

6]XYbg`7fmdhc`9lYWih]jY`CfXYf`_ÒbbhY hfchn`ZY\`YbXYf`9]bnY`\Y]hYb`Y]b KYbXYdib_h `gY]b

8 Y f : U\fd`Ub XYf6]XYb!5Xa]b]ghfUh]cb nY][hžXUgg X]Y I G5 $ZO \ fYbX \ VY] \ X][]hU \ Yb \ JYfa \ O[Ybgk YfhYb \ gY]b \ k \ c \ Yb \ gU[h]$ $XYf'Y \setminus Ya U' = Y'dc' h gWX Y' @Y h Yf' | cb'7c | b V U gY' 8 | Y$ 8 i fW ZØ\fi b[q| YfcfXbi b['ZcfXYfhž'XYf': cfgW i b['i bX jYf`Y]\Yb ž'Yfk À\bh'GhUV`YWc]bg'YXcW\'b]W\h'8]Y'bYiY 91 Y_i h]j | YfcfXbi b['ni 'X][]hU`Yb'J Yfa Ò[Ybgk YfhYb' j cb Dfàq|XYbh'6|XYb'|qh'\Ui h'6fUbWXYbVYcVUWXhYfb'Y]b'k |WXh][Yf GWXf]hh']a 'dc']h]gWXYb'9bhgWXY]Xib[qdfcnYqgž'cVkc\'Y]bY _cb_fYhY; YgYhn[YVib['***J\fY'XUiYfb'_ObbhY"'@Uih'Y]bYf 9f_`Àfi b['XYg'K Y]» Yb' < Ui gYg'i bhYfnY]W\bYhY'6]XYb'Ua A] hhk cW\ X]Y 8 i fW\ $Z\emptyset$ \ fi b[g| YfcfXbi b[\check{z} X]Y XYb 5 b gUhn XYfFY[]Yfib[]bGYni[]UiZX][]hUYJYfa O[Ybgk YfhYibX $X]Y^{-} bYb^{-}ni[fibXY^{-}]Y[YbXY^{-}HYWbc^{-}c]Y^{-}iafY] > h'' + \varepsilon b$ 7c``]bgž'DUfhbYf'VY]'XYf'6YfUhi b[gZ]fa U': G'JYWhcfg / Ua d∧Y``]d/

- 8 Yf: U\fd`Ub'XYf'6]XYb!5Xa]b]ghfUh]cb'nY][hž'XUgg'X]Y
 I G5'ZØ\fYbX'VY]'X][]hU'Yb'J Yfa Ò[Ybgk YfhYb'gY]b'k c``Ybž
 gU[h'XYf'Y\Ya U`][Y'dc`]h]gW\Y'@Y]hYf'j cb'7c]bVUgY
- 8]Y'8ifWXZØ\fib[gjYfcfXbib['ZcfXYfhžXYf': cfgWXib[ibX'9bhk]W_ib['Y]bYg'dchYbn]Y``Yb'IG!7687
 8f]b[`]WX_Y]h'ni 'jYf`Y]\Yb ž'Yfk À\bh'GhUV`YWc]bg'YXcWXb]WXh

8]Y'bYi Y'9I Y_i h]j j YfcfXbi b['ni 'X][]hU`Yb'J Yfa Ò[Ybgk YfhYb j cb'DfÀg]XYbh'6]XYb']gh``Ui h'6fUbW\YbVYcVUW\hYfb'Y]b'k]W\h][Yf GW\f]hh']a 'dc`]h]gW\Yb'9bhgW\Y]Xi b[gdfcnYggž'cVk c\`'Y]bY _cb_fYhY'; YgYhn[YVi b['\\\]\fY'XUi Yfb'_\ObbhY"

@Ui h'Y]bYf'9f_`Àfi b['XYg'K Y]» Yb' < Ui gYg'i bhYfnY]W\bYhY'6]XYb Ua 'A]hhk cW\'X]Y'8i fW\ZØ\fi b[gj YfcfXbi b[\check{z} 'X]Y'XYb'5bgUhn'XYf FY[]Yfi b[']b'6Yni ['Ui Z'X][]hU`Y'J Yfa \grave{O} [Ybgk YfhY'i bX'X]Y']\bYb ni [fi bXY'`]Y[YbXY'HYW\bc`c[]Y'i a fY]» h"

7c``]bg'j Yf[`]W\`X]Y'9I YW h]j Y'CfXYf'a]h'XYa ': fUa Yk cf_'Zcf; `cVU`'9`YWhfcb]W7ca a YfW\' 'XYf'7`]bhcb!FY[]Yfi b[ž'XUg']b'XYb%--\$Yf'\\fYb'j Yf\OZZYbh`]W\h'k i fXY'i bX'X]Y'Ni _i bZh'XYg\\
\delta\hYfbYhg'i bhYfgi W\hY"

9gʻ]ghʻ_`Ufž'XUggʻX]YʻJYfk U`hi b[ʻYf_Ybbhž'XUggʻX]Ygʻb]W\h jYfgW\k]bXYbʻk]fXžʻi bX'XUggʻg]Yʻk]f_`]W\'X]YʻYbhgW\Y]XYbXY 6YXYi hi b[ʻXYfʻHYW\bc`c[]Yʻ]bʻj YfgW\]YXYbYbʻ5bk YbXi b[Ybʻni a Bi hnYb XYg ni _ØbZh][Yb :]bUbngmghYa g VYhcbYb ž gU[hY 7c ``]bg" G]Y k c ``Yb g]W YfghY ``Yb z XUgg X]Y I G5 j cfUi g g]bX"

8 Y f '6] hWc]b! DfY]g``U['i a '%*.\$\$'l \f'9H'VY]'Yhk U'(%", (\$'`' 'Y]b 5 bgh]Y['j cb', ž*'ı ']b'&('Ghi b XYb"

9]bY'5bghfYb[ib[žaY\f'?`Uf\Y]h']b'XYb'FY[i`]Yfib[gfU\aYb'niVf]b[Ybžk]fX'XYb'=bjYghcfYb'XYZ]b]h]j'aY\f'JYfhfUiYb'Vf]b[YbibX'aY\f'5aYf]_UbYf']a'?fmdhc!2_cgmghYa'k]``_caaYb\Y]»Yb'ž'gU[hY'H\caUg'<cc_ž'7\]YZ'7cad`]UbW'CZZ]WYf'jcb6]hghUad']b'XYb'IG5"'KÀ\fYbX'X]Y'?fmdhcaÀf_hY'kY]hYf\]bjc`Uh]`'gY]b'aÒ[Ybž'nY][Yb'X]Y'\Yih][Yb'BUW\f]W\hYbž'XUgg'X]Y5bYf_Ybbib[XifW\X]Y'6]XYb!5Xa]b]ghfUh]cb'XYb'AUf_h

K Ugʻ_ca a h'U`gʻbÀW ghYg3

8]Y 5bcfXbi b[ii a fY]» hi]\fYb: c_i g'Ui Z'?fmdhcfY[i`]Yfi b[ifi bX i a 'J YfVfUi WXYfgWXi hnž':]bUbnghUV]`]hÀhž'F]g]_ca]bXYfi b[ž'X]Y Z]bUbn]Y``Y: Ø\fi b[gfc``Y'XYf'I G5ž'Z]bUbn]Y``Y'=b_`i g]cb'i bX j YfUbhk cfhi b[gj c``Y'=bbcj Uh]cb"

♣ XYb '_ca a YbXYb 'A cbUhYb 'k]fX 'Yg 'k U\fgW\Y]b`]W\

♣ Zcfa Uh]cbgUbZfU[Ybž'8]g_i gg]cbgfi bXYb 'i bX '5fVY]hg[fi ddYb
[YVYbž'cVk c\`'_cb_fYhY 'A U» bU\a Yb 'Y]b][Y 'NY]h']b '5bgdfi W\
bY\a Yb 'k YfXYbž'gU[hY '7c``]bg"

8 i fWk k Y[k]fX Yf_Ubbhž XUgg Yg a Y\f? `Uf\Y]h [YVYb a i gg ž gU[hY Yf" J]Y ``Y]Wk h [Y\h Yg i a K Yfhd Ud]YfYa]gg]cbYbž j]Y ``Y]Wk h i a "] ``Y[U `Y :]bUbnYbž j]Y ``Y]Wk h i a "UbXYfY 8]b[Y k U\fgWk Y]b`]Wk U``Yž i bX]Wk XYb_Yž XUg]gh [i h"

?f]gh]b 'Ga]h\ž'; YgW\ÀZhgZØ\fYf]b 'XYf'?fmdhc!@cVVm]ghYb 6`cW_W\U]b '5ggcW]Uh]cbž'gU[hY '[Y[YbØVYf'6`cW_k cf_gž'XUgg'XYf 6Y[]bb'XYf'GUa a `i b['j cb': U_hYb'i bX'XYf': cfgW\i b['ni 'X]YgYb H\Ya Yb' Y]b'k]f_`]W\'[Ygi bXYf'YfghYf'GW\f]hh']b'Y]bYa dc`]h]gW\Yb'9bhgW\Y]Xi b[gdfcnYgq 'gY]"

8]Y '5 bcfXbi b['g]Y\h'j cfž'XUgg'6Y\ \hat{O} fXYbVYf]W\hY ']bbYf\U`V'j cbgYW\g'A cbUhYb'ZYfh][[YghY``h'k YfXYbž'k cVY]'; YgYhn[YVYf'i bX 2 ZZYbh`]W_Y]h'XUbb'X]Y'A \hat{O} [`]W_Y]h'\UVYbž'g]W\'ni 'Ài » Yfb"'

CZYbg]Wkh]Wk \UVYb k]f'j]Y\\5fVY]h'j cf'i bgž'i bX k]f'a Ò[Ybj]Y\\Y]Wkh'b]Wkh'YXYb Y]bnY\bYb 'dc\]h]gWkYb'J cfgWk\U[ž'XYf']bgYWkg'A cbUhYb'j cf[Y\Y[h'k]fXž'UVYf'ni a]bXYgh'_ÒbbYb'k]faYh\cX]gWk'XUfØVYf'bUWkXYb_Yb'i bX'a]h'XYf'FY[]Yfi b[ni gUa a YbUfVY]hYb ž'gU[hY'Ga]h\"

9]b 5 i Zfi Zž 7687g k Y]hYf ni ghi X]YfYb

Ni `XYb`ØVYffUgW\YbXYfYb`HY]`Yb`XYg`5i ZhfU[gž'gU[hY`Ga]h\ž [Y\ÒfhY`XYf`: c_i g`Ui Z`X][]hU`Y`NYbhfU`VUb_k À\fi b[Yb`fl7687gŁ"`

 $9g`ZcfXYfhž`XYf`: cfgW\ib[`ibX`9bhk]W_`ib[`Y]bYg`IG!7687 \\ 8f]b[`]W_Y]h`ni 'jYf`Y]\Yb ``cVkc\`X]Yg`_Y]bY'; UfUbh]Y`XUZØf \\]ghž`XUgg`Yg`YaU`g`Y]b[YZØ\fh`k]fX` 'gck]Y`X]Y`6YkYfhib[`XYfYfZcfXYf`]W\Yb`HYW\bc`c[]Y"$

 $8\,]Y\,^6\,^c\,W_W\,U]b\,^5\,ggc\,W]Uh]c\,b\,^]gh\,^b\,Yi\,^hfU^*$

⇒W. XYb_YžXUg'K]W.h][ghY'ZØf'i bg']ghžXUgg'k]f'X]Y': À\][_Y]h df]j UhYf'Cf[Ub]gUh]cbYb'i bX'9]bnY`dYfgcbYb'k c``Ybž'HYW.bc`c[]Y fi bX'i a 'XYb'8c``Uf'Ui Zni VUi Ybž'i bX'XUg'\UVYb'k]f'VY]'8c``Uf! i bhYfghØhnhYb'GhUV`YWc]bg'[YgY\Yb ž'gU[hY'Ga]h\"'

GhUV`YWc]bg`ZY\`Yb`Ui ZZU``YbX`]b`XYf`9IY_i h]j j YfcfXbi b["
:]bUbna]b]ghYf]b`*\JbYh`MY``Yb`i bX`XYf`J cfg]hnYbXY`XYf`I G!
BchYbVUb_ž`\Jfca Y`Dck Y``ž`\UVYb`VY]XY`]\fY`6Ygcf[b]g`ØVYf`]\fY

9gʻ]ghʻb]Wkhʻj Yfk i bXYf`]Wkž'XUggʻGhUV`YWc]bgʻb]Wkh'Yfk À\bh k YfXYbž'XUʻMY``YbʻVYfY]hgʻ]a '8YhU]``XUfUbʻUfVY]hYh ž'gU[hYʻzc\b6Y`]nU]fYž'; fØbXYfʻi bXʻ79Cʻj cbʻGc`i bUʻ7ca di h]b["'5i »YfXYa]gh'Y]bYʻX][]hU`YʻI G!K À\fi b['Y]bʻ?cb_i ffYbh'j cbʻGhUV`YWc]bg"

8 Yf?cb[fYgg'k]``gY]bY`NØ[Y``VY]'GhUV`YWc]bg'ghfUZZYb"; YgYhnYbhk ØfZY']b'X]YgYf'F]W\hi b['k YfXYb'k U\fgW\Y]b`]W\'bcW\]b'X]YgYa 'AcbUh'j ca'l G!; YgYhn[YVYf'Y]b[YVfUW\hž'VYf]W\hYhY 6`cW_k cf_g"

 \Rightarrow fYa m'5``U]fYž'79C'j cb'7]fWYž'XYa '9a]hhYbhYb'\]bhYf'XYa [fÒ» hYb'GhUV`YWc]b'I G8'7c]b'fI G87Łž'bUbbhY'X]Y 9IY_i h]j j YfcfXbi b['Y]bYb' K YbXYdi b_h "

8]Y'I G!FY[]Yfi b['\Uh'Yhnh'Y]bYb'[YgUa hghUUh`]W\Yb'5bgUhn'ni f
I bhYfghØhni b['XYf'cZZYbYbž'+bhYfbYh!bUh]j Yb
K]fhgW\UZng]bZfUghfi _hi fž'X]Y'Xi fW\'bYi Y'K YV'!HYW\bc`c[]Yb
Y]b[YZØ\fh'k i fXY' i bX'Vf]b[h'XUg'@UbX'Y]bYb'GW\f]hh'bÀ\Yf'Ub
X]Y'G]W\YfghY``i b[ž'XUgg'XYf'I G!8c``Uf'X]Y'K À\fi b['XYg'+bhYfbYhg
V`Y]Vh'i bX'XUgg'X]Y'8]Y'I G5'V`Y]VYb'X]Y'<Y]a Uh'j cb
df]bn]d]YbhfYi Yf'+bbcj Uh]cb'i bX'K YhhVYk YfV ž'gU[hY'5``U]fY"

п тп

8]Y'Dcgh'6]XYbg'7fmdhc'9|YW'h]j Y'CfXYf'_Ubb'hfchn'ZY\`YbXYf 9]bnY`\Y]hYb'Y]b' K YbXYdi b_h 'gY]bž']gh'_Y]bY'Z]bUbn]Y``Y 6YfUhi b["

8 Y hU]`g