

Jca '?f]Y['ni f': fYi bXgWXUZh.'9]b'6`]W_ Ui Z'XYb'¥`mgÅY!JYfhfU[

9fZU\fYb`G]Y`a Y\f`ØVYf`A UbZfYX`6fca a Yfg`9f]bbYfi b[YbUb`XYb`Nk Y]hYb`K Y`h_f]Y[`i bX`X]Y`XYi hgW\!ZfUbnÒg]gW\Y
5i ggÒ\bi b[`Xi fW\`XYb`\\`mg\AY!J YfhfU["



@OffUW ž8Yi hgW `UbX!'A UbZfYX'6fca a Yf'V`]W_h'Ui Z'Y]b

VYk Y[hYg'@YVYb'ni fØW_žXUg'ghUf_'j cb'XYf'A i g]_'[YdfÀ[h']gh''9f
\Uh'ZfØ\YghY'9f]bbYfi b[Yb'Ub'XYb'Nk Y]hYb'K Y'h_f]Y['i bX'XYb_h

Ub'X]Y'; fUbUhYbY]bgW\`À[Y'Ui Z'XYa 'HØ``]b[Yf'6Yf[']a '5df]``%-(\$
ni fØW_"'=b'X]YgYf'NY]h'k i fXY'gY]bY'<Y]a Uh'ZØf'j]Yf'K cW\Yb

Yj U_i]Yfhž'i bX'Yf'ZUbX'Ni Zi W\h']b'<Øg]b[Yb"'=\W\\\UVY'j]Y`'; `ØW_
[Y\UVh']a 'JYf[`Y]W\'ni 'UbXYfYb'?]bXYfb'k À\fYbX'XYg'?f]Y[Yg ž

gU[h'Yf'a]h'Y]bYa '<Ui W\'j cb'8 Ub_VUf_Y]h']b'XYf'Gh]a a Y''8]Y

A i g]_'\U'Z']\a 'Xi fW\'X]YgY'gW\k YfYb'NY]hYbž'Y]b'; YZØ\`'j cb

<CZZbi b['i bX'Bcfa U`]hÀh'ni 'VYk U\fYb'''I bhYf'XYb'j]Y`Yb'8]b[Ybž

X]Y']\a 'k]W\h]['g]bXž'ZfYi h'g]W\'6fca a Yf'VYgcbXYfg'ØVYf'X]Y

*\a a Y`U[Yž'X]Y'DUfhbYfgW\UZh'nk]gW\Yb'8Yi hgW\`UbX'i bX

: fUb_fY]W\z'X]Y'ZØf']\b'Y]b'Gma Vc``XYf'JYfgÔ\bi b['XUfghY``h''

 $8] YgY`JYfV] bXi b[`k]fX`] a `?cbhYlh`XYg`\] ghcf] gWX`VYXYi hYbXYb \\ Y`mgÅY!JYfhfU[g`jcb`%-*'`g] WXhVUf"$

8 Yf Y mgåY! J Yfhfu[ži bhYfnY] W bYh Ua '&&" 'Jbi Uf '%- *' 'j cb 6i bXYg_Ubn'Yf '? cbfUX '5 XYbUi Yf i bX 'XYa 'ZfUbnÒg]gW Yb GhUUhgdfàg] X YbhYb '7 \ Uf 'Yg 'XY'; Ui 'Yž k Uf 'Y] b 'YbhgW Y] X Yb XYf GW f]hh ni f '6 YYb X][i b['XYf 'U\f\i bXYfhY 'Ub[Yb '9fVZY] b XgW UZh nk]gW XYb 'XYb 'VY] X Yb '@àb X Yfb" '8 Yf 'J Yfhfu['k i f XY'] a 'GU 'cb A i fUh X Yg 'Y mgåY! DU 'UghYg '] b 'DUf]g'i bhYfnY] W bYhi b X 'ghY 'hY 'Y] b Y [fi b X 'Y[Yb X Y 'B Yi [YghU hi b['XYf 'XYi hgW ! ZfUbnÒg]gW Yb 6 Yn] Y\i b[Yb 'X Uf ž X] Y 'gY] h 'XYb '%-) \$ Yf '\J\f Yb 'Ui Z 'Y] b Y 5 i ggÒ\bi b['\] b Uf VY] h Yh Yb" '8] YgY 'DUfhb YfgW UZh 'gc '`hY 'b] W h 'bi f X] Ya Y] b gUa Y 'Yi fcdà]gW Y 'Ni _i b Zh ZÒf X Yfb" '8 Ug '5 V_ca a Yb ghY 'h Y] b Y 'J Yfd Z] W hi b ['ZØf'i b gYfY 'B UW Zc '[Yf X Uf ž VYhcbhY 5 X Yb Ui Yf'i b X 'Y[hY X Ua]h X Yb '; fi b X ghY] b 'ZØf 'X Ug z'k Ug '\Yi hY 'U 'g A chcf' X Yf 'Yi fcdà]gW Yb '\=bhY[fUh]cb' []'h"

8]Y <]ghcf]Y \]bhYf XYf : fYi bXgW UZh

K Ufi a ']gh'X]YgYf'J YfhfU['gc'VYXYi hYbX3'<]ghcf]gW.'[YgY\Yb'[UV Yg'nk]gW.Yb'8Yi hgW.`UbX'i bX': fUb_fY]W.']a a Yf'k]YXYf'D\UgYb j cb'ZY]bXgY`][Yb'6Yn]Y\i b[Ybž'[YdfÀ[h'Xi fW.'?cbZ]_hY'i bX'X]Y ?cb_i ffYbn'i a 'A UW.h'i bX'HYff]hcf]i a "'8]Y' 9fVZY]bXgW.UZh 'k Uf cZh'j cb'fYj c'i h]cbÀfYb'l bfi \Yb'i bX'a]']hÀf]gW.Yb 5i gY]bUbXYfgYhni b[Yb'[YdfÀ[h"'BUW.'XYa 'Nk Y]hYb'K Y`h_f]Y[gW.]Yb'X]Y', VYfk]bXi b['X]YgYf': Y]bXgW.UZh'YXcW.'a Ô[`]W.ž'k Ug a]h'XYa '¥`mgÅY!J YfhfU[']bgh]hi h]cbU`]g]Yfh'k i fXY"'8]Y'GhÀf_i b[XYf'Ni gUa a YbUfVY]h'i a gW.`cgg'b]W.h'bi f'dc`]h]gW.Y'6Y`Ub[Yž gcbXYfb'Ui W.'6YfY]W.Y'k]Y'6]`Xi b['i bX'\$ [YbXž'k Ug'ni nU\`fY]W.Yb'\$]h]Uh]j Ybž'Yhk U'XYa '8Yi hgW.!: fUbnÒg]gW.Yb

8 Yf'J Yfhfu['a Uf_]YfhY'ni XYa 'XYb'6Y[]bb'fY[Y`a À»][Yf?cbgi `hUh]cbYb'nk]gWXYb'XYb'GhUUhg!'i bX'FY[]Yfi b[gWXYZg'gck]YXYb'5i » Yba]b]ghYfb'VY]XYf'@ÀbXYf"'8]YgY'[Ya Y]bgUa Yb'HfYZZYbn]Y`Yb'XUfUi Z'UVžY]bY'k Y]h[Y\YbX'[`Y]WX [Yf]WXhYhY' < U`hi b[']bXYf'5i » Ybdc`]h]_'ni 'Ybhk]W_Y`bž']bgVYgcbXYfY']b'6Yni ['Ui Z'X]Y

 $\label{thm:cda} Yifcda]gWXY'9]b][ib["'5iWX'kYbb'Yg']b'XYf'JYf[Ub[YbY]h\\ gdcfUX]gWX'ni'=bhYfYggYb_cbZ]_hYb'_Ua~ž'[Y'hYb'8Yi~hgWX'UbX'ibX':fUb_fY]WX'Yi~hY'U`q'X]Y'JcffY]hYf'XYf'9I!=bhY[fUh]cb"$

9]b 6`]W_]b X]Y Ni _i b Zh

K]f'g]bX'b]Wkh'bi f'BUWkVUfbž'k]f'g]bX'DUfhbYf ž'_ÒbbhY'a UbgU[Ybž'k Ybb'a Ub'X]Y'XYi hgWk!ZfUbnÒg]gWkYb'6Yn]Y\i b[Yb']b'XYf\Yi h][Yb'NY]h'VYhfUWkhYh''8Yf'\paragangayY!JYfhfU['V`Y]Vh'Y]b: i bXUa Ybh'X]YgYf': fYi bXgWkUZh'i bX'k]fX'Xi fWk'k Y]hYfY JYfY]bVUfi b[Ybž'k]Y'XYb'JYfhfU['j cb'5UWkYb'&\$%-ž'VY_fÀZh][h''8]YgY'bYi YfY'JYfY]bVUfi b['n]Y`h'XUfUi Z'UVž'X]Y'Ni gUa a YbUfVY]h]b'6YfY]WkYb'k]Y'JYfhY]X][i b['i bX'?i `hi f'ni 'j Yfh]YZYb'i bX'nY][hž XUgg'X]Y'dUfhbYfgWkUZh`]WkYb'6Ya Ø\i b[Yb'Ui Wk']b'Ni _i bZh'\cWk]a '?i fg'ghY\Yb''

♣ 'Y]bYa '9i fcdU'XYf'J]Y`ZU`h'i bX'XYg'K UbXY`g'V`Y]Vh'XYf
]bhYffUW]U`5i ghUi gWX 'nk]gWXYb'8 Yi hgWX`UbX'i bX': fUb_fY]WX'j cb
nYbhfU`Yf'6YXYi hi b["'8]Y'<YfUi gZcfXYfi b[Ybž'XYbYb'g]WX'X]Y
VY]XYb'@ÀbXYf'[Y[YbØVYfgY\Ybž'YfZcfXYfb'Y]bY'ghUf_Y'i bX
j Yf`Àgg`]WXY'DUfhbYfgWXUZhž'X]Y'ØVYf'dc`]h]gWXY'8]ZZYfYbnYb
\]bUi g[Y\h"A UbZfYX'6fca a Yfž'XYf'a]h'gY]bYf'A i g]_ghYhg'Y]b
NY]WXYb'ZØf': f]YXYb'i bX'JYfghÀbX][i b['gYhnhž'gd]Y[Y`h'X]YgYb
; Y]gh'k]XYf'i bX'nY][hž'k]Y'k]WXh]['Yg']ghž'Ui g'XYf'; YgWX]WXhY'ni
`YfbYb'i bX'XUg'; i hY'ni 'VYk U\fYb"

8 Y hU]`g	
Cfh	@OffUWX ž'8 Yi hgWX `Ub X
EiY``Yb	• k k k "j Yf`U[g\ Ui g! 'Ui a Ubb"XY
	• UfWX]j "X]d`c"XY
	XY"k]_]dYX]U"cf[

6 Ygi WX Yb 'G]Y 'i bg 'Ui Z 'bU[!Vk "XY