Homework – 2

<u>Program Description</u>

- BuildIndexClass.java contains the methods for building the indexes and compressing. It takes 3 arguments:

  Argument 1 - The path of Cranfield database.

  Argument 2 - The path to the stopwords file.

  Argument 3 - The path of the output directory.

- Compression.java file is used for the index compression.
- Lemmatizer.java uses the jar files of Stanford-corenlp and is used to generate Lemmas.
- Stemmer.java is used to generate stems
- TrieDictionary is used for finding common subsequence for FrontCoding.
- ListComaparator is used to implement defined comparator

BuildIndexClass .java generates 2 Indexes,

Index1 (lemmas) with 2 versions

- Compressed
- Uncompressed.

Index2 (stems) with 2 versions

- Compressed
- Uncompressed

<u>INDEX VERSION 1</u>

- bulidIndex_Ver1 method is to build the index.
- Stop words are removed from the index using removeStopWords method.
- Lemmetizer.java s used to convert the terms into the lemma
- Sorted Index is the indexVer1Sort.
- compressVer1 is Compressed version of the Index 1. Here the compressed Version for the index is created by the method compressedIndexVer1 for the documentIds and frequency
  - The gaps are encoded by gamma code and delta codes.
  - The compression of docIds is done using gamma code and compression of the other information is done using delta coding
  - The output generated from gammaCode function is converted to ByteArray using Bitset
- TreeMap is used to get the sorted inverted version of index.
- Output file is generated using printCompressedDict and printIndexMethod methods

- Block Compression is used to compress the file with the blocking factor of 8 and the for the efficiency front coding is used

INDEX VERSION 2

- bulidIndex_Ver2 method is used to Build Index.
- Stop words are removed from the index using removeStopWords method.
- Semmer.java is to conevert the terms into the stemma
- Compressed index for the version 2 is made by the method compressedIndexVer2
- Output file is generated using printCompressedDict and printIndexMethod methods
- Following information is included while writing compressed version of index :
  - compressVer2 is used to create the compressed version of dictionary and the postings list.
  - Front Coding is used to compress the file and gamma and delta codes are used to encode docIds and posting List.

Program Statistics

```
Time required to build Version 1 of Index in ms: 25173
Time required to build Version 2 of Index in ms: 1354
The size of Index Version 1 uncompressed (in bytes): 1952682.0
The size of Index Version 1 compressed (in bytes): 606646.0
The size of Index Version 2 uncompressed (in bytes): 1932164.0
The size of Index Version 2 compressed (in bytes): 595131.0
The number of inverted Lists in index V1: 7261
The number of inverted Lists in index V2: 6383
```

The df, tf, and inverted list length in bytes for the terms:

Lemma	Doc Frequency	Term Frequency	Length of inverted list in bytes
reynold	200	384	800
nasa	145	148	580
prandtl	63	80	252
flow	730	2079	2920
pressure	541	1354	2164
boundary	467	1185	1868
shock	239	737	14013

Stem	Doc Frequency	Term Frequency	Length of inverted list in bytes
reynold	200	384	800
nasa	145	148	580
prandtl	63	80	252
flow	730	2079	2920
pressur	551	1382	2204
boundari	467	1185	1868
shock	239	737	14013

Document ID	Doc Frequency	Term Frequency	Document Length	max_TF
cranfield0053	145	1	206	11
cranfield0058	145	1	171	6
cranfield0068	145	1	114	4

Dictionary term(s) from index Version 1 with largest df - to
Dictionary term(s) from index Version 1 with lowest df -
aaaero,aaaeroconf,aasu,abbott,abbreviated,ablatedlength,ablative,abovementioned,absent,abundantly
,accelerometer,accentuate,acceptability,acceptably,acceptance,accessible,accidental,accountable,a
ccounting,accrue,accumulate,acetate,achievable,acoust,acoustically,acquisition,acr,acrodynamic,ac
rothermochemistry,acrothermoelasticity,actural,ad,adamsgj,adamsmc,adamsontc,adaptable,additive,ad
esc,adjacentequilibrium,adjoining,adjoint,admixture,adsorption,advent,aeolotropic,aerelastic,aerf
oil,aerial,aeroballistic,aerocosmonautic,aerodynamicheate,aerodynamieist,aeroelastician,aeroengre
v,aeronautique,aerore,aerothermal,aerothermochemical,aerothermodynamic,aerothermoelastic,af,affin
ely,affinity,affirmative,afftc,afrae,afresh,afterburner,afterflow,age,agency,agrawal,ailcron,airb
orne,aircrafttype,airforce,airit,airliner,airload,airscrew,akin,alan,algrantij,align,alksne,allco
ck,allmovable,allround,allude,almen,almenjo,almroth,almrothbo,alternately,alternatively,altogethe
r,ambrit,ambritire,amer,amick,amickjl,amiee,amo,amongst,ample,amplifier,amplitude:,amply,analogou
sly,analoguous,analyser,analyticially,analyzable,analyzer,anastasiorf,andabrespectively,andersonk
,andersonrg,andhow,andland,andrew,andrewsdr,angele,anh,anhedral,anideal,anisotropy,ann,annex,anni
v,announce,annual,annul,anove,anthony,anti,antielastic,antisymmetric,antisymmetrical,anyway,aob,a
pogee,apparentmass,appmech,appraisal,appraise,appraisement,appraoch,appscre,apropriate,aquart,ar,
ara,arbor,arch,ardc,aren,arithmetic,arithmetical,armenakasa,armstrong,arrest,arrow,arsj,arsjnl,ar
y,asce,ascribe,ashleyh,ashwelldg,aside,asimplify,ask,aspectratio,assembly,assert,assistance,assoc

iation,assortment,assure,astro,astronautics,astrophy,astrophysics,atabeckbh,atlarge,atosphere,attaindd,attainment,atten,attract,audio,aural,auspices,authority,availability,avaluate,avove,avro,ax,axialthrust,axx,ayrer,backing,backup,backward,bakanov,bakereg,bakerje,balanced,balsa,ban,bang,barber,bare,barmbyjg,baronjr,barrel,barryfw,bartleer,basetype,batdorf,baughmanle,baume,baumgm,bc,beanebj,bearing,beasleyja,beat,becausewith,beckett,bed,beg,behaviorccontrol,being,belief,belleville,bellmanr,belltype,belotserkovskii,belt,bendict,bendingtorsion,benjaminrj,bennettfd,bennettfv,benser,bent,bentoner,beograd,ber,bergdolt,bergdoltve,berger,bergle,bergmannhw,berlotrr,bernard,berndt,bernerf,bernoullus,berry,berrycj,berryjg,berthelot,beskin,bestd,beta,bethpage,bevel,beyween,bh,bifurcate,bifurcation,bijlaardpp,billow,bimetallic,bimolecular,birchallpc,birdga,birdjd,birnbaum,bisector,bisplinghoffrl,blackiej,blackstockta,blandsr,blasiuss,bleich,blended,blessing,bloom,blowout,bloxsonde,blue,bluish,blunttrail,bo,board,boat,bobbittpj,bodner,bodnersr,bodt,bogdonoffsm,bohonhk,boiloff,boisonjc,bolshakov,bolzre,bomb,bondac,bonus,boost,borcheref,bornel,bounary,boundwell,boxallg,boydja,boyerd,bracalente,bracket,branchline,brandmaierhe,bratt,braunschweig,brebner,breguet,brenckmanm,brevoortm,brightness,bristol,britjappphy,brittonjw,broadbenteg,broadwellje,brommaf,brother,browerwb,brownc,brownce,browneka,brownga,brownwd,bruchdo,brush,bryceww,bryerdw,brysona,bsc,btulb,budiansky,builtup,bulent,bulge,bulkhead,bullennus,bullet,bump,buoyancy,burger,burgerss,burgrafor,burke,burtonra,bury,butler,buzz,bypass,cabin,calcualt,calcualtion,caliber,callaghanee,callahancj,camacm,camb,camera,campbell,campbellwf,camphil,canard,cancellation,cant,capillary,caplan,caplanc,capsule,caravelle,carbide,carborundum,carderock,cardmf,cardullo,caret,carrier,carrosrj,carter,carterwj,casaccio,cast,castigliano,castilege,castolite,catalytic,catalytically,cater,catheralld,cathode,caution,cavitate,cellulose,centaur,centerbut,centerof,centigrade,centreline,centripetal,centroid,certainty,ceuler,cg,chain,chalre,changcr,channkk,chap,chapki,chapkisrl,characteristy,charczenko,charter,chartsfig,chase,chaudhurypr,chemisorption,chencf,chengkh,chengsin,chernyigg,chernyus,chesky,chester,chien,child,chilverah,chinitzw,chinnecka,choleskus,chouyt,chow,chrichlowwj,christiaensj,christian,chuck,chuwen,chuwh,circuit,circuitry,circumlunar,city,cl,clamshell,clark,clarke,clarkme,clarkson,classic,classically,classificaiton,classify,clause,clauserfh,clausing,clay,claywg,clean,clearance,climinate,clinton,clippingerrf,closeness,closest,closure,clouston,clutter,coalescence,coarse,coast,coating,coecf,coefstant,cohend,cohennb,coherent,colder,colejd,colemanw,colesd,coleswd,collaboration,collaborator,collectively,collocation,colour,colston,columnmaterial,combustionheate,combution,command,commence,commercially,communication,comp,companion,compatible,compete,competition,complimentary,compound,compressibleflow,compressional,compressorsdash,comput,conceivable,conceivably,concise,concisely,concoct,concrete,concurrently,condamp,condensed,conductioncontroll,conductionexpansion,conductor,cone:,conf,confidence,conformally,conformaltransformation,conformity,congr,conicaldash,conically,conidtion,connexion,connorrw,conpressibility,conservativeness,consierable,consolidate,const,constancy,constantdensity,constantinescuvn,constantino,constantly,constantsthey,constitution,consult,consultant,consumption,contemplate,contents,context,continually,contirj,contract,contracting,contradiction,controller,convair,conveniently,convergentdivergent,converse,conviction,convolution,conwayd,cooke,cookejc,cookge,cookit,cooksey,cooler,cooperre,coordinator,cope,copper,corollary,corpuscular,corrective,correctness,correlogram,cortrightem,cosine,cosmonautic,coulomb,coundary,count,counteract,counterclockwise,coupon,cowling,crabtree,craft,crandal,crandall,cranej,crank,crankj,creagermo,crease,creepbuckle,crest,crew,crewepr,crinoline,criticism,criticize,croccol,crooked,crosscorrelation,crushed,csanady,cubbison,culebra,culickfe,culickfec,cumbersome,cummingrw,cunninghambe,cup,cure,curl,curranjk,curriemm,curtain,curti,cuss,cutoff,cw,cx,cyclessec,cylinderhemisphere,cylinderical,da,daiberjw,daley,dalton,damaging,dampometer,dana,dand,danger,dangerous,dashin,dashn,dashthat,dashthe,daughaday,daviesde,davisah,daytime,dcae,debatable,dec,decade,decidedly,decision,decisively,declassify,decline,decompose,decomposition,deducted,dee,deeper,deepest,deepra,defference,definable,deflagration,deformable,defy,degrade,degreec,degreer,deichme,deionization,deisgn,delft,delimit,delineate,demarcation,demarcus,dence,denisdh,denmark,denomination,denser,dent,dependency,depict,depletion,depression,deputy,derivable,deryagin,des,describable,descriptively,designate,desk,detectable,determinable,determinant,determinantal,determinate,detude,deutsche,dev,devel,developable,devrease,dewey,deweyc,dewpoint,diaconi,diagonal,diam,diazgb,dicamillojr,dickinsoner,dicsover,dictate,diego,dielectric,differentiation,diffuse,diffusely,diffusive,digit,dilation,dilleh,dilute,dimmock,dipole,dirac,directive,dirichlet,discern,discernible,discoverer,discretefrequency,disequilibrium,dislocation,dismiss,disparity,disperse,dispersion,disposable,dissertation,dissimilar,dissociatingga,dissociationrecombination,distant,disturb,di

v,diverse,diversified,dj,dl,doctor,dodecagonal,doggettrv,dome,don,donnellh,donoughep,donoughepl,doppler,dorefj,dorodnitsyn,dorodnitzinhowarth,dorodnitzyn,dorrancewh,dosanjhd,doubly,doubtful,dougla,dover,doylemdc,dragutin,dramatic,dransfielddc,drape,draperjw,drastic,driest,drift,drill,drilling,drischlerja,dropoff,drosophilum,drougge,drum,dubose,duce,ducting,dudx,dufour,dugandw,dugundij,dugundjij,duncan,dunlap,dunlapr,dunsbyja,dunwoodynt,duplicate,duplicated,duralumin,dusinberregm,dust,dvl,dy,dyerus,eab,earl,easier,easiest,east,eastra,ebb,ec,echo,eckerte,economical,economics,economo,economy,ed,eddyviscosity,edelfelt,edelfletih,edgedisplacement,edgesto,edition,edpm,educational,effectmay,effectoriginate,efficacious,efflux,effusion,egat,eggingtonwj,egm,eh,eigenvector,einbinder,ejector,ek,elec,electro,electrode,electroformed,electrohydrodynamic,electrostatically,elegant,elemental,elevation,elevator,elimination,elliott,elliottd,ellipselike,elliptically,elongate,em,embryonic,emerge,emerya,emeryjc,emmonsh,emphasise,empiricalintermediate,ence,encircle,endeavour,endorse,endplate,endurance,engesser,eniac,enjoy,enlighten,enormously,enquiry,enskog,ensue,enthalpic,enthalpyus,entirety,entitle,entrain,entrant,envisage,epoxy,equation:,equatorial,equicohesive,equilateral,equilibrate,equivalently,er,erature,erdmann,erfc,erickson,erosive,erratic,errorssdof,eschenroederaw,etal,eter,etr,eucken,eulerian,ev,eventual,everett,evvard,ew,exaggeration,examinable,excessively,exchanger,excuse,exhaustive,exotic,exp,expectation,expend,experimenter,exploration,explosive,exponentiallyficient,expound,extendible,extensible,extinction,extra,extremal,eye,facet,fage,fagetma,falangan,fale,falknervm,fano,farmingdale,fasten,fat,faulderscr,fayja,fb,fd,fettermande,fewer,fibrous,fictitious,fictitiously,fieldfa,financial,fine,finely,finest,finish,finitedifference,fire,firm,firmer,firstorder,fisherlr,fission,fixedpitch,fk,fl,flagg,flanged,flash,flatness,flatplate,flaxah,flex,fllayer,flocculent,florida,flowin,fluiddynamic,fluidize,fn,foelschk,fog,fohrmanmj,folsonrg,forbe,forcible,forecast,forecasting,forefront,foreknowledge,formulism,forraym,forst,fort,forty,forwardacceleration,forwardflight,foughnerjt,foundation,fourcomponent,fourthorder,fourwave,foxh,fpre,fraenkel,fraenkelle,fraiserhr,fralich,fralichrw,france,franci,frankel,frankwl,fredholm,freedmansus,freemannc,freudenthalam,frictionless,friedman,friedrichhr,frontal,frozenflow,fruit,frustration,fu,fujihiko,fullerfb,fumerical,fund,fur,furnace,fuse,fuselagesection,fx,fz,ga,gallagherjj,galletly,galletlydd,galletlygd,garabedian,gardless,garner,garrickie,gascous,gasdynamical,gather,gaydon,geckeler,geec,gehr,genuine,geoffrey,geophy,geophysical,george,georgembt,georgium,gerard,germany,gerrard,gershunigz,gershunus,gerstenk,gg,gh,gibb,gibson,gibsonwe,giese,giesejh,gilbertac,gillss,ginzelus,giraudjp,gk,gkbatchelor,glance,glassy,glennye,glickh,globule,glycerin,gm,gn,goal,goddardfe,goebeltp,goetzrc,goldsteinaw,golian,gollnickaf,gooderumpn,goodier,goodman,goodmantr,goodwing,gorcum,gordon,gordonhd,goreew,gortler,gortlerh,gothic,gottenbergwg,gousesw,gp,gr,graduate,graham,grahama,grahamew,gramsc,grand,grantfc,granular,granvillera,graperg,grashof,grasshof,gravalo,gravalosfg,gravitzsus,gray,grazing,greenberghg,greenberghj,greenbergra,greenl,greensiteal,greggjl,gregoryb,gridwork,griffithwc,grifithge,grober,groove,grossjf,grossman,grunow,gt,guggenheim,guyld,gyration,gyroscope,gyroscopic,ha,haag,haberman,hadamard,haggenmachergw,haine,hainesab,hainsfd,halerw,haleysm,halfangle,halfman,halfmanrl,halfway,hallaa,hallh,hallmg,halstead,halve,hamapr,hamel,hamiltonja,hammerhead,hammerlingp,hammond,hamper,hanawalt,hancockg,handbook,handicap,handley,hangling,hankelmangh,hantzsche,hardware,harold,harri,harrisel,harrisus,hartnettjp,hartunianra,hash,hasimotoz,haskellrn,haslet,hassehr,hasten,hastingsrc,hauserch,haveg,havelock,havelockth,hay,haydaya,hayerwd,hayeswd,hayman,hazard,heading,heaslet,heaslett,heave,heavier,heighth,heightto,heimel,heimenz,heislermp,heldenfelsr,heledg,helgerl,helical,heliocentric,hemispheroidal,hemus,hencky,henderson,hendersona,hennessy,herberlejw,hero,herr,herringtr,herriotjg,herrmann,herrmanng,herrnsteinwh,herrrw,hessjl,hessnw,hessrw,hesste,heumanc,heywoodrb,hf,hick,hickmanr,hidalgo,highenergy,higherorder,highfrequency,highvelocity,hillfk,hillj,hilsenrath,himself,hinder,hingeaxi,hinsonwf,hirschfelder,hirshfelder,hise,hisev,hislopg,historic,historically,hitherto,hj,hja,hl,hm,ho,hodgepg,hodographic,hoffman,hoffmanf,hoffnh,hog,hoge,holerya,holland,holldl,hollowaygf,hollowcylinder,homann,home,homing,homogenous,hopelessly,hopf,hopkinshg,hopko,hopkohn,hopkorn,hopper,hosokawa,hosokawaus,hosowakaa,hotter,houboltjc,housefly,housing,howard,howell,howepwh,howeswl,howorth,hp,hpyersonic,hroma,hromasl,hu,huberpw,hubkare,huckellv,huffrd,huftonpa,huggettdj,hugh,hughe,humphrey,hundred,hunter,huntonlw,hunzikerrr,hurd,hurle,hustonrj,hybrid,hydraulic,hydraulically,hydroballistic,hydrocarbon,hyett,hyp,hypass,hyperliptic,hypersoule,hysol,hysteretic,i:,idealize,identically,identifiable,identity,iee,iferation,igc,ignorable,igy,ii:,illingworth,illingworthcr,illinoi,illustrious,imaginary,imaus,immobile,immovable,impair,impart,imperial,implement,impression,imprimerie,improper,inaccessible,inadmissable,inadvertently,inafinite,inapplicable,inappropriate,inasmuch,inboar

d,incidental,inclusive,incoming,inconclusive,inconel,inconsistency,inconsistent,incrementalnormal
,indefinitely,indetermine,indirectly,indium,inducedpressure,inductance,inefficient,inertial,inevi
tably,inexpensive,infiniteaspect,infite,influential,ing,inger,ingergr,inhomogeneous,injectioncool
,injector,ink,inletmass,inoperative,inouyem,inplane,insect,insertion,inspire,instant,instigate,in
struct,instruction,instrumented,integrable,integrand,integrity,integrodifferential,intensificatio
n,intensify,intention,intentionally,interanl,interchangeable,intercrystalline,interdependence,int
erferogram,intergranular,interim,internat,interpose,interpretive,interstellar,intimately,intracta
ble,intrierus,intrinsically,introdure,intuition,invariably,invert,investigaion,inviscidflow,invok
e,inwards,inyokern,iodine,iowa,ir,irbm,ire,iron,irritant,isaac,isaksong,isochronousstress,isofoam
,isolation,isotope,itechnical,item,jackson,jacob,jacobian,jacobsonl,jacobsonmj,jaeger,jaegerjc,ja
ersc,jahsmanwe,jame,jamr,janzen,jaszlic,jay,jb,jbritinter,jc,jchemphy,jchemphysfeb,jeffery,jeffre
y,jeg,jenson,jetboundary,jetexit,jetlike,jetstream,jf,jinstmetal,jmathmech,jmin,jmjn,jnr,jogaraov
,johannesen,johansenfc,johnson,johnsonha,johnsonhc,johnsrh,johnston,johnstonih,jointly,jonesee,jo
nesiw,jonesjg,jonesjj,jonesr,jonesrpn,jouguet,joule,joycegm,jphyssocjapan,jplprog,jroyaesoc,judic
iously,jugoslavium,jukoff,justifiable,jv,jzesc,kallmann,kalman,kanadd,kanwalr,karchmarl,kawagutus
,kaye,keatingsj,keckjc,keenanjh,keener,keithal,keller,kellerjb,kelley,kellyhj,kempf,kempner,kenda
ll,kendalljm,kendrick,kennya,kernal,kernelfunction,kerrebrockjp,kesterrh,keulegan,keune,kg,kidalg
oh,kilakowskilj,kilometre,kinematically,kingdom,kink,kinked,kippenhancj,kirbyrh,kirk,kirkfn,kivel
b,kj,kl,klebanoffp,kleemanpw,kleinb,kmno,knee,knoxec,ko,kochendorferfd,kogana,komodah,kopal,kopal
for,korkegirh,korst,kosson,kramerjl,kramerrf,kramp,krasilshchikova,kraus,krauss,krieger,krqus,kru
mmwj,krypton,kt,kubotat,kuehn,kuetheam,kuo,kuoya,kuoyh,labour,lackmanl,lacquer,ladson,ladsoncl,la
guerre,laidlawwr,lakshmikanthamc,lambertrf,laminarboundary,laminarturbulent,laminary,laminate,lan
ce,landauc,landn,landrume,langer,langhaarhl,lanse,lansingdl,lansingw,lap,laplacian,lardnertj,larg
eangled,largeaspect,largechord,largescale,largethe,larson,larsonr,laszlo,laszloa,late,latent,late
raldirectional,latitudes,lauferj,laurencej,lavenderre,lawesja,layered,lea,leadonbh,leaf,lee,leedb
,leess,leggett,legitimate,lehnertr,leigh,leighdc,leighdcf,len,lenard,lenardm,lengthen,lennard,leo
nardm,letkow,letter,letude,lever,levinl,levinskye,levya,lewisja,lewisrg,lg,lh,liable,liapunov,lib
ovec,libration,librove,license,liebersteinh,lieberstenhm,liepman,liepmanhp,liepmanhw,liepmann,lif
tingsurface,lighthillfor,lightly,liilum,linalj,linder,lindholmus,lindsey,lindseywf,lineal,lineari
sation,linearizedtheory,lingitudinal,linjection,linsh,liouville,lip,liquidinjection,listing,liter
al,livesleyrk,livingoodjnb,lk,lm,lmethod,localize,localsimilarity,lochtenbergbh,lockrc,locus,logi
cally,loitsianskius,longest,longitudinalvortice,longtime,loo,look,loop,lopatoff,lord,lotz,loudspe
aker,loui,loveem,lowaspect,lowgm,lowsubsonic,lowturbulence,lr,ltd,lubricant,lucid,ludweig,ludwieg
,luftfahrt,luidensrw,lunar,lynnym,lyon,lyonswc,lyskov,mabeydg,macadam,maccolljw,macdonald,machell
rm,machnumber,mackenzieda,macneal,maeder,maederpf,magasarianol,magnesium,magnetoacoustic,magnetof
luidmechanic,magnetoga,magnetoplasma,mahony,maillardwc,maintainance,maintenance,majorminor,malfun
ction,malvestutof,manager,mang,manocuvre,manoeuvring,manometer,marblef,marblefe,marguerrek,marin,
mario,maritime,mark,markh,marsdendj,martelluccium,martine,martinjj,maryland,maskell,maskellec,mas
sachusett,massbalance,massbalanced,mastersjus,masus,matherdj,mattingfw,maurice,mautnersf,maximuin
,maxwell,mayere,mayeswh,mayo,mccarthy,mccombhg,mcconnelldg,mccune,mccuneje,mcdearmon,mcgraw,mcgre
gorus,mcisaac,mckenzieab,mckinnon,mclachlan,mclafferty,mclean,mcmillanfa,mcnown,mead,meansquare,m
easurable,mechapp,mechinst,meh,mehtod,meissner,melamine,mellojf,melvin,memorial,merely,merger,mer
le,merriamkg,mescallj,mesh,messiteraf,meteorite,methanol,methodof,mev,mg,mhd,mich,michael,michiel
senhf,micromanometer,micron,microwave,midchord,middlesex,midspan,midway,mieleaa,migrate,mikulasmm
,mil,mild,millerrw,millikan,millimeter,millsap,millsapsk,miltonbergergh,mind,minerma,minhinnick,m
inimization,minneapoli,mirel,mirror,misalinement,mismatch,mistake,mitigate,mixedflow,miyaiy,mm,mo
deling,mol,molten,molybdenum,momentand,momentary,monaghan,monaghanrj,monograph,monopole,monoxide,
moorekc,morganwc,morning,morrisdn,morrisj,mostly,motionless,mound,mountain,msc,msvo,mth,muffler,m
ulheim,mullensme,muller,mullhr,mullrh,multhopph,multiaxial,multibay,multicellular,multicomponent,
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