

NU_mbh\cg. K c %) \$ Hci f]ghYb Ui Z Y]b Yb 9]b \ Y]a]gWX Yb hfYZZYb °

9bhXYW_Yb^G]YžkY`WXY`YifcdÀ]gWXYb^FY]gYn]Y`Y`ibhYf CjYfhcif]gaig``Y]XYbžibX`YfZU\fYb^G]Yžk]Y`X]Yg^XUg^@YVYb XYf^9]b\Y]a]gWXYb^VYY]bZiggh"



NU_mbh\cgž; f]YWXYb`UbX'!`NU_mbh\cgžX]Y'a U`Yf]gWXY

[f]YWX]gWXY'\bgY`z'ghY\h']a ': c_i g'XYf'8]g_i gg]cb'\@VYf

Cj Yfhci f]ga i g']b'9i fcdU'''\@Ui h'Y]bYf'I bhYfgi WXi b['XYg

Vf]h]gWXYb'DcfhU`g' K \]WX3 ']gh'NU_mbh\cg'XUg'Ua 'ghÀf_ghYb

\@VYf`Ui ZYbY'FY]gYn]Y``Ui Z'XYa '?cbh]bYbh''A]h'Yhk U'%)\$

\[VYfbUWX hi b[Yb'dfc'9]bk c\bYf'k]fX'XYi h`]WX\z'k]Y'ghUf_'XYf

Hci f]ga i g'XUg'\@YVYb'XYf'9]b\Y]a]gWXYb'VYY]bhf\WXh][h''8]Y

\bgY`z'X]Y'bi f'fi bX'(\$"\$\$\$'9]bk c\bYf'\Uhz'Yf`YVh'\A\f`]WX'Y]bYb

Ni ghfca 'j cb'W]fWU'*'A]``]cbYb'I f`Ui VYfb''8]Yg'ghY``h'X]Y'[YgUa hY

`c_U`Y'\bZfUghfi _hi f'i bX'X]Y'\@YVYbgei U`]h\Ah'XYf'6Yk c\bYf'Ui Z'X]Y

DfcVY''

8 Y f '8 fi W_ž 'X Y f 'X i f W 'X Y b 'a Ugg]j Y b '5 b g h]Y ['Ub 'Hc i f]g h Y b hg h Y \ hž ']g h 'c ZZ Y b g]W \ h`]W \ "'9]b \ Y]a]g W Y 'V Y f]W h Y b 'j c b

ghY][YbXYb'A]YhYb'i bX'Y]bYa 'ghÀbX][Yb'JYf_Y\fgUi Z_ca a Yb k À\fYbX'XYf'<cW\gU]gcb"'8]Y'a Ugg]j Y'5bnU\`'Ub'Hci f]ghYb'ZØ\fh ni ', VYf`Ughi b[Yb']b'XYb'8]Ybgh`Y]ghi b[Yb'i bX'dfÀ[h'ghUf_'XUg gcn]U'Y'@YVYb'j cf'Cfh"'9]b'HUI]ZU\fYf'Ui Z'NU_mbh\cg'\Uh'g]W\'ØVYf XUg'JYf\U`hYb'Vf]h]gW\Yf'DUfhmhci f]ghYb'VYgW\k Yfhž'X]Y @Àfa VY'Àgh][i b[Yb'V]g'ZfØ\'a cf[Ybg'j Yfi fgUW\Yb'i bX'gca]h'XYb GW\`UZ'XYf'9]b\Y]a]gW\Yb'ghÒfYb"

Hci f]ga i g'i bX'gY]bY': c`[Yb

8]Y'j cf\YffgW\YbXYb'6YgW\k YfXYb'ØVYf'XYb'Hci f]ga i g
VYgW\f\ab_Yb'g]W\b]W\hbi f'Ui Z'@\fa i bX'JYf_Y\f"8]Y
9]b\Y]a]gW\Yb'VY_`U[Yb\Z'XUgg'`c_U`Y'; YgW\\\a\ZhY'i bX'_i `hi fY``Y
5b[YVchY'ni bY\a YbX'Ui Z'X]Y'6YX\ØfZb]ggY'XYf'Hci f]ghYb
Ui g[Yf]W\hYh'g]bX\Z'k cXi fW\'X]Y'5i h\Ybh]n]h\\\h'XYf'\dgY\`'Y]XYh"8]Y
I b[`Y]W\\Y]h'nk]gW\Yb'XYf'NU\`'XYf'6Ygi W\Yf'i bX'XYf
Ubg\\agg][Yb'6Yj \O`_Yfi b['k]fZh': fU[Yb'ni f'BUW\\U`h][_Y]h'Ui Z'
Ni [`Y]W\'a i g\fcca h'X]Y'Gcf[Y'i a 'X]Y'I a k Y'hi bX'X]Y
@YVYbgei U`]h\\\h']b'X]YgYb'\ØVYf`Ui ZYbYb'8 Ygh]bUh]cbYb"': Ugh'\%) \$
Hci f]ghYb'_ca a Yb'Ui Z'YXYb'9]bk c\bYf\Z'k Ug'Ybcfa Y'DfcV`Ya Y
]b'6Yni ['Ui Z'X]Y'9fgW\k]b[`]W_Y]h'Z\Øf'9]b\Y]a]gW\Y'i bX'X]Y
VYfY]hg'Ub[YgdUbbhYb'K c\bJ Yf\\\\h'b]qqY'bUW\'q]W\'n]Y\\\"

8]Y'Ghi X]Y'j cb' K\]WX3'HfUj Y`'\Uh'Ui »YfXYa 'nk Y]'k Y]hYfY

\(\pm \text{X}\)_UhcfYb'i bhYfgi WXh. 'X]Y'8]WXhY'j cb'Hci f]ghYb'dfc

E i UXfUh_]`ca YhYf'i bX'X]Y'; YgUa hnU\`'XYf', VYfbUWXhi b[Yb'''\delta\)

X]YgYa 'Ni gUa a Yb\Ub['VY`Y[h'\delta\frac{1}{2}]yb']b'?fcUh]Yb'a]h'%'' \(\text{z}\)

Hci f]ghYb'dfc'9]bk c\bYf'XYb'nk Y]hYb'D`Uhn\text{z}k \(\text{A}\)fYbX

: i YfhYj Ybhi fU'Ui Z'XYb'? UbUf]gWXYb'\delta\gY`b'a]h'%%, \(\text{z}+'\text{Zc}\)[h''8]YgY

NU\`Yb'i bhYfghfY]WXYb\text{z}XUgg'XUg'DfcV\`Ya 'XYg'Cj Yfhci f]ga i g

b]WXh'bi f'NU_mbh\cg'VYhf]\(\text{Zh}\text{z}\gcbXYfb'Ui WX'UbXYfY'Yi fcd\(\text{A}\)]gWXY

FY]gYn]Y`Y']b'A]h\`Y]XYbgWXUZh'n]Y\h''

9]b 6`]W_ Ui Z Ub X Y f Y Y i f c d À]g W Y G h À X h Y

B]Wk h'bi f' \pm 0gY`b'Yf`YVYb'XYb'8 fi W_'Xi fWk'XYb'A UggYbhci f]ga i g" \pm 0'GhÀXhYb'k]Y'DUf]gž'5h\Yb'i bX'?cdYb\U[Yb'[]Vh'Yg'YVYbZU``g U`Ufa]YfYbXY'NU\`Yb"'DUf]g'k Y]gh'Y]bY'hci f]gh]gWkY'8]WkhY'j cb

(%, "&, \$`Hci f]ghYb`dfc`Ei UXfUh_]`ca YhYf`Ui Zž`[YZc`[h'j cb`5h\Yba]h', , ")') `i bX`?cdYb\U[Yb`a]h'*' "- (("'8]YgY`K YfhY j YfXYi h`]W\Yb`X]Y`< YfUi gZcfXYfi b[Ybž'X]Y`a]h'Y]bYf`b]W\h bUW\\U`h][Yb`Hci f]ga i gdc`]h]__'j YfVi bXYb`g]bX"

: Øf'j]Y`Y'FY[]cbYb']b'9i fcdU'ghY``h'g]W\'XU\Yf'X]Y'XfÀb[YbXY
: fU[Y. 'K]Y'j]Y`Y'Hci f]ghYb'g]bX'ni 'j]Y`Y3'5b[Yg]W\hg'XYf
ghY][YbXYb'NU\`Yb'i bX'XYf'XUa]h'Y]b\Yf[Y\YbXYb'DfcV`Ya Y']gh
Yg'Ub'XYf'NY]hž'Y]bY'ga UfhYfY'Hci f]ga i gdc`]h]_'ni 'Ybhk]W_Y`bž'X]Y
gck c\``X]Y'6YXØfZb]ggY'XYf'FY]gYbXYb'U`g'Ui W\'X]Y'XYf
9]b\Y]a]gW\Yb'VYfØW_g]W\h][h"'Cj Yfhci f]ga i g'V`Y]Vh'gca]h'Y]b
XfÀb[YbXYg'H\Ya Už'XUg'b]W\h'][bcf]Yfh'k YfXYb'_Ubbž
]bgVYgcbXYfY'Ui Z'Y]bYf'gc'VYgi W\hYb' ⇒bgY``k]Y'NU_mbh\cg"

±g[YgUa h'V`Y]Vh'UVni k UfhYbžk Y`WXY'A U» bU\a Yb'Yf[f]ZZYb k YfXYbži a 'X]Y'6U`UbW'nk]gWXYb'Hci f]ga i g'i bX'@YVYbgei U`]hÀh Ui Z'X]YgYf']Xm``]gWXYb'[f]YWX]gWXYb'±bgY``i bX']b'UbXYfYb ØVYf`Ui ZYbYb'8Ygh]bUh]cbYb'\Yfni ghY``Yb"'K]Y'X]Y'6Yf]WXhY'j cb' GWX k ÀV]gWXY'i bX'BYcg'? cga cg'nY][Ybž']gh'X]Y <YfUi gZcfXYfi b['[fc» ž'XcWX'X]Y'; YgdfÀWXY'ØVYf'@Ògi b[Yb a ØggYb'Xf]b[YbX'VY[]bbYb"

8 Y hU]`g	
Cfh	NU_mbh\cgž'; f]YW\Yb`UbX
EiY``Yb	• k k k "gW\k UYV]gW\Y"XY
	• bYcg_cga cg"Wca

6 Ygi WX Yb 'G]Y 'i bg 'Ui Z. 'Y]bY!fY]gY "XY