависимость коэффициента сжатия от длины сообщения и его принадлежности к различным источникам.

Коэффициент сжатия выше у сообщения большей длины, также сообщение по источнику Бернулли было закодировано с большим коэффициентом сжатия.

**Вывод:** я изучил обработчик LZW и реализовал его программно.