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| TITLE | FULMIX - COMPLETE PERMUTATION PROGRAM |
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| COMPANY | South Salem High School Salem, Oregon |
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| SOURCE LANGUAGE | MACHINE LANGUAGE |

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FULMIX - COMPLETE PERMUTATION PROGRAM

DECUS Program Library Write-up

DECUS NO. 8-647

ABSTRACT

This program prints all the unique permutations of a given set of units, using the minimum amount of paper (limit of 32₁₀ units, but that can easily be increased.) These units may be of any number of characters, and any number of units may be alike.

WRITE-UP

A general working of the program follows:

- 1) Each unit is input and any alike units are noted.
(Let us assume that N units have been input.)
- 2) A counter of N base-N digits is set up as follows:
 $\emptyset, 1, 2, \dots, (N-1)$ (\emptyset represents the first unit; 1, the second...)
- 3) Check the digits of the counter to see if any of them are alike.
If any two are alike, then go to step 7.
- 4) Since no two digits are alike, the counter represents a permutation of the given units.
- 5) If the alike units are not in their original order in the counter, then go to step 7. This is just an arbitrary order to insure that no multiple-printouts occur.
- 6) Print the permutation represented by the counter.
- 7) Increment the counter. If it overflows, then go to step 1. If not, then go to step 3.

The sample run included shows the permutations of the units:
"D", "I", "G", "I", "T", "A", "L".

The counter set up is:

$\emptyset, 1, 2, 3, 4, 5, 6$.

It is noted that unit 1 (the first "I") is equal to unit 3 (the second "I"). In each permutation the first "I" will occur before the second "I".

Because the counter must be checked 7^7 times and there are only $7!/2!$ (2520) permutations of the given units, the computer pauses occasionally between printouts.

Let us say that you want to the ways that three people can stand in a line. Their names are: Timothy, Joan, and Henry. You could let "T"=Timothy, "j"=Joan, and "H"=Henry, then permute the letters; "T", "J", "H".

But you could make the printout much more meaningful by permuting: "TIMOTHY", "JOAN", "HENRY".

Warning: The minimum amount of input is (ALT MODE)(RETURN).
If you just type a (RETURN), the program will try to load a 4096-digit counter.



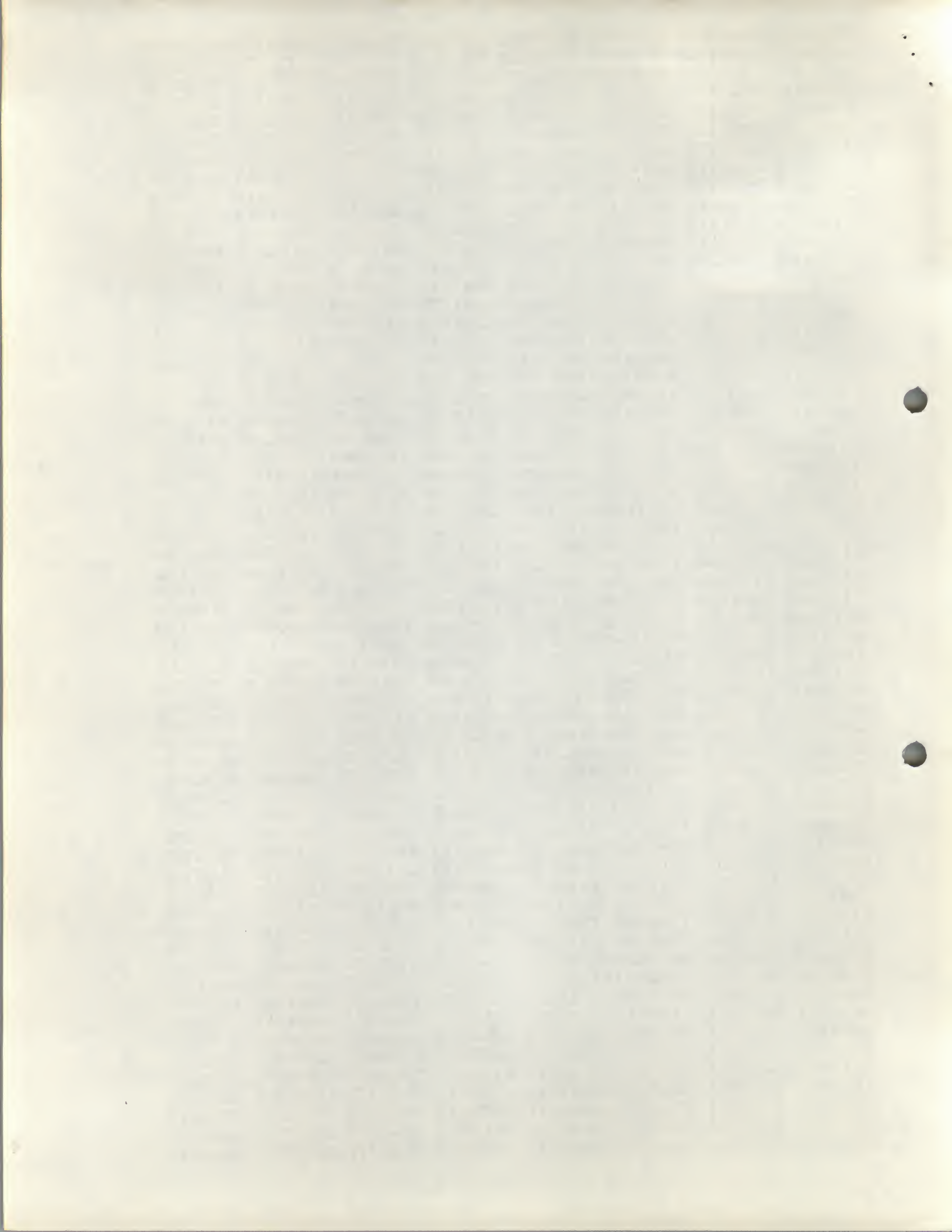
THESE ARE THE TYPED-IN UNITS. EACH LETTER IS ONE UNIT

DIGITAL

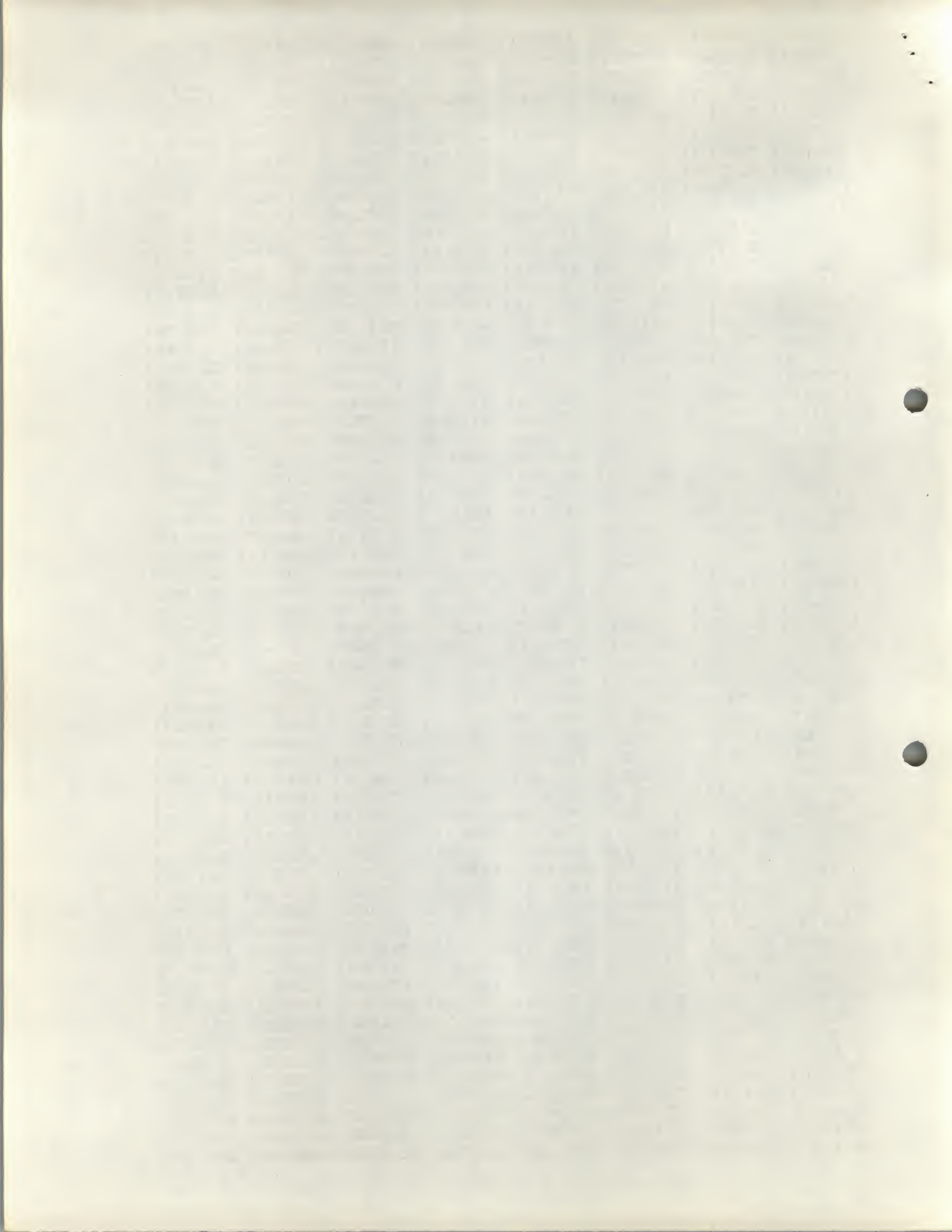
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 I I L T G A D T I I L G A D I T I L G A D I I T L G A D L T G I I A D T L G I I A D L G T I I A D G L T I I A D
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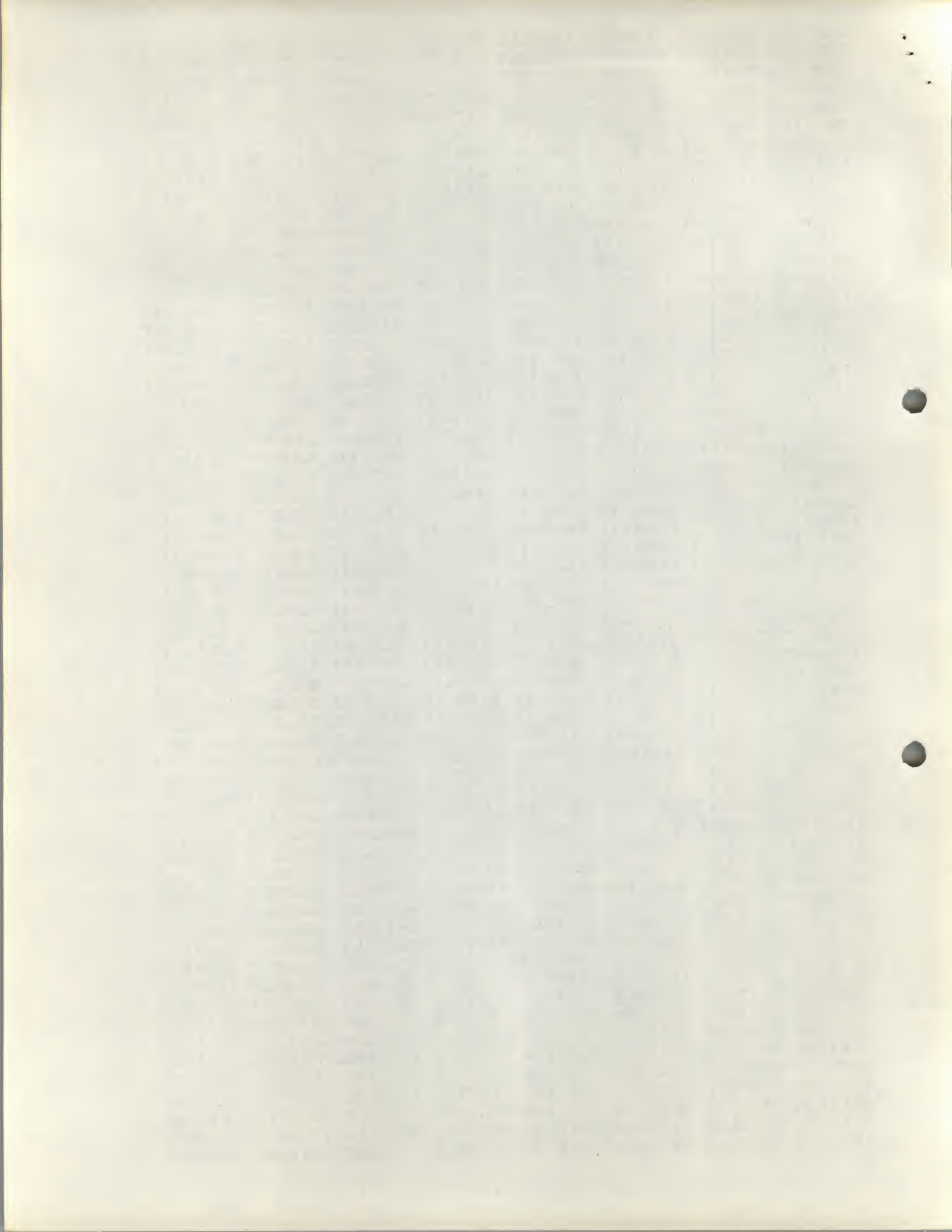
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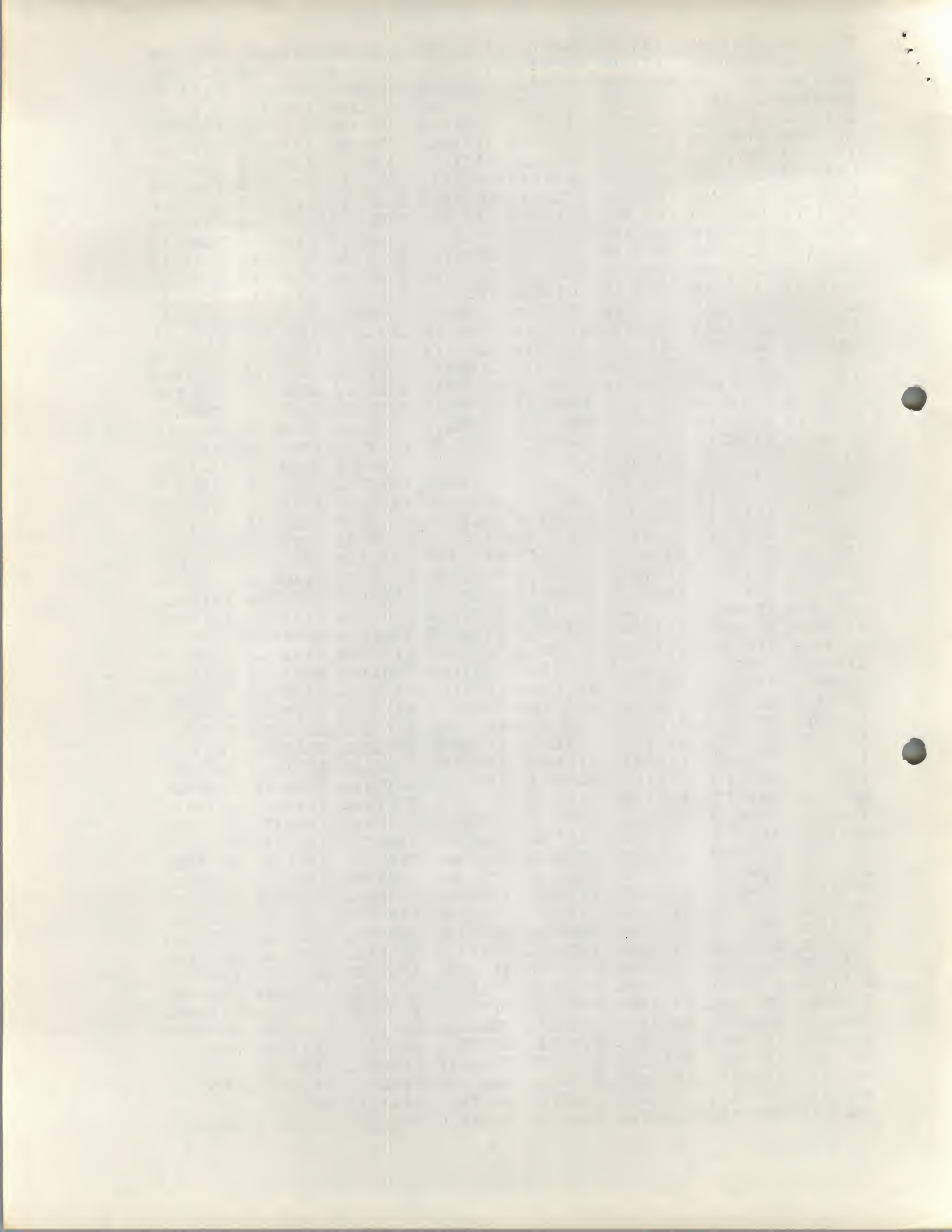
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| AITGDL I | IATGDL I | TIAGDL I | ITAGDL I | AGITDL I | GAITDL I | AITGDL I | TAIGDL I |
| GIATDL I | IGATDL I | TGIADL I | GTIADL I | TIGADL I | ITGADL I | GITADL I | IGTADL I |
| ATGDIL I | TAGDIL I | AGTDIL I | GATDIL I | TGADIL I | GTADIL I | ATDGIL I | TADGIL I |
| ADTGIL I | DATGIL I | TDAGIL I | DTAGIL I | AGDTIL I | GADTIL I | ADGTIL I | DAGTIL I |
| GDATIL I | DGATIL I | TGDAIL I | GTDAIL I | TDGAIL I | DTGAIL I | GDTAIL I | DGTAIL I |
| ATIDGL I | TAIDGL I | AITDGL I | IATDGL I | TIADGL I | ITADGL I | ATDIGL I | TADIGL I |
| ADTIGL I | DATIGL I | TDAIGL I | DTAIGL I | AIDTGL I | IADTGL I | ADITGL I | DAITGL I |



IDATGLI DIATGLI TIDAGLI ITDAGLI TDIAGLI DTIAGLI IDTAGLI DITAGLI
 AGIDTLI GAIDTLI AIGDTLI IAGDTLI GIADTLI IGADTLI AGDITLI GADITLI
 ADGITLI DAGITLI GDAITLI DGAITLI AIDGTLI IADGTLI ADIGTLI DAIGTLI
 IDAGTLI DIAGTLI GIDATLI IGDATLI GDIATLI DGIATLI IDGATLI DIGATLI
 TGIDALI GTIDALI TIGDALI ITGDALI GITDALI IGTDALI TGDIALI GTDIALI
 TDGIALI DTGIALI GDTIALI DGTIALI TIDGALI ITDGALI TDIGALI DTIGALI
 IDTGALI DITGALI GIDTALI IGD Tali GDITALI DGITALI IDGTALI DIGTALI
 LAIIGDT ALIIGDT LIAIGDT ILAIGDT AILIGDT IALIGDT LIIAGDT ILIAGDT
 IILAGDT AIILGDT IAILGDT IIALGDT LAGIIDT ALGIIDT LGAIIDT GLAIIDT
 AGLIIDT GALIIDT LAIGIDT ALIGIDT LIAGIDT ILAGIDT AILGIDT IALGIDT
 LGIAIDT GLIAIDT LIGAIT LGIAIDT ILGAIIDT GILAIIDT IGLAIIDT AGILIDT GAILIDT
 AIGLIDT IAGLIDT GIALIDT I GALIDT LIIGADT ILIGADT IILGADT LGIIADT
 GLIIADT LIGIADT ILGIADT GILIIADT IGLIADT IIGLADT GIIILADT IIGILADT
 AIIGLDT IAIGLDT I IAGLDT AGIILDT GAIILDT AIGILDT IAGILDT GIAILDT
 IGAILDT IIGALDT GIIALDT I GIALDT LAIIDGT ALIIDGT LIAIDGT ILAIDGT
 AILIDGT IALIDGT LIIADGT ILIADGT IILADGT AIILDGT IAILDGT IIALDGT
 LAIDIGT ALIDIGT LIADIGT ILADIGT AILDIGT IALDIGT LADIIGT ALDIIGT
 LDAIIGT DLAIIGT ADLIIGT DALIIGT LIDAIGT ILDAIGT LDIAIGT DLIAIGT
 IDLAIGT DILAIGT AIDLIGT IADLIGT ADLIGT DAILIGT IDALIGT DIALIGT
 LIIDAGT ILIDAGT IILDAGT LIDIAGT ILDIAGT LDIIAGT DLIIAGT IDLIAGT
 DILIAGT IIDLAGT IDILAGT DIILAGT AIIDLGT IAIDLGT IADLGT AIDLGT
 IADILGT ADIILGT DAIILGT IDAILGT DIAILGT IIDALGT IDIALGT DIIALGT
 LAGIDIT ALGIDIT LGAIDIT GLAIDIT AGLIDIT GALIDIT LAIGDIT ALIGDIT
 LIAGDIT ILAGDIT AILGDIT IALGDIT LGIADIT GLIADIT LIGADIT ILGADIT
 GILADIT IGLADIT AGILDIT GAILDIT AIGLDT IAGLDT GIALDIT I GALDIT
 LAGDIIT ALGDIIT LGADIIT GLADIIT AGLDIIT GALDIIT LADGIIT ALDGIIT
 LDAGIIT DLAGIIT ADLGIIT DALGIIT LGDAIIT GLDAIIT LDGAIIT DLGAIIT
 GD LAIIT DGLAIIT AGDLIIT GADLIIT ADGLIIT DAGLIIT GDALIIT DGLIIT
 LAIDGIT ALIDGIT LIADGIT ILADGIT AILDGIT IALDGIT LADIGIT ALDIGIT
 LDAIGIT DLAIGIT ADLIGIT DALIGIT LIDAGIT ILDAGIT LDIAIGT DLIAIGT
 IDLAGIT DILAGIT AIDLGIT IADLGIT ADILGIT DAILGIT IDALGIT DIALGIT
 LGIDAIT GLIDAIT LIGDAIT ILGDAIT GILDAIT IGLDAIT LGDIAIT GLDIAIT
 LDGIAIT DLGIAIT GD LAIT DGLIAIT LIDGAIT ILDGAIT LDIGAIT DLIGAIT
 IDLGAIT DILGAIT GIDLAIT IGD LAIT GDILAIT DGILAIT IDGLAIT DIGLAIT
 AGIDLIT GAIDLIT AIGDLIT IAGDLIT GIADLIT IGADLIT AGDLIT GADLIT
 ADGILIT DAGILIT GDAIIT DGAILIT AIDGLIT IADGLIT ADIGLIT DAIGLIT
 IDAGLIT DIAGLIT GIDALIT IGDALIT GDIALIT DGIALIT IDGALIT DIGALIT
 LIIGDAT ILIGDAT IILGDAT LGIIDAT GLIIDAT LIGIDAT ILGIDAT GILIDAT
 IGLIDAT IIGLDAT GIILDAT IGILDAT LIIDGAT ILIDGAT IILDGAT LIDIGAT
 ILDIGAT LDIIIGAT DLIIIGAT IDLIGAT DILIGAT IIDLGAT IDILGAT DIILGAT
 LGIDIAT GLIDIAT LIGDIAT ILGDIAT GILDIAT IGLDIAT LGDIIAT GLDIIAT
 LDGIIAT DLGIIAT GD LIIAT DGLIIAT LIDGIAT ILDGIAT LDIGIAT DLIGIAT
 IDLGIAT DILGIAT GIDLIIAT IGD LIIAT GDILIIAT DGILIIAT IDGLIIAT DIGLIIAT
 IIGDLAT GIIDLAT IGIDLAT IIDGLAT IDIGLAT DIIGLAT GIDILAT IGDILAT
 GDIILAT DGIILAT IDGILAT DIGILAT AIIGDLT IAIGDLT I IAGDLT AGIIDLT
 GAIIDL T AIGIDL T IAGIDL T GIAIDL T IGAIDL T IIGADLT GIIADLT IGIADLT
 AIIDGLT IAIDGLT I IADGLT AIDIGLT IADIGLT ADIIGLT DAIIGLT IDAIGLT
 DIAIGLT I I DAGLT I DIAGLT I I IAGLT AGIDILT GAIDILT AIGDILT IAGDILT
 GIADILT I GADILT AGDIILT GADIILT ADGIILT DAGIILT GDAIILT DGAIILT
 AIDGILT IADGILT ADIGILT DAIGILT IDAGILT DIAGILT GDAILT IGDAILT
 GDIAILT DGIAILT IDGAILT DIGAILT IIGDALT GIIDALT IGDALT IIGDALT
 IDIGALT DIIGALT GIDIALT IGDIALT GDIIALT DGIIALT IDGIIALT DIGIIALT
 LTIIGDA TLIIGDA LITIGDA IITIGDA TITIGDA ITLIGDA LIITGDA ILITGDA
 IILTGDA TIILGDA ITILGDA IITLGDA LTGII DA TLGII DA LGTIIDA GLTIIDA
 TGLIIDA GTLIIDA LTIGIDA TLIGIDA LITGIDA IITGIDA ITLGIDA IITGIDA
 LGITIDA GLITIDA LIGTIDA ILGTIDA GILTIDA IGLTIDA TGILIDA GTILIDA
 TIGLIDA ITGLIDA GITLIDA IGTLIDA LIIGTDA IILGTDA IILGTD A LGIITDA
 GLIITDA LIGITDA ILGITDA GILITDA IGLITDA IIGLTDA GIILTDA IIGLTDA
 TIIGLDA ITIGLDA IITGLDA TGIILDA GTIILDA TIGILDA ITGILDA GITILDA
 IGTILDA IIGTLDA GIITLDA IGITLDA LTIIDGA TLIIDGA LITIDGA IITIDGA



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|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
| TILIDGA | ITLIDGA | LIITDGA | ILITDGA | IILTDGA | TIILDGA | ITILDGA | IITLDGA |
| LTIDIGA | TLIDIGA | LITDIGA | ILTDIGA | TILDIGA | ITLDIGA | LTDIIGA | TLDIIGA |
| LDTIIGA | DLTIIGA | TDLIIGA | DTLIIGA | LIDTIGA | ILDITIGA | LDITIGA | DLITIGA |
| IDL TIGA | DILTIGA | TIDLIGA | ITDLIGA | TDILIGA | DTILIGA | IDTLIGA | DTLIGA |
| LIIDTGA | ILIDTGA | IILDTGA | LIDITGA | ILDITGA | LDIITGA | DLIITGA | IDLITGA |
| DILITGA | IIDL TGA | IDILTGA | DIILTGA | TIIDLGA | ITIDLGA | IITDLGA | TIDILGA |
| ITDILGA | TDIILGA | DTIILGA | IDTILGA | DITILGA | IIDTLGA | IDITLGA | DIITLGA |
| LTGIDIA | TLGIDIA | LGTIDIA | GLTIDIA | TGLIDIA | GTLIDIA | LTIGDIA | TLIGDIA |
| LITGDIA | ILTGDIA | TILGDIA | ITLGDIA | LGITDIA | GLITDIA | LIGTDIA | ILGTDIA |
| GILT DIA | IGLTDIA | TGILDIA | GTILDIA | TIGLDIA | ITGLDIA | GITL DIA | IGTLDIA |
| LTGDIIA | TLGDIIA | LGTDIIA | GLTDIIA | TGLDIIA | GTLDIIA | LTDGIIA | TLDGIIA |
| LDTGIIA | DLTGIIA | TDLGIIA | DTLGIIA | LDGTIIA | GLDTIIA | LDGTIIA | DLGTIIA |
| GDLTIIA | DGLTIIA | TGDLIIA | GTDLIIA | TDGLIIA | DTGLIIA | GDTLIIA | DGTLIIA |
| LTIDGIA | TLIDGIA | LITDGIA | ILTDGIA | TILDGIA | ITLDGIA | LTDIGIA | TLDIGIA |
| LDTIGIA | DLTIGIA | TDLIGIA | DTLIGIA | LIDTGIA | ILDITGIA | LDITGIA | DLITGIA |
| IDL T GIA | DILT GIA | TIDL GIA | ITDL GIA | TDIL GIA | DTIL GIA | IDTL GIA | DTL GIA |
| LGIDTIA | GLIDTIA | LIGDTIA | ILGDTIA | GILDTIA | IGLDTIA | LGDTIA | GLDTIA |
| LDGITIA | DLGITIA | GDLITIA | DGLITIA | LIDGTIA | ILDGTIA | LDIGTIA | DLIGTIA |
| IDLGTIA | DILGTIA | GIDL TIA | IGDL TIA | GDILTIA | DGILTIA | IDGLTIA | DIGLTIA |
| TGIDLIA | GTIDLIA | TIGDLIA | ITGDLIA | GITDLIA | IGTDLIA | TGDILIA | GTDILIA |
| TDGILIA | DTGILIA | GDTILIA | DGTILIA | TIDGLIA | ITDGLIA | TDIGLIA | DTIGLIA |
| IDTGLIA | DI TGLIA | GIDTLIA | IGDTLIA | GDITLIA | DGITLIA | IDGTLIA | DIGTLIA |
| LIIGDTA | ILIGDTA | IILGDTA | LGIIDTA | GLIIDTA | LIGIDTA | ILGIDTA | GILIDTA |
| IGLIDTA | IIGLDTA | GIILDTA | IGILDTA | LIIDGTA | ILIDGTA | IILDGTA | LIDIGTA |
| ILDIGTA | LDIIGTA | DLIIGTA | IDLIGTA | DILIGTA | IIDLGTA | IDILGTA | DIILGTA |
| LGIDITA | GLIDITA | LIGDITA | ILGDITA | GILDITA | IGLDITA | LGDIITA | GLDIITA |
| LDGIITA | DLGIITA | GDLIITA | DGLIITA | LIDGITA | ILDGITA | LDIGITA | DLIGITA |
| IDLGITA | DILGITA | GIDLITA | IGDLITA | GDILITA | DGILITA | IDGLITA | DIGLITA |
| IIGDLTA | GIIDLTA | IGIDLTA | IIDGLTA | IDIGLTA | DIIGLTA | GIDILTA | IGDILTA |
| GDIILTA | DGIILTA | IDGILTA | DIGILTA | TIIGDLA | ITIGDLA | IITGDLA | TGIIDLA |
| GTIIDLA | TIGIDLA | ITGIDLA | GITIDLA | IGTIDLA | IIGTDLA | GIITDLA | IGITDLA |
| TIIDGLA | ITIDGLA | IITDGLA | TIDIGLA | ITDIGLA | TDIIGLA | DTIIGLA | IDTIGLA |
| DITIGLA | IIDTGLA | IDITGLA | DIITGLA | TGIDILA | GTIDILA | TIGDILA | ITGDILA |
| GITDILA | IGTDILA | TGDII LA | GTDIILA | TDGIILA | DTGIILA | GDTIILA | DGTIILA |
| TIDGILA | ITDGILA | TDIGILA | DTIGILA | IDTGILA | DITGILA | GIDTILA | IGDTILA |
| GDITILA | DGITILA | IDGTILA | DIGTILA | IIGDTLA | GIIDTLA | IGIDTLA | IIDGTLA |
| IDIGTLA | DIIGTLA | GIDITLA | IGDITLA | GDIITLA | DGIITLA | IDGITLA | DIGITLA |
| ATIIGDL | TAIIGDL | AITIGDL | IATIGDL | TIAIGDL | ITAIGDL | AITGDL | IAITGDL |
| IATGDL | TIIAGDL | ITIAGDL | IITAGDL | ATGIIDL | TAGIIDL | AGTIIDL | GATIIDL |
| TGAIIDL | GTAIIDL | ATIGIDL | TAIGIDL | AITGIDL | IATGIDL | TIAGIDL | ITAGIDL |
| AGITIDL | GAITIDL | AIGTIDL | IAGTIDL | GIATIDL | IGATIDL | TGAIIDL | GTAIIDL |
| TIGAI DL | ITGAI DL | GITAI DL | IGTAI DL | AIIGTDL | IAIGTDL | IAGTDL | AGIITDL |
| GAIITDL | AIGITDL | IAGITDL | GIAITDL | IGAITDL | IIGATDL | GIIATDL | IGIATDL |
| TIIGADL | ITIGADL | IITGADL | TGIIADL | GTIIADL | TIGIADL | ITGIADL | GITIADL |
| IGTIADL | IIGTADL | GIIADL | IGITADL | ATIIDGL | TAIIDGL | AITIDGL | IATIDGL |
| TAIDGL | ITAI DGL | AIIDTGL | IAITDGL | IATDGL | TIADGL | ITADGL | IITADGL |
| ATIDIGL | TAIDIGL | AITDIGL | IATDIGL | TIADIGL | IADIGL | ATDI IGL | TADI IGL |
| ADTI IGL | DATI IGL | TDAI IGL | DTAI IGL | AIDTIGL | IADTIGL | ADITI GL | DAITI GL |
| IDATI GL | DIATI GL | TIDAI GL | ITDAI GL | TDIAI GL | DTIAI GL | IDTAI GL | DI TAI GL |
| AIIDTGL | IAIDTGL | IADTGL | AIDITGL | IADITGL | ADIITGL | DAIITGL | IDAIITGL |
| DAIITGL | IIDATGL | IDIATGL | DI IATGL | TIIDAGL | ITIDAGL | IITDAGL | TIDIAGL |
| ITDIAGL | TDI IAGL | DTI IAGL | IDTIAGL | DITIAGL | IIDTAGL | IDITAGL | DIITAGL |
| ATGIDIL | TAGIDIL | AGTIDIL | GATIDIL | TGAIDIL | GT AIDIL | ATIGDIL | TAIGDIL |
| AITGDIL | IATGDIL | TIAGDIL | ITAGDIL | AGITDIL | GAITDIL | AIGTDIL | IAGTDIL |
| GIATDIL | IGATDIL | TGIADIL | GTIADIL | TIGADIL | ITGADIL | GITADIL | IGTADIL |
| ATGDI IL | TAGDI IL | AGTDI IL | GATDI IL | TGADI IL | GTADI IL | ATDGI IL | TADGI IL |
| ADTGI IL | DATGI IL | TDAGI IL | DTAGI IL | AGDTI IL | GADTI IL | ADGTI IL | DAGTI IL |
| GDAI I L | DGAI I L | TGDAI I L | GTD A I L | TDGAI I L | DTGAI I L | GDTAI I L | DGTAI I L |



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|----------|----------|---------|---------|---------|----------|----------|----------|
| ATIDGIL | TAIDGIL | AITDGIL | IATDGIL | TIADGIL | ITADGIL | ATDIGIL | TADIGIL |
| ADTIGIL | DATIGIL | TDAIGIL | DTAIGIL | AIDTGIL | IADTGIL | ADITGIL | DAITGIL |
| IDATGIL | DIATGIL | TIDAGIL | ITDAGIL | TDIAGIL | DTIAGIL | IDTAGIL | DI TAGIL |
| AGIDTIL | GAIDTIL | AIGDTIL | IAGDTIL | GIADTIL | IGADTIL | AGDITIL | GADITIL |
| ADGITIL | DAGITIL | GDAITIL | DGAITIL | AIDGTIL | IADGTIL | ADIGTIL | DAIGTIL |
| IDAGTIL | DIAGTIL | GIDATIL | IGDATIL | GDIATIL | DGIATIL | IDGATIL | DIGATIL |
| TGIDAIL | GTIDAIL | TIGDAIL | ITGDAIL | GITDAIL | IGTDAIL | TGDIAIL | GTDIAIL |
| TDGIAIL | DTGIAIL | GDTIAIL | DGTIAIL | TIDGAIL | ITDGAIL | TDIGAIL | DTIGAIL |
| IDTGAIL | DITGAIL | GIDTAIL | IGDTAIL | GIDTAIL | DGITAIL | IDGTAIL | DIGTAIL |
| AIIGDTL | IAIGDTL | IIAGDTL | AGIIDTL | GAIIDTL | AIGIDTL | IAGIDTL | GIAIDTL |
| IGAIDTL | IIGADTL | GIIADTL | IGIADTL | AIIDGTL | IAIDGTL | IIADGTL | AIDIGTL |
| IADIGTL | ADIIGTL | DAIIGTL | IDAIGTL | DIAIGTL | IIDAGTL | IDIAGTL | DI IAGTL |
| AGIDITL | GAIDITL | AIGDITL | IAGDITL | GIADITL | IGADITL | AGDIITL | GADIITL |
| ADGII TL | DAGIITL | GDAIITL | DGAIITL | AIDGITL | IADGITL | ADIGITL | DAIGITL |
| IDAGITL | DIAGITL | GIDAITL | IGDAITL | GDAIITL | DGIAITL | IDGAITL | DIGAITL |
| IIGDATL | GII DATL | IGIDATL | IIDGATL | IDIGATL | DIIGATL | GIDIATL | IGDIATL |
| GDIATL | DGIATL | IDGIATL | DIGIATL | TIIGDAL | ITIGDAL | IITGDAL | TGIIDAL |
| GTIIDAL | TIGIDAL | ITGIDAL | GITIDAL | IGTIDAL | IIGTDAL | GII TDAL | IGITDAL |
| TIIDGAL | ITIDGAL | IITDGAL | TIDIGAL | ITDIGAL | TDIIGAL | DTIIGAL | IDTIGAL |
| DITIGAL | IIDTGAL | IDITGAL | DIITGAL | TGIDIAL | GTIDIAL | TIGDIAL | ITGDIAL |
| GITDIAL | IGTDIAL | TGDIIAL | GTDIIAL | TDGIIAL | DTGIIAL | GDTIIAL | DGTIIAL |
| TIDGIAL | ITDGIAL | TDIGIAL | DTIGIAL | IDTGIAL | DITGIAL | GIDTIAL | IGDTIAL |
| GDITIAL | DGITIAL | IDGTIAL | DIGTIAL | IIGDTAL | GII DTAL | IGIDTAL | IIDGTAL |
| IDIGTAL | DIIGTAL | GIDITAL | IGDITAL | GDIITAL | DGIITAL | IDGITAL | DIGITAL |

