

## FY\`]b[Yf'ZcfXYfh']bbYfdUfhY]`]WXYb8]U`c[.'=gh'XYf':f]YXYb'[YZÀ\fXYh3

GD8!J]nYWXYZ]b'FY\`]b[Yf'VYhcbh'X]Y'6YXYi hi b['Zf]YX`]WXYf 8YVUhhYb'ØVYf'5i »Ybdc`]h]\_'i bX'?cbhU\_hY'ni 'Fi gg`UbX'j cf XYa 'VYj cfghY\YbXYb'DUfhY]hU["



8 Yi hgWX`UbX`!'\D`XYf'U\_hi Y``Yb'dc`]h]gWXYb'8 YVUhhY'XYf'GD8
k ]fX'Y]b' A Ub]ZYgh '`Ui hž'XUg'ni f'BYi Ui gf]WXhi b['XYf'5i » Yb!'i bXG]WXYf\Y]hgdc`]h]\_'Ui Zfi Zh''8 ]YgYg'; fi bXgUhndUd]Yf'ZcfXYfh'i bhYf
UbXYfYa '; YgdfÀWXY'a ]h'Fi gg`UbX'gck]Y'Y]bYb'Ghcdd'XYf
GhUh]cb]Yfi b['bYi Yf'I G!A]hhY`ghfYW\_YbfU\_YhYb']b'8 Yi hgWX`UbX''
5b\_Y'FY\`]b[Yfž'A]b]ghYfdfÀg]XYbh]b'XYg'GUUf`UbXYg'i bX
J]nYWXYZ]b'XYf'GD8 ž'YfZi \f'Yfgh'Xi fWX'X]Y'JYfÒZZYbh`]WXi b['j cb
X]YgYa 'A Ub]ZYgh''G]Y'ghY\h'XYb'\RYYb'nk Uf'\_f]h]gWX'[Y[YbØVYfž
Yf\_Ybbh'YXcWX'XYb'`Y[]h]a Yb'K i bgWX'Y]b][Yf'DUfhY]a]h[`]YXYf
Ubž'UVk Y]WXYbXY'Dcg]h]cbYb'ni f'FY[]Yfi b[gdc`]h]\_'ni 'Ài »Yfb''
K]f'a ØggYb'ni f'?Ybbhb]g'bY\a Ybž'XUgg'Yg']b'8Yi hgWX`UbX'gY\f
Zf]YXYbgVYk Y[hY'A YbgWXYb'[]Vh'Z'[]Vh'FY\`]b[Yf'ni 'VYXYb\_Yb
i bX'g]Y\h'X]Y'Bchk YbX][\_Y]hž'i bhYfgWX]YX`]WXY'A Y]bi b[Yb']b'XYf

GD8 'ni 'X]g\_i h]YfYbž'Ui W 'k Ybb'g]Y'g]W 'b]W h'a ]h'XYb : cfXYfi b[Yb'XYg'A Ub]ZYghg']XYbh]Z]n]YfYb'\_Ubb"

8 Yf 'GD8!7\YZ'@Ufg'?`]b[ VY]``\Uh'g]W\ '\_`Uf'j cb`XYb`: cfXYfi b[ Yb XYg'A Ub]ZYghg'X]ghUbn]Yfh'i bX`VYhcbhž'XUgg'Yg'\_Y]bY'?Y\fhk YbXY]b'XYf'I bhYfghØhni b[ 'XYf'I \_fU]bY'[ YVYb'k ]fX"'9f'a UW\h'XYi h']W\ž XUgg'Fi gg`UbX'ZØf'XUg'@Y]X']b'XYf'I \_fU]bY'j YfUbhk cfh']W\ ']gh'i bX DfÀg]XYbh'Di h]b'XYb'?f]Y[ 'gcZcfh'VYYbXYb'\_ObbhYž'k Ybb'Yf'k c``hY'' @Ui h'?`]b[ VY]`'g]bX'a ]`]hÀf]gW\Y'GhÀf\_Y'i bX'X]d`ca Uh]gW\Y 6Ya Ø\i b[ Yb'b]W\h']a 'K ]XYfgdfi W\ 'ni Y]bUbXYfž'gcbXYfb Yf[ ÀbnYb'g]W\ "'9f'k YfhYh'XUg'A Ub]ZYgh'XU\Yf'b]W\ h'U`g dYfgOb`]W\Yb'5b[ f]ZZž'gcbXYfb'U`g'HY]`'Y]bYf']bbYfdUfhY]`]W\Yb 8 ]g\_i gg]cbž'X]Y'j cf'XYa 'DUfhY]hU[ 'j ca '&+'''V]g'&-'''\*j b] k Y]hYf[ YZØ\fh'k ]fX"'5i W\'J YfhY]X][ i b[ ga ]b]ghYf'6cf]g'D]ghcf]i g Ai » YfhY'g]W\ '\_f]h]gW\ ž']bXYa 'YfXUg'A Ub]ZYgh'U`g FYU`]hÀhgj Yfk Y][ Yfi b[ 'VYnY]W\ bYhY'i bX'\Yfj cf\cVž'XUgg'Di h]b YW\ hY'X]d`ca Uh]gW\Y'; YgdfÀW\Y'gUVch]Yfh''

## 9]bV`]W\_Y ]b XUg A Ub]ZYgh

8 Ug'A Ub]ZYghžXUg'j cb'a Y\fYfYb'8i hnYbX'dfca ]bYbhYb Gcn]U`XYa c\_fUhYbž'XUfi bhYf'Fc`Z'A ØhnYb]W\'i bX'FU`Z'GhY[bYfž i bhYfnY]W\bYh'k i fXYž``Y\bh'X]Y'XYfnY]h][ Y'a ]`]hÀf]gW\Y ?cbZfcbhUh]cbgghfUhY[]Y'gck]Y'X]Y'\c\Yb'5iZfØghib[gUig[UVYb ]b 8 Yi hgWX `Ub X `UV" `9]b `nYbhfU`Yf `Di b\_h`]gh XYf `5i Zfi Z'ni f  $gWAf]hhk Y]gYbFØW__Y\fini YbhgdUbbhYbGYn]Y\ib[Yba]h$ Figg`UbX'ibX'XUg'9bXY'XYf'GhUh]cb]Yfib['bYiYf'IG! A ]hhY`ghfYW\_YbfU\_YhYbžX]Y`8Yi hgWX`UbX`ni 'Y]bYa 'dchYbn]Y``Yb 5b[f]ZZgn]Y``a UWXYb'\_ObbhYb"' \dig gVYgcbXYfY'k ]fX'X]Y'[Yd`UbhY  $9f(\delta) = x yg J yfh y [x][ib[g(Uig(Uig(Uiz')z) cxyf(Uf)) Dfcnybh$  $XYg.6 = D.c bY._`UfY.g]W.Yf Y]hqdc`]h]qW.Y.6Y[fØbXib[._f]h]q]Yfh"$ 8 | Y 'J Y f Z Ugg Y f 'Uf [ i a Y b h ] Y f Y b ž 'X Ugg '8 Y i hg W \ `Ub X 'i b X 'X | Y ' I G 5 VYfY]hg'&\$&('X]Y'GhUh]cb]Yfi b['\_cbj Ybh]cbY``Yf A ]hhY`ghfYW\_Ybk UZZYb`]b`8Yi hgWX`UbX`j YfY]bVUfhYbžk À\fYbX Figg`UbX'VYfY]hg'A]hhY`!'ibX'@Ub[ghfYW\_YbfU\_YhYb']b'XYf'9|\_`UjY ?U`]b]b[fUX:\Uhz:X]Y:ZUgh:YXYg:N]Y`:]b:9i fcdU:YffY]W\Yb:\_ObbYb"

 $\pm 0.13 \ YgYf^{-1}[\ YgdU^{h}YbYb^{-1}8\ ]g_{i}\ gg]cb^{-1}]bbYf^{U^{h}}V^{-1}XYf^{-1}GD8^{-1}ghY^{-1}Yb^{-1}g]W$ 

b]Wkh'bi f'X]Y'; YbcggYb'\]bhYf'XUg'A Ub]ZYghž'gcbXYfb'Ui Wk UbXYfY'dfca ]bYbhYfY'Gh]a a Yb'k ]Y'GU\fU'K U[Yb\_bYWkhjcb'XYf 6GK "'G]Y'gWk'À[h'gc[Uf'Y]bY'[Ya Y]bgUa Y'?i bX[YVi b['a]h'XYb \( \bar{b}\)]h]UhcfYb'XYg'A Ub]ZYghg'j cfž'i a 'I bhYfghØhnYf'ni 'a cV]`]g]YfYb" CV'X]YgY'j YfgWk]YXYbYb'GhfÒa i b[Yb'Y]bY'bYi Y'8 mbUa ]\_']a DUfhY]!'i bX'5i » Ybdc`]h]\_!8]g\_i fg'YfnYi [Yb'\_ObbYbž'V`Y]Vh UVni k UfhYbž'XcWk'XYf'VYj cfghY\YbXY'DUfhY]hU['k]fX'g]WkYf`]Wk \]`ZfY]Wk'gY]bž'i a 'Y]bY'\_`UfY'@]b]Y'ni 'Z]bXYb'i bX'a O[`]WkYfk Y]gY bYi Y'GhÀf\_Y'ZØf'X]Y'GD8 'ni '[Yk]bbYb"

8]Y'8YVUhhY']bbYf\U`V'XYf'GD8'nY][hž'k]Y'k]W\h]['XYf'I a [Ub[a]h'UVkY]W\YbXYb'Dcg]h]cbYb']gh'i bX'k]Y'bchkYbX]['Yg']ghž'g]W\XYb'<YfUi gZcfXYfi b[Yb'XYf'5i »Ybdc`]h]\_'ni 'ghY``Yb'' 8]Yi bhYfgW\]YX`]W\Yb'Dcg]h]cbYb'a ØggYb']bbYf\U`V'XYf'DUfhY]X]g\_i h]Yfh'kYfXYb ž'\YVh'FY\`]b[Yf'\Yfj cf''; YfUXY']b'X]YgYbhi fVi `YbhYb'NY]hYb']gh'XYf'8]U`c['i bYf`Agg`]W\' XU']gh'g]W\'k c\`YXYf'Y]b][''

: Øf'k Y]hYfY' $\pm$ Zcfa Uh]cbYb'ni 'X]YgYf'H\Ya Uh]\_'`YgYb'G]Y'Ui W\'X]Y 5fh]\_Y`'j cb'K Y`hž'HU[YggW\Ui'i bX'b!hj "

8 Y hU]`g	
Cfh	8 Ying W. `Ub X
EiY``Yb	• k k k "k Y`h"XY
	• k k k "hU[YggW\Ui"XY
	• k k k "b!hj "XY

6Ygi WXYb G]Y i bg Ui Z. b!U[ "bYh