

6`cW_WXU]b'_Ubb'i bUV\Àb[]['j cb'?fmdhc Y]bY'[fØbY'Ni_i bZh'\UVYb

8]YgYf'A cbUh'gWXY]bh'b]WXh'XYf'dYfZY_hY'A ca Ybh'ZØf'Y]bY

*pgh]hi h]cb'k]Y'; c'Xa Ub'GUWXg'ni 'gY]bži a 'g]WX'ZØf'X]Y

J cfhY]'Y'j cb' 6'cW_WXU]b 'cXYf' Hc_Yb]g]Yfi b[

Y]bni gYhnYb"'GWX']Y» ']WX'g]bX'X]YgY'GWX'U[k cfhY'ni bÀWXgh

]a '?fmdhck À\fi b[ggY_hcf'VYfØ\a h'[Yk cfXYbž'XYf']a

j Yf[Ub[YbYb'*J\f'nk Y]'8f]hhY''gY]bYg'K YfhYg'j Yf'cfYb'\Uh''

I bX'X]Y''Øb[ghY'*a d'cg]cb'j cb'GUa'6Ub_a Ub!: f]YXg': HL!

*a dYf]i a 'k]fX'k U\fgWXY]b']WX'XUni 'ZØ\fYbž'XUgg'j]Y'Y

hfUX]h]cbY''Y:]bUbn]Yfg'j cf'X][]hU'Yb'J Yfa O[Ybgk YfhYb

ni fØW_gWXfYW_Yb'' k Ybb'b]WXh'gc[Ufž'g]Y'U'g'6Yhfi [
 j YfgdchhYb"'5'g'g]WX'[fØbY'5_h]j]ghYbž'Dc']h]_Yf'i bX

K]ggYbgWXUZh'Yf'X]YgYb'A cbUh'Ui Z'XYf'7CD&+
 j YfgUa a Y`hYbž'gdfUWX'F cg]Y' < Ua dgcbž'Y]bY

; YgWXÀZhgZØ\fYf]b'j cb'; c'Xa Ub'GUWX gž'ZfO\']WX'ØVYf

VY]XYg"'*b'XYb''YhnhYb'A cbUhYb'/ Ua d\Y'']d/

8]YgYf'A cbUhgWXY]bh'b]WX h'XYf'dYfZY_hY'A ca Ybh'ZØf'Y]bY

#bgh]hi h]cb'k]Y'; c`Xa Ub'GUWXg'ni 'gY]bž'i a 'g]WX'ZØf'X]Y'J cfhY]`Y

j cb' 6`cW_WXU]b 'cXYf' Hc_Yb]g]Yfi b['Y]bni gYhnYb"'GWX`]Y»`]WX

g]bX'X]YgY'GWX`U[k cfhY'ni bÀWXgh']a '?fmdhck À\fi b[ggY_hcf

VYfØ\a h'[Yk cfXYbž'XYf']a 'j Yf[Ub[YbYb'*J\f'nk Y]'8 f]hhY`'gY]bYg

K YfhYg'j Yf'cfYb'\Uh"'I bX'X]Y''Øb[ghY'=a d`cg]cb'j cb'GUa

6Ub_a Ub!: f]YXg': HL!=a dYf]i a 'k]fX'k U\fgWXY]b`]WX'XUni 'ZØ\fYbž

XUgg'j]Y`Y'hfUX]h]cbY``Y':]bUbn]Yfg'j cf'X][]hU`Yb

J Yfa Ò[Ybgk YfhYb'ni fØW_gWXfYW_Yb' 'k Ybb'b]WXh'gc[Ufž'g]Y'U`g

6Yhfi ['j YfgdchhYb"

5`g`g]W\`[fØbY`5_h]j]ghYbž`Dc`]h]_Yf`i bX`K]ggYbgW\UZh`Yf`X]YgYb A cbUh`Ui Z'XYf`7CD&+`j YfgUa a Y`hYbž`gdfUW\`Fcg]Y`<Ua dgcbž Y]bY`; YgW\ÀZhgZØ\fYf]b`j cb`; c`Xa Ub`GUW\gž`ZfÒ\`]W\`ØVYf`VY]XYg" ± XYb `YhnhYb `A cbUhYb `\ Uh'g]W\ X]Y `K U```GhfYYh'6Ub_'a]h'XYf < cb['?cb['A cbYhUfm'5i h\cf]hmž'XYf'6Ub_'ZØf' ± hYfbUh]cbU`Yb NU\`i b[gUi g[`Y]W\ i bX `UbXYfYb :]bUbn]bgh]hi hYb ni gUa a Yb[YhUbži a 'Y]bY `? Ud]hU`a Uf_h]b]h]Uh]j Y `bUa Ybg ; YbYg]g `ni `ghUfhYb `fY]b `B Ua Yž'XYb `g]Y ``Y]XYf'a]h'XYa Ub[YgW\`U[YbYb `?fmd hc!6fc_Yf'hY]`hŁ" `8]YgY ; YbYg]g `n]Y`h'XUfUi Z UVž'6`cW_W\U]b `i bX'X][]hU`Y `Hc_Yb]g]Yfi b[`ni `bi hnYbži a ±bj YghcfYbž'X]Y '_`]a UVYnc[YbY `5b`Y]\Yb `_Ui ZYbž'XUVY] `ni `\Y`ZYbž X]Y `XUa]h'j YfVi bXYbYb `9a]gg]cbgnYfh]Z]_UhY `]b `9W\hnY]h'ni i YfZc`[Yb"`

OK]h\Q6Y]; YbYg]g`XYb_Yb`k]f`XUfØVYf`bUW\ž`k]Y`G]Y
6`cW_W\U]bž`Ga Ufh!7cbhfUWh!HYW\bc`c[]Y`i bX'€H!; YfÀhY
j Yfk YbXYb`_ObbYbž`i a '; fYYb!6cbX!JYfhfÀ[Y`ni 'i bhYfghØhnYb ž
gU[hY`<Ua dgcb`Ui Z'Y]bYf`7CD!BYVYbj YfUbghU`hi b["'G]Y`a Yf_hY
Ubž`XUgg`X]Yg`XYb`DfcnYgg`j cb`XYf` 6i W\YfghY``i b['V]g`\]b`ni f
9fghUi g[UVYžJYfk U`hi b['j cb`JYfa O[Ybgk YfhYb`i bX`"'"X]Y
GY_i bXÀfa Uf_h_ca dcbYbhY"

 $C \ XYf'k \]Y'6ÅbÅX]WhY'BcYbg'jcb'XYf'6 \#N'_Øfn`]WX']b'Y]bYa \\ Dc XWUgh'k \]YXYf\c`hY.' 9g']gh'hUhgÀWX`]WX'gWXk \]Yf][\ \check{z}'Y]bY'[fØbY \\ 5b`Y]\Y'ni 'j Yf_Ui ZYb'Onc XUmQ'5VYf'k Ybb'G]Y'XYb'ni _ØbZh][Yb 7C &!5i g[`Y]WX'Ub\Åb[Yb'_ObbYb'Ok]h\'hc_Yb]gUh]cbQXUbb'k]fX Yg'ZØf'XYb'9bX]bj Yghcf'j]Y``UhhfU_h]j Yf'' '$

5VYf'5b`Y[Yf'gc``hYb'Ui ZdUggYb"'8Ybb'k À\fYbX'; YbYg]g']a a YfbcW\'bi f'Y]b'D]`chdfcY_h']ghž'ghY\h'Yg'gma Vc`]gW\'ZØf'Y]bYbkY]hUi g'[fÒ»YfYb'Di b_h'CVkc\``XYf'?fmdhc!Ni gUa a YbVfi W\'X]Y\dignormal{\text{bi}} YghcfYb']bg'K\Ub_Yb'[YVfUW\h'\Uhž\UhYf'X]Y'9| dYf]a YbhY'a]h6`cW_W\U]b'i bX'Hc_Yb]g]Yfi b['b]W\h'[Yghcddh''

8 UfØVYf`\]bUi g`YffY]W\Yb`X]YgY`Yhnh`a]h`k UW\gYbXYf`ghUUh`]W\Yf I bhYfghØhni b[`Y]b][Y`i bYfk UfhYhY`CfhY"`8]Y`K Y`hVUb_`Ybhk]W_Y`h XYfnY]h`Y]b`8]Ybghdfc[fUa a `ZØf`?c\`YbghcZZ_fYX]hfY[]ghYfž`XUg Y]b`6`cW_W\U]b!GmghYa `bUa Ybg`7\]U`j Yfk YbXYh"`I bX`]a A U]bghfYUa !NYbhfU`VUb_k YgYb``Ui ZYb`XYfnY]h`HYghg`ZØf`X][]hU`Y NYbhfU`VUb_k À\fi b[Yb`]a ; fc»\UbXY``fX\`j cb`6Ub_`ni `6Ub_Ł"`

 $8]Y' <? A 5 VY]gd]Y`gk Y]gY`UfVY]hYh`XYfnY]h`a]h`XYf`DYcd`Y g`6Ub_cZ'7 \]bU`i bX`UbXYfYb`NYbhfU`VUb_Yb`Ub`Y]bYa `gc[YbUbbhYb a 6f]X[Y!Dfc^Y_hz`i a `]\bYb`XYb`gcZcfh][Yb`5i ghUi gW\'j cb JYfa Ò[Ybgk YfhYb`ni `Yfa Ò[`]W\Yb"`<math>\pm$ b`9i fcdU`\UVYb`X]Y`6Ubei Y XY`: fUbW'i bX`X]Y`GW\k Y]nYf]gW\Y`BUh]cbU`VUb_`XUg`Dfc^YWh'\$ fU j cf[YghY``hz`Y]b`7687!D]`chdfc^Y_h`ZØf`8Yj]gYb"

I bX'cVk c\``X]YgY' \pm 0]h]Uh]j Yb'bcW.'D]`chdfcY_hY'g]bXžghY``Yb'g]Y Y]bY'j O``]['bYi Y'5fW\]hY_hi f 'XUfž'k]Y'Ci ga ÄbY'A UbXYb[ž'Y]b 6YfUhYf'j cb'5WWbhi fYž'_Øfn`]W\'Ui Z'Y]bYa 'HfYZZYb'XYf 9i fc!) \$!; fi ddY']b'K Ug\]b[hcb'gU[hY''CXYf'k]Y'5Xf]Ub'HcV]Ug j ca ' \pm ': 'k]YXYf\c`hY.' 8]Y'k]W\h][ghYb'8]b[Yž'X]Y'k]f'j cb'?fmdhc VY_ca a Yb'\UVYbž'g]bX'X]Y' \pm XYYb'XYf'Hc_Yb]g]Yfi b[ž?fmdhc[fUZ]Y'i bX'j YfhY]`hYf'<Ui dhVØW\Yf''G]Y'g]bX'gY\f'k]W\h][Y HYW\bc`c[]Yb'i bX'Yg'k]fX'j]Y``YI dYf]a Ybh]Yfh''

9g'ØVYffUgWkh'b]Wkhž'XUgg'X]Y'5_hYi fYž'X]Y'X]YgY'9I dYf]a YbhY j cfUbhfY]VYbž'VYghfYVh'g]bXž'g]Wk'j cb'G_UbXU`Yb'k]Y'XYf': HL! a d`cg]cb'ni 'X]ghUbn]YfYbž']bXYa 'g]Y'VYhcbYbž'XUgg'g]Y'a]h i a ZUggYbXYf'5i Zg]Wkh'XYg'9ghUV`]g\a Ybhg'cdYf]YfYb"'G]Y'VYhcbYbUi Wkž'XUgg'g]Y'j Yfgi WkYbž'X]YgY'HYWkbc`c[]Yb'Y]bni gYhnYbž'i a fYU`Y'DfcV`Ya Y'ni '`ÒgYb' 'UbghUhh'g]Y'Y]bZUWk'i a ']\fYf'gY`Vgh k]``Yb'ni 'j Yfk YbXYb"'

8]Y; YbYg]g! \$\(\phi\)]h]Uh]j Yini a '6Y]gd]Y`; Yfgi WkhžiXUgiDfcV`Ya ini `OgYbžiXUggiXYfiA Uf_hiZØfi7C &!NYfh]Z]_UhYi\Yi hYigciZfU[a Ybh]Yfh i bXii bXii fWkg]Wkh][']ghžiXUggiYgiZØfi \$\(\phi\)j YghcfYbigWkk]Yf][']ghž dchYbn]Y``Ygi; fYYbk Ug\]b['ni 'j YfZc`[Yb"'CVk c\``Wk]bYg]gWkY 9a]hhYbhYbi[fØbYi5b`Y]\Ybi]a 'K Yfhij cb'' \$\$iA fX"'I G8 'j Yf_Ui Zh\UVYbži]qhiX]YiHfUbqdUfYbniX]YqVYnØ[`]WkiqY\fi[Yf]b["

? ObbhY 'X]Yg'c\bY '8][]hU`!5ggYh!HYW bc`c[]Yb'[YgW Y\Yb3 J]Y``Y]W h"6Ub_Yb'_ObbhYb'h\YcfYh]gW '6fi W hY]`Y'j cb'; fYYb 6cbXg'a]h'VYghY\YbXYb'DfcnYggYb'j Yf_Ui ZYb"'G]Y'_ObbhYb'Ui W]b'XYf'@U[Y'gY]bž'Y]b'Y]bn][Yg'Wca di hYf[YghØhnhYg'[`cVU`Yg < Ui dhVi W 'ZØf'?c\`YbghcZZ[i hgW f]ZhYb'ni 'YfghY``Ybž'k Ybb'g]Y a]hY]bUbXYf'i bX'a]h'XYa'OZZYbh`]W Yb'GY_hcf ni gUa a YbUfVY]hYb"'

 $5VYf^*X]Y^*\setminus UfhY^*K^*U\setminus f\setminus Y]h^*]gh\check{z}^*XUgg^*X]YgY^*j^*Yfb\varnothing bZh][Yb^*\pm_0]h]Uh]j^*Yb^*XYfnY]h^*b]W^*h^*j^*cf\setminus UbXYb^*g]bX\check{z}^*k^*A\setminus fYbX^*XUg^*V^*c^*Y^*5i^*Z_ca^*a^*Yb^*XYf^*YghY\setminus YbXYb^*DfU_h]_Yb^*XYf^*YghY\setminus YbXYb^*DfU_h]_Yb^*gck^*c^*VY]^*U^*hYb^*5_hYi^*fYb^*U^*g^*Ui^*W^*VY]^*X][]hU^*Yb^*9j^*Ub[Y^*]ghYb^*Ui^*g^*Ogh^*'I^*bX^*X]Yg^*_Ubb^*YhnhYbX^*]W^*ni^*J^*cfhY]^*Yb^*Z\varnothing \setminus fYb\check{z}^*Ui^*W^*k^*Ybb^*X]Y^*6^*cW_W^*U]b^*gY^*Vgh^*b]Y^*]b^*[fc^*Ya^*I^*a^*ZUb[Y]b^*[YZ\varnothing \setminus fh^*k^*]Y^*.$

8]Yg'k]fX'AU]bghfYUa!\DjYghcfYb'b]W\h'kYb][Yf'a]gghfUi]gW\
[Y[YbØVYf'?fmdhc'aUW\Yb"'5VYf'Yg'jYfXYih`]W\h'Y]b'[fÒ»YfYg
H\YaU.'KYbb']b'XYf'JYf[Ub[Yb\Y]h'X]gfidh]jY'HYW\bc`c[]Yb
YbhghUbXYb'g]bXž'gY]'Yg'X]Y'9]gYbVU\b'cXYf'XUg'\DhYfbYhž'g]bX
b]W\h']aaYf'X]Y':c`[Yb'YfghYf'CfXbib['jcb'6YXYihib["'9g']gh
bcW\ni'ZfØ\ž'ia'ni'VYifhY]`Ybž'cV'X][]hU`Y'5ggYhg'X]Y'KY`h
jYfÀbXYfb''cXYf'g]Y'[fØbYf'aUW\Yb'_ObbYb"'

[]``]Ub"hYhh4 Zh"Wca

8 YhU]`g

6 Y gi W Y b 'G]Y 'i b g 'Ui Z '_fmd hc!b Y k g "Uh