

Dc`]h]_i bhYff]WX h']b'GUWX gYb!5b\U`h. 9]bV`]W_']b'X]Y'6]`Xi b[gYbhk]W_`i b[

9bhXYW_Yb'G]Y'X]Y'9bhk]W_`i b['XYg'Dc`]h]_i bhYff]Wk hg']b
XYi hgWk Yb'GWki `Yb'j cb'%- (-'V]g'&\$%-"'9]bY'bYi Y'Ghi X]Y
XYg'@=Z6]'nY][hž'k]Y'XYf'Dc`]h]_i bhYff]Wk h'j cb'dc`]h]gWk Yb
9]bZØggYb'[YdfÀ[h'kifXY'ibX'kY`WkY'IbhYfgWk]YXY
nk]gWk Yb'XYb'6i bXYg`ÀbXYfb'VYghY\Yb"'9fZU\fYb'G]Yž'k]Y
dc`]h]gWk Y'6]`Xi b['nif'GhÀf_i b['XYf'8 Ya c_fUh]Y'VY]hfÀ[h
i bX'kY`WkY'Fc``Y'b]Wk h![mabUg]U`Y'GWki`ZcfaYb'XUVY]
gd]Y`Yb"'HUi WkYb'G]Y'Y]b']b'gdUbbYbXY'9f_Ybbhb]ggY'ØVYf
X]Y'5i qk]f_i b[Yb'dc`]h]qWkYf'6]`Xi b['Ui Z'X]Y'; YqY``qWkUZh"



8 Y f '9] b Z i gg 'X Y f 'd c `] h] g W Y b '6] `X i b ['U i Z 'X] Y

; YgY``gWX UZh. '9]b '6`]W_ 'Ui Z'X]Y

I bhYff]WXhgnY]h]b 8 Yi hgWX `Ub X

 \pm 0 'XYb '`YhnhYb ' \pm U\fYb '\Uh'X]Y '[YgY``gW\UZh`]W\Y '8 YVUhhY ' \emptyset VYf

dc`]h]gWXY'6]`Xi b['Ub'GWXi `Yb'Ub'6YXYi hi b['[Yk cbbYb"'8Yf FØW_[Ub['XYg'J YfhfUi Ybg']b'ghUUh`]WXY' \deltagh]hi h]cbYb'i bX'XYf 5bgh]Y['YI hfYa 'fYWX hYf'DUfhY]Yb'k YfZYb': fU[Yb'Ui Zz'k Y`WXY'Fc``Y X]Y'gWXi `]gWXY'dc`]h]gWXY'6]`Xi b[']b'XYf'8Ya c_fUh]Y'gd]Y`h"'9]bY bYi Y'Ghi X]Y'XYg'@Y]Vb]n! \deltagh]hi hg'ZØf'6]`Xi b[gj Yf`Ài ZY'fl@-Z6]Ł``Y[h bi b'Y]bYb': c_i g'Ui Z'X]Y'I bhYff]WX hgnY]hYb'ZØf'XUg': UWX'Dc`]h]_ i bX'XYfYb'9bhk]W_`i b[']a 'NY]hj Yf`Ui Z''

9bhk]W_`i b['XYf'dc`]h]gW\Yb'6]`Xi b[.'9]b'\]ghcf]gW\Yf \ VYfV`]W

8]Y'Ghi X]Y'UbU`mg]Yfh'X]Y'I bhYff]W\hgnY]h'ZØf'dc`]h]gW\Y'6]`Xi b[']b
XYi hgW\Yb'GW\i `Yb'j cb'%- (-'V]g'\\$%-""\=bhYfYggUbhYfk Y]gY
VY`Y[Yb'X]Y'8UhYbž'XUgg'Ub'b]W\h![ma bUg]U`Yb'GW\i `Zcfa Yb']b
XYf'FY[Y``a Y\f'Ghi bXYb'ZØf'Dc`]h]_'j cf[YgY\Yb'k UfYb'U`g'Ub
; ma bUg]Yb"'8]Yg'ghY\h']a '?cbhfUgh'ni 'U_hi Y``Yb'5bbU\a Ybž'XUgg
; ma bUg]UghYb'\Yi hY'a Y\f'dc`]h]gW\Y'6]`Xi b['Yf\U`hYb"
6YgcbXYfg'Ui ZZÀ``][']gh'X]Y'9bhk]W_`i b['gY]h'XYb'%-+\$Yf'\J\fYbž
U`g'X]Y'I bhYff]W\hgnY]hYb']b'U``Yb'6i bXYg`\AbXYfb'\V]g']b'X]Y
%--\$Yf'\J\fY'bU\Yni 'j YfXcddY`h'k i fXYbž'\YXcW\ghUf_
I bhYfgW\]YXY'nk]gW\Yb'XYb'6i bXYg`\AbXYfb'Ui ZhfUhYb"

Dc`]h]gWXY: ÀfVi b['XYg'I bhYff]WX hg

9]b VYa Yf_Ybgk YfhYg 9f[YVb]g XYf I bhYfgi Wi b[]gh XYf 9]b Zi gg XYf dc]h]gW Yb Ni gUa a YbgYmi b[XYf @UbXYgfY[]Yfi b[Ui ZX]Y I bhYff]W hgnY]h]b X]YgYa : UW "K À\fYbX XYf NY]h V]g 9b XY XYf %- - \$Yf *J\fY k Uf ni VYc VUW hYb Z XUgg i bhYf GD8![YZØ\fhY b FY[]Yfi b[Yb a Y\f Ghi b XYb Z Øf dc]h]gW Y 6] Xi b[Ub[YVc hYb k i fXYb Z k À\fYb X 78 I ![YZØ\fhY F Y[]Yfi b[Yb hYb XYb n]Y `` k Yb][Yf Ghi b XYb j c fgU\Yb "8]YgY 9bhk]W_i b[k Uf VYgc b XYfg XYi h`]W]b XYb c ghXYi hgW Yb 6i b XYg`Àb XYfb Z k c Y]bY W f]ghXYa c_fUh]gW Y F Y[]Yfi b[X]Y 5bnU\`XYf I bhYff]W hgghi b XYb g][b]Z]_Ubh fYXi n]YfhY "GY]h XYb &\$\$\$Yf J\fYb]ghX]YgYf 9]b Zi qq YXc W b]W ha Y\f gc Ui g[YdfÀ[h"

FY[]cbU`ibhYfgWX]YX`]WXYf`Ni[Ub['nif'dc`]h]gWXYb6]`Xib[

8]Y'I bhYfgW\]YXY'nk]gW\Yb'XYb'6i bXYg`\AbXYfb'g]bX'Ui W\']b'XYb \YhnhYb'\\J\fnY\bhYb'VYa Yf_Ybgk Yfh'[YV\]YVYb''K \A\fYbX \Y]gd]Y`gk Y]gY'BcfXf\Y]b!K Ygh\\Z\Yb'i a 'X]Y'\\J\fhUi gYbXk YbXY g]YVYb'I bhYff]W\hgghi bXYb'\\Z\Øf'XUg': UW\'Dc`]h]_'Y]bd`\UbhY\\Z\YU['X]Y \NU\\`]b'\6UmYfb'i bX'\GUW\\gYb'\bi f'VY]'nk Y]'\Ghi bXYb''\8]YgY \8]g_fYdUbn'\nY][h\\Z'k]Y'\fY[]cbU\`i bhYfgW\]YX`]W\'GW\\\\\YfY]b \8Yi hgW\`UbX'\Ui Z'\dc`]h]gW\Y'\H\Ya Yb'j cfVYfY]hYh'\k YfXYb''

9f[YVb]ggYZØfX]Y; YgY``gWXUZh. 9]bKYW_fiZnifFYZcfa

8]Y '5i hcfYb 'XYf 'Ghi X]Y 'ZcfXYfb 'Y]bY 'j YfghÀf_hY ': cfgW\i b['ni f dc`]h]gW\ Yb '6]`Xi b[ž']bgVYgcbXYfY '\]bg]W\ h`]W\ 'XYf '\ 7]j]W @]hYfUWm ž'U`gc 'XYf 'n]j]`[YgY``gW\ UZh`]W\ Yb 'i bX 'dc`]h]gW\ Yb '? ca dYhYbnYb"'9]b 'VYggYfYg'J YfghÀbXb]g 'XYf '5i gk]f_i b[Yb dc`]h]gW\ Yf '6]`Xi b['_ObbhY 'XUVY]'\Y`ZYbž'Ui Z'X]Y 'XYfnY]h][Y [YgY``gW\ UZh`]W\ Y 'Dc`Uf]g]Yfi b['ni 'fYU[]YfYb"'8]YgY ': cfgW\i b[gc``hY 'b]W\ h'bi f'X]Y 'GW\i `ghUbXUfXg']b 'XYb ': c_i g'bY\a Ybž gcbXYfb 'Ui W\ 'X]Y '5i gk]f_i b[Yb 'Ui Z'X]Y '[YgY``gW\ UZh`]W\ Y HY]`\UVY 'XYf'GW\ Ø`Yf'i bX 'XYfYb '9b[U[Ya Ybh']b 'dc`]h]gW\ Yb DfcnYggYb"

#b '5bVYhfUWk h'XYf'dc`]h]gWk Yb' < YfUi gZcfXYfi b[Ybža]h'XYbYb
8 Yi hgWk `UbX'_cbZfcbh]Yfh']ghž'V`Y]Vh'UVni k UfhYbž'k]Y'X]Y
6]`Xi b[gY]bf]Wk hi b[Yb'Ui Z'X]YgY': cfgWki b[gYf[YVb]ggY
fYU[]YfYb'k YfXYb"'9]b'[Yn]Y`hYf'5i gVUi 'XYf'dc`]h]gWk Yb'6]`Xi b[
_ÒbbhY'b]Wk h'bi f'XUg'J YfhfUi Yb']b'XYa c_fUh]gWk Y'Ghfi _hi fYb
ghÀf_Ybž'gcbXYfb'Ui Wk'Y]bYb'YbhgWk Y]XYbXYb'6Y]hfU['ni f
A]bXYfi b['XYf'dc`]h]gWk Yb'9I hfYa]g]Yfi b['`Y]ghYb"</pre>

Cf][]bU`ghi X]Y.

 $GYbXn]_{\check{z}'B} "\check{z}'A Y bYfh\check{z}'I "\check{z}' < Y`V][\check{z}'A "`fl&&&(L": Yi Yfk Y f'XYf 8 Ya c_fUh]Y3'Dc`]h]gWX Y'6]`Xi b['U`g'I bhYff]WX hgZUVX 'Ub U``[Ya Y]bV]`XYbXYb'GWXi `Yb'XYf'GY_i bXUfghi ZY'=]b'XYf 6i bXYgfYdi V`]_'8 Yi hgWX`UbX'j cb'%-(-'V]g'&$%-"@Y]Vb]n! <math>\oplus$ gh]hi h ZØf'6]`Xi b[qj Yf'Ài ZY"'8 $C \neq @]b_{C}$

 $: \emptyset f `k Y] h Y f Y ` + b Z c f a U h] c b Y b `ni ` X Y b ` 8 U h Y b ` i b X ` X Y f ` G h i X] Y$

8 YhU]`g

6Ygi WXYb G]Y i bg Ui Z. a Y]b!VYf `]b bYh