

IEST5021

7 cfdcfUhY '9bj]fcba YbhU` 'Gi ghU]bUV]`]hmF Ydcfh]b[

7ci fgY⁻Cj Yfj]Yk

'GhJZZ'7cbhJWh'8YhJ]`g'

'7cbj Ybcfg'

B Ua Y	9a U]`	5j U]`UV]`]m	@cWJhjcb	D\cbY
5Ufcb A U[bYf		9aU]`WcbhUWh dfYZYffYX"AYYh]b[g Vm5ddc]bhaYbh'		

GWXcc``7cbHJWhi±bZcfa Uh]cb

GWkcc`cZ<iaUb]hJYg'UbX'@Ub[iU[Yg

@cWUhjcb. GWkcc`CZZJWYž'AcfjYb'6fckb'6i]X]b[ž'@YjY``&ž'&),

CdYb]b['< ci fg. 'A cbXUm! ': f]XUmž'- Ua '!') da

D\cbY. Ž*%%.-',) %,,%

: UI . Ž*%'&'-' ,) ', +\$)

9a U]`. \U`4 i bgk "YXi "Ui

7 ci fgY 8 YHJ]`g 7 fYX]hDc]bhg * Gi a a UfmcZh\Y 7 ci fgY

5ggYgga5**/gg**Ygga Ybh

 $: i \ ffh Yf`[i] XUbWY`dfcj] XYX`]b`WUgg`UbX`j]]U`A ccX`Y"\\$

5ggYgga Ybh'HUg_g'

5ggYgga YbhhUg_	K Y][\h	8iY'8UhY	Gh XYbh@YUfb]b[Ci hWca Yg 5ggYggYX
@ hYfUhifYFYj]Yk 5gg][baYbhi	' \$1	8 i Y^&^k YY_g^UZ I Yf^h\Y^Z <u>I</u> fgh k YY_^cZ]bhYbg]j Y^WUggYg	% <u>Z</u>
; fci d'DfYgYbhJhJcb'	&\$ı	Cb'h\Y``UghXUmcZh\Y'gYWcbX kYY_`cZ]bhYbg]jY'WUggYg	%2&2
±x]j]Xi U`5gg][ba Ybh) \$1	8 i Y '8 UhY 'H65ž'hck UfXg'h\Y YbX'cZhYfa "	

Gi Va]gg]cb`bchYg.Cb!WJa di gʻgh XYbhgʻdfYgYbh]b`WJgg/X]ghJbWYʻgh XYbhgʻgi Va]h'Uʻdck Yfdc]bhik]h\Ui X]cʻi]UʻA ccX`Y"

Hi fb]h]b gYh]b[. `H\]g Ugg][ba Ybh]g gi Va]hhYX h\fci [\`Hi fb]h]b UbX gh XYbhg Xc bchgYY Hi fb]h]b g]a]`Uf]hmfYdcfhg"

5ggYgga Ybh' . \(\pm\X\]j]Xi U 5gg][ba Ybh

GHJfh'XUhY.

@Yb[h\."\$\$\$"k cfXg

5XX]h]cbU`XYhU]`g.

GYY'A ccX`Y'Zcf'YI lfU'XYhJ]`g

Gi Va]gg]cb bchYg.Gi Va]hj]U A ccX`Y

 $\label{thm:limit} \begin{array}{ll} \mbox{Hi fb]h]b"gYhh]b" . "H\]g"Ugg][ba Ybh"]g"gi Va]hhYX"h\]fci [\ \ 'Hi fb]h]b"UbX"gh XYbhg"Xc"bchgYY"Hi fb]h]b g]a]"Uf]hmfYdcfhg" \\ \end{array}$

5 https://bxubwww.Fyei]fYaYbhg

 $\hbox{Ghi XYbhg'UfY'ghfcb[`m'YbWc'i fU[YX'hc'UhhYbX'U```WUggYg'UbX'fYj]Yk'``YWhfY'fY'WcfX]b[g''' } \\$

7ci fgY GWX YXi `Y

J]Yk 'WUgg'hja YHUV'Y

H]a YtUV`Y

8UHY	HmdY	7 cbh/bh
K YY_'%'cZhYfa fWca a YbWjb['' '>i bYŁ A cbXUmUbX'Hi YgXUm		Hk c'Z ```XUmg'cZ]bhYbg]j Y'k cf_g\cdg']b'gYa]bUf ghm`Y"': cW g']g'cb'dfUWfJWYg'cZWcfdcfUhY Ybj]fcba YbhU`fYdcfh]b["
K YY_`+`cZhYfa fWcaa YbWJb[`%)`>i`mL AcbžHiYgžKYX		H\fYY`Zi```XUmg`cZ]bhYbg]jY`kcf_g\cdg`]b`gYa]bUf ghm`Yž`k]h\`ghiXYbhdfYgYbhUh]cbg`cb`h\Y`Z]bU``XUm' 7UgY`ghiXm'ZcW'g"

FYgci fW/g

DfYgWf]VYX F Ygci fWYg

H\YgY'k]``VY'dfcj]XYX'j]U'mcif'AccX`Y'g]hYžig]b['h\Y'@9; 5BHC'gmghYaž'UbX'j]U'mcif'ckb'fYgYUfW\"

FYWca a YbXYX FYgci fWyg

H\YgY`k]``VY`dfcj]XYX`j]U`mcif`AccX`Y`g]M`žig]b[`h\Y`@9; 5BHC`gmghYažiUbX#cf`j]U`mcif`ckb`fYgYUfW\"

7ci fgY 9j U'i Uhjcb UbX 8Yj Y'cda Ybh

 $: YYXVUW_k \] ``VY'[Uh\YfYX'j] UA m9l dYf]YbW'''DfYj] ci g`Wca a YbhUfmgi [[Yghg`h\Y`bYYX`Zcf`Z fh\Yf] bhY[fUh]cb`cZcb!`]bY`UbX`]b!WUgg`UWj] hm''8Yj Y`cda Ybhg`UWfcgg`h\Y`A 9A `dfc[fUa `[]j Y`ZcW g`hc`h\Y Yl dYf]YbW'`cZX]ghUbW'`ghi XYbhg`UbX`h\Y`VYhhYf`i gY`cZcb!`]bY`Zcfi a g`UbX`]bXYdYbXYbhfYgYUfW\`Vm ghi XYbhg''$

5 WUXYa]W<cbYghmUbX D`U[]Uf]ga

D`U[]Uf]ga `]g`i g]b['h\Y`k cfXg`cf`]XYUg`cZch\Yfg`UbX`dfYgYbh]b['h\Ya `Ug`mci f`ck b"'=hWUb`hU_Y`a Ubm Zcfa gžZfca `XY`]VYfUhY`W\YUh]b['hc`UWW]XYbhU``mWcdm]b['Zfca `U`gci fW'k]h\ci hUW_bck `YX[Ya Ybh'

 $I BGK `[fci dg'd`U[]Uf]ga `]bhc'h\Y'Zc``ck]b[`WUhY[cf]Yg.$

 $7 \text{ cdm}b[...i g]b[...h\Y.gUa Y.cf.j Yfmig]a] \Uf'k cfXg'hc'h\Y.cf][]bU''hYl h'cf']XYU'k]h\ci h'U\V_bck `YX[]b[...h\Y.cf][]bU''hYl h'cf']XYU'k]h'cf']$