

CgbUVfØW_'YffY]W\h'<U`VnY]h']a '; `UgZUgYfUi gVUi .'6]g'&\$&+gc``Yb',) "\$\$\$'<Ui g\U`hY'Ni [Ub['ni 'gW\bY``Ya '♣bhYfbYh VY_ca a Yb"

 $\pm 0.^{\circ} C gbUVfØW_igWX fY]hYhiXYf^5i gVUi iXYg^; `UgZUgYfbYhnYg^a]h $$ _fAZh][Yb^{\circ} GWX f]hhYb^{\circ} j cfUb^{"}8]Y^{\circ} GK^{\circ} C^{\circ} BYhn^{\circ} bX^{\circ}; `UgZUgYf^{\circ} BcfXk^{\circ} Ygh^{\circ} bY^{\circ} Yb^{\circ} gY]h^{\circ} &\$ &\% X]Y^{\circ} < YfUi gZcfXYfi b['Ubz^{\circ} V]g^{\circ} &\$ &+ ']bg[YgUa^{\circ} h^{\circ},) "$$$ '< Ui g^{\circ} U^{\circ} hYb^{\circ} Y]bYb^{\circ} Ni [Ub[iniaagWX bY^{\circ} Yb^{\circ} bhYfbYh^{\circ} ni Yfa^{\circ} O[`]WXYb^{"}8Yf^{\circ} Nk^{\circ} gWXYbVYf]WX^{\circ} h^{\circ} nY][hz^{\circ} XUgg^{\circ} X]Y^{\circ} 6Ui^{\circ} UfVY]hYb^{\circ} [ih^{\circ} a^{\circ} NY]hd^{\circ} Ub^{\circ}]Y[Ybz^{\circ} ibX^{\circ} Ui^{\circ} WX^{\circ} X]Y^{\circ} bAWX^{\circ} ghYb^{\circ} 5i^{\circ} gVUi^{\circ} [YV]YhY^{\circ} g]bX^{\circ} VYfY]hg^{\circ} ZYgh[Y^{\circ} Y[h^{"} 8]YgYg^{\circ} bhYfZUb[Yb^{\circ} k]fX^{\circ} U^{\circ} g^{\circ} Y]bYg^{\circ} XYf^{\circ} [fO^{\circ} hYb^{\circ} bZfUghfi^{\circ} hi^{\circ} fdfc^{\circ} Y^{\circ} hY^{\circ}]b^{\circ} XYf^{\circ} FY[]cb^{\circ} Ub[YgY^{\circ} Yb^{\circ} ibX^{\circ} VUh^{\circ} XUg^{\circ} N]Y^{\circ} ZX][]hU^{\circ} Y^{\circ} Ni^{\circ} ibZh^{\circ} XYf^{\circ} GhUXh^{\circ} bUWX^{\circ} U^{\circ} hYb^{\circ}][nia^{\circ} YghU^{\circ} hYb^{\circ}]$

8]Y'8][]hU`]g]Yfi b['[Y\Òfh'ni 'i bgYfYb'k]W\h][ghYb Ni_i bZhgh\Ya Yb ž'VYhcbh'CVYfVØf[Yfa Y]ghYf]b'?Uh\Uf]bU'DÒhhYf i bX'\YVh'\Yfj cfž'XUgg'gW\bY``Y' +bhYfbYhUbgW\`ØggY'b]W\h'bi f'ZØf I bhYfbY\a Ybž']bgVYgcbXYfY']b'XYf'GhUfh!i d!<Ui dhghUXh B]YXYfgUW\gYbgž'j cb'[fc»Yf'6YXYi hi b['g]bXž'gcbXYfb'Ui W\'ZØf Df]j Uh\Ui g\U`hY''5i W\'g]Y'k YfXYb']b'bU\Yf'Ni_i bZh'X]Y'JcfhY]`Y j cb'\c\Yb', VYfhfU[i b[gfUhYb'VYbÒh][Ybž'X]Y'ZØf'Y]bYb fY]Vi b[g`cgYb'+bhYfbYhni [Ub['bchk YbX]['g]bX''

cfhgWxf]hhYVY]a 5igVUi

6YfY]hg`]b`a Y\fYfYb`GhUXhhY]`Ybž'XUfi bhYf`XUg`?Uh\Uf]bYbj]YfhY`i bX`X]Y`j cfXYfY`K ØghYž'g]bX`X]Y`6Ui UfVY]hYb`UV[YgW\`cggYb" 8YfnY]h`k]fX`]b`UbXYfYb`; YV]YhYb`k]Y`Gi hh\Ui gYbž'9j YfgVi f[ž

@Øghf]b[Yb'i bX'<Y``Yfb'_fÀZh]['k Y]hYf'[YVUi h'' K]Y'j]Y`Y 6Øf[Yf]bbYb'i bX'6Øf[Yf']b']\fYf'GhfU» Y'Yf`YVh'\UVYbž'[Y\h'XYf 5i gVUi 'nØ[]['j cfUb ž'Yf_`Àfh'DÒhhYf'i bX'\YVh'\Yfj cfž'XUgg'X]Y GK C'BYhn'U`g'`c_U`Yf'5bV]YhYf'Y]bY'k]W\h][Y'Fc``Y'VY]'XYf ?ccfX]bUh]cb'XYf'5fVY]hYb'gd]Y`h"

5fh]_Y`i bhYfgi W\i b[Yb`nY][Ybž'XUgg'V]g'Yhnh'a Y\f'U`g'&\$\$
?]`ca YhYf'XYf'; `UgZUgYfhfUggY'j Yf`Y[h'k i fXYbž'k Ug']b'Yhk U'XYf
8]ghUbn'j cb'XYf'6fYa Yf'6fØW_Y'ni f'&\Ub!7fi mZZ!5fYbU']b
5a ghYfXUa 'Ybhgdf]W\h''8]Yg'VY]b\U`hYh'Ui W\'X]Y'\phghU``Uh]cb'j cb
ØVYf'&\$\$'BYhnj YfhY]`Yf_AghYb'i bX'gYW\g'gdYn]Y``Yb'7c!
GhUbXcfhYb'ZØf': HH<'fl]VYf'hc'h\Y'<ca Y\t'''JcfghUbXga]h[`]YX
8Ub]Y``K UgW\ck'j cb'XYb'GhUXhk Yf_Yb'CgbUVfØW_'Yf_`Afh
; `UgZUgYfUbgW\`ØggY'g]bX'b]W\h'bi f'gW\bY``ž'gcbXYfb'Ui W\
bUW\\U`h]["'G]Y'j YfVfUi W\Yb'fi bX'%+!a U``k Yb][Yf'Ghfca ']a
JYf[`Y]W\'ni '\Yf_Òa a `]W\Yb'?i dZYf`Y]hi b[Yb"

8]Y'BUW\ZfU[Y'ghY][h

8]Y 8]g_fYdUbnink]gWXYb 5b[YVchii bX BUWXZfU[Y'k ÀWXghii bX XYf'A Uf_h'ZØf'; `UgZUgYfUbgWX `ØggY'n]Y\h']a a Yf'a Y\f

\$\text{b}\text{h}\text{f}\text{ggYbhYb'Ub'' 5bXfYUg'A UmYfž'; YgWX\AZhgZØ\fYf'j cb'; `UgZUgYf
BcfXk Yghz'ghY``h'_`Uf.' 8]Y BUWXZfU[Y'bUWX'\c\Yb'6UbXVfY]hYb
k \AWXgh'_cbh]bi]Yf']WX'' '9f'Ya dZ]Y\`h'XYb'6Øf[Yf]bbYb'i bX
6Øf[Yfbz'X]Y'; Y`Y[Yb\Y]h'ni 'bi hnYbz']\fY'=a a cV]`]Yb'Xi fWX'Y]bYb
; `UgZUgYfUbgWX`i gg'Ui Zni k YfhYb''8]Yg'k \AfY'Y]bY'ni _i bZhgg]WXYfY

\$\text{b}\text{j}\text{Ygh}\h']b|z'X]Y'Ui Z``Ub[Y'G]WX h'9fhfU['Vf]b[Yb'_\ObbhY''

6YgcbXYfg'j cfhY]`\UZh']gh'XUg'C dYb'5WW gg!Df]bn]dž'XUg g]W\YfghY``hž'XUgg'XUg'; `UgZUgYfbYhn']b'CgbUVfØW_X]g_f]a]b]Yfi b[gZfY]'ZØf'XYb'[YgUa hYbHY`Y_ca a i b]_Uh]cbga Uf_h'ni [Àb[`]W\']gh"'8]Yg'[]Vh'XYb JYfVfUi W\Yfb'X]Y'A Ò[`]W_Y]hž'g]W\'ZfY]'nk]gW\Yb i bhYfgW\]YX`]W\Yb'5bV]YhYfb'i bX'HUf]ZYb'k]Y'HY`Y_ca ž'CgbUhY`i bX'%' %'ni 'YbhgW\Y]XYb"'8]Y'5i gk U\``\Uh'g]W\'gca]h'Yf\YV`]W\Yfk Y]hYfh'i bX'X]Y'6YX]b[i b[Yb'g]bX'ZØf'U``Y'[`Y]W\"

 $8\,]Y\,^cGhUX\,hk\,\,Y\,f_Y\,!\,B\,Y\,hn\,hc\,W\,hY\,f^*V\,Y\,fY\,]hY\,h^*V\,Y\,fY\,]hg^*X\,]Y\,^cb\,\grave{A}\,W\,g\,hY\,b$

5i gVUi dfc Y_hY j cf" =a '_ca a YbXYb'*J\f'k YfXYb'k]f'Ua

K YghYfVYf[ž']b' < UghYž'DmY'i bX'; fYhYgW\'a]h'XYa '5i gVUi

ZcfhZU\fYb"'GhØW_'ZØf'GhØW_'_ca a Yb'k]f'i bgYfYa 'N]Y`bÀ\Yf ž'gc

H]bc'GW\a Y`n`Yž'; YgW\\AZhgZØ\fYf'j cb'GK C'BYhn"'8]Y
_cbh]bi]Yf`]W\Yb': cfhgW\\f]hhY'g]bX'Ui Z'XYf'Cb`]bY!D`UhhZcfa

k k k "gk c!bYhn"XY#a]gg]cb![`UgZUgYfž'k c'U``Y'5i gVUi [YV]YhY'i bX

XYf'U_hi Y``Y'GhUhi g'Y|bni gY\Yb'q]bXž'Xc_i a Ybh]Yfh"

Ni_i bZh'XYg'gW\bY``Yb'=bhYfbYhg

8 Yf; `UgZUgYfUi gVUi ']b 'C gbUVfØW_']gh'Y]b 'k]WX h][Yf'GWX f]hh']b Y]b Y ni bY\a YbX'X][]hU`Y'Ni _i bZh" K À\fYbX'X]Y 'GhUXh'Ub 'XYf X][]hU`Yb '\dag{b}ZfUghfi _hi f'UfVY]hYhž'k]fX'_`Ufž'XUgg'YXY'\dog{b} Ygh]h]cb']b X]YgY'HYWX bc`c[]Y'b]WX h'bi f'_i fnZf]gh][Y'@Ògi b[Yb'V]YhYhž gcbXYfb'Ui WX'`Ub[Zf]gh][Y'J cfhY]`Y'Vf]b[h"'8]YgY'9bhk]W_`i b['k]fX YbhgWXY]XYbX'ZØf'X]Y'K YhhVYk YfVgZÀ\][_Y]h'XYf'GhUXh'i bX'X]Y : ÒfXYfi b['bYi Yf'HYWX bc`c[]Yb']b'XYb'_ca a YbXYb'\dy\fnY\bhYb gY]b"'8]Y'GhUXh'C gbUVfØW_'nY][hž'XUgg'a]h'XYa 'f]WXh][Yb'5bgUhn i bX'`c_U`Ya '9b[U[Ya Ybh'Y]bY'ni _i bZhgg]WXYfY \dog{b}hYfbYhj Yfgcf[i b['ZØf'U``Y'YffY]WXVUf']gh"

 $8]Y \cdot 9b \text{ lk }] \underline{W} \text{ ib } [\cdot Y] \text{bYg}; \quad \text{UgZUgYfbYhnYg}]b \cdot C \text{gbUVfØW} \text{ghY} \text{ hrb}] Wk h bi f \cdot Y] bY \cdot hY Wk b] gWk Y \cdot J \text{YfVYggYfi b} [\cdot \text{XUfž} \text{gcb} \text{XYfb} \cdot \text{VUh} \text{Ui} \cdot \text{Wk} h] YZ[\text{Y} \setminus \text{Yb} \text{XY} \cdot [\text{YgY} \cap \text{gWk} \cup \text{Zh}]) Wk Y \cdot 5 i \text{ gk }] f_i b [\text{Yb} \cdot \cdot 5 b [\text{Yg}] Wk \text{hg} \cdot \text{XYf} k \cup \text{Wk} \text{gYb} \text{XYb} \cdot \text{X}] []hU \cdot \text{Yb} \cdot 5 b \text{Zcf} \text{XYfi b} [\text{Yb} \cdot] b \cdot j] Y \cdot \text{Yb} \cdot \text{@Y} \text{VYbgVYfY}] Wk \text{Yb} z j \text{cb} \cdot \text{XYf} \cdot 6] \cdot \text{Xi b} [\cdot \text{V}] \text{grii} \text{f} \cdot 5 \text{fVY}] hz k]fX \cdot \text{XYf} \cdot \text{Ni} [\cup \text{b} [\cdot \text{ni} \cdot <] [\cdot \cdot | \text{GdYYX} | + b \cdot \text{Y} \cdot | \text{b} \cdot \text{Y} \cdot | \text{g} \cdot \text{g} \cdot | \text{g} \cdot | \text{g} \cdot | \text{g} \cdot \text{Y} \cdot | \text{g} \cdot | \text{g$

K]fhgWX UZh`]WX Y 5i gk]f_i b[Yb XYg ; `UgZUgYfUi gVUi g

5fVY]h[YVYfjYfVÀbXY fl685Ł _ ObbYb gWxbY ``Y

♣bYYfbYhj YfV]bXi b[Yb X]Y DfcXi _h]j]hÀh]b I bYYfbY\a Yb XYi h`]Wx
ghY][Yfb "6YgcbXYfg ZØf GhUfhli dg i bX _ `Y]bY I bYYfbY\a Yb]b

B]YXYfgUWxgYbž X]Y 'Ui Z'X][]hU`Y @Ogi b[Yb 'Ub[Yk]YgYb 'g]bXž

V]YhYh XYf Ni [Ub['ni 'Y]bYa 'a cXYfbYb'; `UgZUgYfbYhn

Yb hgWxY]XYbXY 'J cfhY]`Y "'8]YgY I bYYfbY\a Yb 'dfcZ]h]YfYb 'j cb
gWxbY``YfYb 'HfUbqU_h]cbYb i bX 'XYf'A Oj ``]Wx_Y]hž]\fY

8 YbghYghib[YbX][]hU`niYfkY]hYfb"

 $8]Y'j YfVYggYfhYb' + bhYfbYhj YfV]bXi b[Yb'ZØ\fYb'cZh'Ui W\'ni 'Y]bYf GhY][Yfi b['XYf' + a a cV]']Ybk YfhY']b'XYb'VYhfcZZYbYb'; YV]YhYbž'XU a cXYfbY'? Ai ZYf'i bX'A]YhYf'ni bY\a YbX'K Yfh'Ui Z'[i hY + bhYfbYhUbV]bXi b['Y[Yb"8]Y'GhUXh'CgbUVfØW_'_ObbhY'gca]h b]W\'h'bi f'j cb'Y]bYf'_U`_i ']YfhYb' < UbX'i b['dfcZ]h]YfYbž'gcbXYfb Ui W\'XYb'I bhYfbY\a YbgghUbXcfh']bg[YgUa h'ghÀf_Yb''$

$BUWX \setminus U^h][Y]h^ibX^iO_c^c[]gWXY^i; Yg]WXhgdib_hY$

8]Yii a k Y`hZfYi bX`]WXYb'9][YbgWXUZhYb'XYf'; `UgZUgYfhYWXbc`c[]Y j YfX]YbYb'VYgcbXYfY'6YUWXhi b["'8]Y']a '5i gVUi 'j Yfk YbXYhYb A UhYf]U`]Yb'g]bX'`Ub[`YV][ži bX'XYf'9bYf[]Yj YfVfUi WX']gh']a J Yf[`Y]WX'ni f'\Yf_Òa a `]WXYb'?i dZYfhYWXbc`c[]Y'Yf\YV']WX b]YXf][Yf"'@Ui h'Y]bYf'Ghi X]Y'XYf'=bhYfbUh]cbU`
HY`YWca a i b]WUh]cb'I b]cb'fHI Ł'j YfVfUi WXh'Y]b
; `UgZUgYf`Y]hYf'Yhk U'%+!a U``k Yb][Yf'9bYf[]Y'U`g'Y]b'?i dZYf_UVY`" 8]YgY'9]bgdUfi b[Yb'a ØggYb']b'6YhfUWXh'[Ync[Yb'k YfXYbž]bgVYgcbXYfY'XU'j]Y`Y'GhÀXhY'i bX'FY[]cbYb']\fY'?`]a Un]Y`Y

8 i fWX 'X]Y': ÒfXYfi b['Y]bYg'bUWX\U`h][Yb' \Rightarrow hYfbYh'ni [Ub[g i bhYfghØhnh'X]Y'GhUXh'CgbUVfØW_'b]WXh'bi f'X]Y'U_hi Y``Yb 6YXØfZb]ggY']\fYf'6Øf[Yfž'gcbXYfb']bj Ygh]Yfh'Ui WX']b'X]Y ni _ØbZh][Y'@YVYbgei U`]hÀh''8]Y' \Rightarrow a d`Ya Ybh]Yfi b[i a k Y`hZfYi bX`]WXYf'HYWXbc`c[]Yb'gc``hY'XU\Yf'U`g'dcg]h]j Yg'N]Y`]a 'FU\a Yb'j cb' \Rightarrow bZfUghfi _hi fdfc'Y_hYb'Ub[YgY\Yb'k YfXYb''

6`]W_'Ui Z'X]Y'Ni _i bZh.'8][]hU`Y'HY]`\ UVY

9]b'k Y]hYfYf'YbhgW\Y]XYbXYf'5gdY_h']gh'X]Y'X][]hU'Y'HY]`\UVY'ZØf
U'`Y'6Øf[Yf]bbYb'i bX'6Øf[Yf"'8Yf'Ni [Ub['ni 'gW\bY``Ya '\dag hYfbYh
Yfa O[`]W\h'Ygž']b'Y]bYf'ni bY\a YbX'j YfbYhnhYb'K Y`h'hY]`ni \UVYbž
gY]'Yg'VY]'C'b`]bY!J YfUbghU`hi b[Ybž'XYf'Bi hni b['X][]hU`Yf
6]`Xi b[gUb[YVchY'cXYf'VY]a 'Ni [Ub['ni 'HY`Ya YX]n]b!8]YbghYb"
8]Y'GhUXh'CgbUVfØW_'ghfYVh'b]W\h'bi f'XYb'5i gVUi ž'gcbXYfb'Ui W\
X]Y'7\UbWYb[`Y]W\\Y]h']a 'X][]hU`Yb'FUi a 'Ub"

I a 'X]Yg'ni 'YffY]WXYbž'gc``hYb'±b]h]Uh]j Yb'[YZÒfXYfh'k YfXYbž'X]Y]bgVYgcbXYfY'gcn]U``VYbUWXhY]`][hY'6Yj Ò`_Yfi b[g[fi ddYbUbgdfYWXYb"'GWXi`i b[Yb'ni f'X][]hU`Yb'?ca dYhYbn'i bX'Ni [Ub[ni '[Øbgh][Yb'±bhYfbYhdU_YhYb'_ObbhYb'XUni 'VY]hfU[Ybž'XUggb]Ya UbX'ni fØW_[Y`UggYb'k]fX'i bX'YXYf'X]Y'JcfhY]`Y'Y]bYga cXYfbYb'; `UgZUgYfbYhnYg'ZØf'g]WX'bi hnYb'_Ubb"

8 Y hU]`g

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