ARTICLES

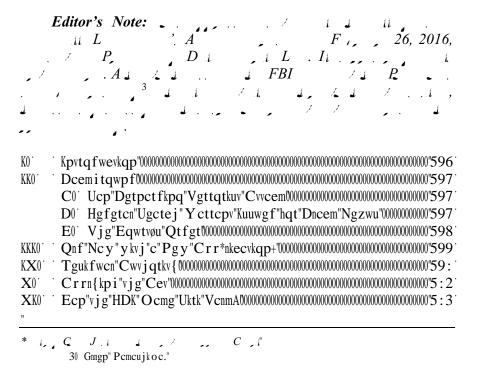
Y KNNC O G V V G "N C Y "T G X K G Y "

74<6"Uw o o gt"4238"

O CMKP I "CRRNGUCWEG<"TGHNGEVKQPU"QP"CRRNGøU" KRJQPG"ECUG"

 $\label{eq:cwn-loop-relation} J \ Q P Q T C D N G "R C W N "L 0" F G " O W P K \setminus , " \\ F K U V K P I W K U J G F "L W T K U V "K P "T G U K F G P E G. " Y K N N C O G V V G "W P K X G T U K V [" E Q N N G I G "Q H "N C Y "]$

RTKXCE ["NCY"U [ORQUKWO"MKEM/QHH"CFFTGUU"~"HGDTWCT ["48."4238"



u"

596"

ILLAME ELA EIE "

]74<595"

KO""KPVTQFWEVKQP"

 $I\ qqf"\ o\ qtpkpi0"\ V\ jcpm"\ \{qw."\ Ewtvku."\ hqt"\ v\ jcv"\ xgt\{"\ mkpf"\ kpvtq\ fwevkqp0"\ Kv"ku"c"rngcuwtg"vq"dg"c"u\ o\ cnn"rctv"qh"v\ jku"xgt\{"kpvgtguvkpi"\ U\{\ o\ rqukw\ o\ 0"\ Nkmg"\ \{qw."\ K"\ c\ o"\ xgt\{"\ kpvgtguvgf"\ kp"\ y\ jcv"\ qwt"\ gzrgtv"\ urgcmgtu"\ jcxg"vq"vgmn"wu"vqfc\{0"Cpf"v\ jcpmu"vq"cnn"qh"\{qw"hqt"vcmkpi"vk\ o\ g"\ htq\ o"\{qwt"dwu\{"ue\ jgfwngu"vq"cvvgpf"vqfc\{\emptysetu"U\{\ o\ rqukw\ o\ 0"\ J\ qy\ gxgt."\ dghqtg"\ y\ g"\ i\ gv"vq"v\ j\ g"\ o\ gcv"cpf"\ rqvcvqgu."uq"vq"urgcm."htq\ o"qwt"rtkxce\{"\ nc\ y"\ gzrgtvu"\ vqfc\{."\ K"\ jcxg"\ dggp"\ i\ kxgp"\ v\ j\ g"\ rtkxkng\ i\ g"\ qh"\ o\ cmkp\ i"uq\ o\ g''\ dtkgh"\ tg\ o\ ctm$

598"

4238_"

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 $o\; cuucetg\; \hat{o}\; dgeq\; o\; g"\; uwdlgev"\; vq"\; c"\; hg\; fgtcn"\; eqwtv"\; qt\; fgtA"\; Vq"\; cpu\; y\; gt"\; v\; j\; cv"\; dgeq\; o\; g"\; uwdlgev"\; vq\; c\; hg\; fgtcn\; eqwtv\; qt\; fgtA\; Vq\; cpu\; y\; gt\; v\; j\; cv\; dgeq\; o\; g\; uwdlgev\; vq\; c\; hg\; fgtcn\; eqwtv\; qt\; fgtA\; Vq\; cpu\; y\; gt\; v\; j\; cv\; dgeq\; o\; g\; uwdlgev\; vq\; c\; hg\; fgtcn\; eqwtv\; qt\; fgtA\; vq\; cpu\; y\; gt\; v\; j\; cv\; dgeq\; o\; g\; uwdlgev\; vq\; c\; hg\; fgtcn\; eqwtv\; eq$ $swguvkqp."\ y\ g\emptyset xg"\ i\ qv"\ vq"\ i\ q"\ dcem"\ rcuv"\ vj\ g"\ kRj\ qpg."\ Cr\ rng."\ cp\ f"\ Uvgxg"$ $Lqdu="yg \emptyset xg"iqv"vq"iq"dcem"449" \{gctu"vq"vjg"Cnn"Ytkvu"Cev"qh"39:;\emptyset"$

$\hbox{\tt KKK0""}Q \hbox{\tt NF"} N \hbox{\tt CY"} Y \hbox{\tt KVJ"} \hbox{\tt C"} P \hbox{\tt GY"} C \hbox{\tt RR*NKECVKQP+"}$

Vjg" Cm" Ytkvu" Cev" qh" 39:; "ku" tghtgujkpin{"dtkgh"dwv"dtqcf." rtqxkfkpi"vjcv<"

> $\begin{center} $^*c+"Vjg"Uwrtgog"Eqwtv"cpf"cnn"eqwtvu"guvcdnkujgf" \end{center}$ d{"Cev"qh"Eqpitguu" ... " ...

599"

59:"

 $\label{eq:constraints} Vjg"\,vgng\,r\,j\,qpg"\,eq\,o\,rcp\{"\,\,o\,qxg\,f"\,\,vq"\,\,xcecvg"\,\,vj\,g"\,\,eqwtv\emptyset u"\,qt\,fgt."\,dwv"\,\,vj\,g"\,\,eqwtv"\,\,cpu\,\,y\,gtg\,f"\,\,vj\,\,cv"\,\,kv"\,\,j\,\,c\,f''\,\,cwv\,j\,\,qt\,kv\,\{"\,\,vq''\,\,kuuwg''\,\,vj\,\,g''\,\,qt\,\,fgt''\,\,wp\,\,fgt''\,\,vj\,\,g''\,\,Cnn''\,\,Y\,\,tkvu''\,\,Cev0^3:"$

 $\label{eq:continuous} Vjg"Uwrtgog"Eqwtv"citggf"ykvj"vjg"fkuvtkev"eqwtv0^{42}"Vjg"Uwrtgog"Eqwtv" qdugtxgf"vjcv"vjg"Cnn"Ytkvu"Cev"rgtokvu"c"eqwtv"vq"wug"kvu"lwfiogpv"vq"õcejkgxg"vjg"tcvkqpcn"gpfu"qh"vjg"ncy0ö^{43}"Vjg"Eqwtv"jgnf"kp"vjcv"ecug"vjcv<"$

 $\label{eq:continuous_problem} \begin{array}{c} vjg" \; rqy \; gt" \; eqphgttg \; f" \; d \; "\; vjg" \;]Cnn" \; Y\; tkvu_" \; Cev" \\ gzvgp \; fu." \; wp \; fgt" \; cr\; rtq\; rtkcvg" \; ektew o uvcpegu." \; vq" \; rgtuqpu" \\ y\; jq." \; vjqwi \; j" \; pqv" \; rctvkgu" \; vq" \; vjg" \; qtk\; ikpcn" \; cevkqp" \; qt" \\ gpic\; ig\; f"\; kp" \; y\; tqp\; i\; fqkp\; i." \; ctg"\; kp"\; c"\; rqukvkqp" \; vq"\; htwuvtcvg" \\ vjg" \; k\; o\; rng\; o\; gpvcvkqp" \; qh"\; c"\; eqwtv" \; qt\; fgt" \; qt" \; vjg" \; rtq\; rgt" \\ c\; f\; o\; kpkuvtcvkqp" \; qh"\; lwuvkeg." \; cp\; f"\; gpeq\; o\; rcuugu" gxgp" \; vj\; qug" \\ y\; j\; q\; j\; cxg\; pqv\; vcmgp\; cp\; \{\; chhkt\; o\; cvkxg\; cevkqp\; vq\; j\; kp\; fgt\; lwuvkeg)^{44"} \end{array}$

 $\label{eq:continuous} Uq."vjg"Cev\emptysetu"rqygt"gzvgpfu"vq"\~orgtuqpu"yjq."vjqwij"pqv"rctvkgu"vq"vjg"qtkikpcn"cevkqp"qt"gpicigf"kp"ytqpifqkpi."ctg"kp"c"rqukvkqp"vq"htwuvtcvg"vjg"korngogpvcvkqp"qh"c"eqwtv"qtfgt"qt"vjg"rtqrgt"cfokpkuvtcvkqp"qh"lwuvkeg0\"o^{45}"$

 $Pqy." vy q" vj kpiu" ctg" engct<" *3+" vj g" Cnn" Y tkvu" Cev" gpeq o rcuugu" vj qug" yj q" j cxgpøv" vcmgp" cp { "chhkt o cvkxg" cevkqp" { gv. "cpf" *4+" vj g" Cev" crrnkgu" vq"pqprctvkgu0" J gtg. "vj cv" o gcpu" Crrng0" }$

KX0""TGUKFWCN"CWVJQTKV["

 $\label{eq:Vjg"Cnn"} V tkvu"Cev"ku"c"tguk f wcn"uqwteg"qh"cwv j qtkv { "hqt"eqwtvu0"Hqt" gzc o rng." v j g" Uwrtg o g" Eqwtv" gzrnckpg f" v j cv" wpf gt" v j g" Cev" eqwtvu" ecp" kuuwg"qtf gtu" v j cv"ctg"pqv"eqxgtg f" d { "c"tg i wnct"uvcvwvg0^{46"} }$

 $^{48. \}quad \text{$i$.$i$} \quad \text{,"DCNNGPVKPGØU"NCY"FKEVKQPCT["*5f"gf0"3;8;+"*cp"qtfgt"vq"crrgct"cpf"vguvkh{θ}$

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 $\texttt{hkxg"}\ y\ \texttt{kvpguugu0"Ukpeg"}\ v\ j\ g"\ y\ \texttt{kvpguugu"}\ y\ gtg"uecvvgtg\ f"\texttt{kp"}\ f\texttt{khhgtgpv}$

4238_" MAKING APPLE A CE"

5:3"

5:4"

wu ô nc y { gtu" cpf" pqpnc y { gtu" cnkmg0" V j g" qwveq o g" qh" y j cv" j cr r gpu" vq" v j g" Ucp" Dgtpct f kpq" u j qqvgtøu" nqemg f" kR j qpg" y knn" nkmgn { "chhgev" c" nct i g" pw o dgt" qh" õtg i wnctö" r gq r ng0"

 $\label{eq:continuous_problem} Y \ j \ kn \ "vjg" \ dcvvng" \ qxgt" \ rtgegfgpvu." \ qtfgtu." \ cpf" \ crrgcnu" \ y \ knn" \ j \ crrgp" \ kp" \ eqwtvtqqou." \ vjg" \ fgdcvg" \ qxgt" \ rtkxce \ "cpf" \ vjg" \ fgdcvg" \ qxgt" \ gpet \ \{rvgf" \ vgejpqnqi \ \{" \ ykm" \ oquv" \ uwtgn \ \{" \ tcig" \ qp" \ kp" \ vjg" \ rwdnke" \ \~oqyp" \ uswctg0\"o" \ Cntgcf \ \{."yg\'oxg" \ uggp" \ cp" gpqtoqwu" \ oqwv" \ qh" \ ogfkc" \ eqxgtcig" \ qp" \ vjku" \ kuuwg0" \ Vko" \ Eqqm." \ Crrngou" \ Ejkgh" \ Gzgewvkxg" \ Qhhkegt." \ tgngcugf" \ crwdnke" \ ngvvgt0^{58"} \ Vjg" \ crrgcn" \ vq" \ vjg" \ rwdnke" \ fqgupøv" \ uvqr" \ vjgtg0" \ Lko" \ Eqog \ \{."vjg" \ ugxgpvj" \ fktgevqt" \ qh" \ vjg" \ HDK" \ cpf" \ c"hqtogt" \ Fgrwv \ "Cvvqtpg \ "I \ gpgtcn" \ kp" \ vjg" \ I \ gqtig" \ Y0" \ Dwuj" \ cfokpkuvtcvkqp." \ ytqvg" \ c \ c \ "O$