

6Øf[Yf[Y`X. I bgYf'@YVYb'Ui Z'XYf'7ci W\'XUg'gU[Yb'X]Y'9a dZÀb[Yf°

8 Y f 'F H@'Nk Y]! 6 Y f] Wk h' ØV Y f 'B] Wc 'i b X '> Ub] b Y ž '6 Øf[Y f[Y `X! 9a d ZÀb[Y f ž 'V Y `Y i Wk hY h' X Y f Y b '@Y V Y b ggh] `'i b X [Y g Y ``g Wk U Zh`] Wk Y '8 Y V U h Y "



D`Ui `Ua `GYYž'8Yi hgW\`UbX`!'\\ 18 Yi hgW\`UbX`gcf[hXUg 6Øf[Yf[Y`X`ZØf'_cbhfcj YfgY'8]g_i gg]cbYb`i bX`dc`]h]gW\Y 5i gY]bUbXYfgYhni b[Yb"'8]YgY`ghUUh`]W\Y'; fi bXg]W\Yfi b[`ZØf 5fVY]hggi W\YbXY`YfgYhnh`gY]h`&\$&' `XUg`ZfØ\YfY`5fVY]hg`cgYb[Y`X =\vec{z}VYggYf`VY_Ubbh`U`g`<Ufhn`\\ "`A]h`a cbUh`]W\Yb`6YhfÀ[Yb`j cb)*' `9i fc`ZØf`5``Y]bghY\YbXY`i bX`) \$* `9i fc`ZØf`DUfhbYf`gc```Yg`XYb@Y]ghi b[gVYfYW\h][hYb`Y]b`g]W\YfYg`A]b]a i a `V]YhYb"`8cW\`b]W\hU``Y`9a dZ\b[Yf`hfY]VYb`U_h]j `X]Y`Gi W\Y`bUW\`Y]bYf`6YgW\\\Zh][i b[j cfUbž'k]Y`X]Y`FH@NKY]!Gcn]U`fYdcfhU[Y` 5fa Yg`8Yi hgW\`UbXnY][h"

B]Wc'i bX'\Jb]bY\z'6\Øf[Yf[Y`X!9a dZ\\and b[Yf'Ui g'D`Ui 'Ua 'GYY\z'\\and i \rightarrow Yfb]b'\XYf'FYdcfhU[Y\z'\XUgg'g]Y'gY]h'\J\\fYb'j cb'ghUUh`]W\\Yb'\@Y]ghi b[Yb

 $\begin{tabular}{ll} & YVYYD'i bX'fY[i `AfY'5fVY]h'UV`Y\bYb'''K A\fYbX'*JUb]bY'gU[h.'] & WYYYY][Ybh`]WX'ZØf'YXYb'HU[ža U``[i W_Ybž'k Ug'_ca a h ž'g]Y\h B]Wc']b'XYb'ghUUh`]WXYb'@Y]ghi b[Yb'' [fc*Y'Df]j]`Y[]Yb''i bX'g]Y\h _Y]bYb'; fi bXž'g]WX'i a 'Y]bYb'*cV'ni 'VYa Ø\Yb'''=\fY'9]bghY``i b[]gh'YxcWX'b]WXh'fYdfAgYbhUh]j 'ZØf'X]Y'A Y\f\Y]h'XYf'6Øf[Yf[Y`X!6Yn]Y\Yfž'X]Y'cZh'a Y\f'I bhYfghØhni b['VY]a 'K]YXYfY]bgh]Y[']bg 6Yfi Zg`YVYb'k ØbgWXYb'''8]YgY': c`[Y'j cb'' 5fa Yg'8Yi hgWX`UbXk]fX'Ua''*''A U]'&$&)'i a '&$''%)'I \f'Ui Z'F H@'Nk Y]'Ui g[YghfU\`hži bX'nY][h'gca]h'b]WXh'bi f'dYfgÒb`]WXY'GWX]W_gU`Yž'gcbXYfb'k]fZh Ui WX': fU[Yb'Ui Zž'k]Y'XUg'6Øf[Yf[Y`X']b'XYf'; YgY``gWXUZh k U\f[Ybca a Yb'k]fX''$

$Dc^{h}gWXY'8YVUhhY'ibX'[YgY^{g}WXUZh^{}]WXYFYU^{h}h$

 $8]Y''dc`]h]gWXY'8]g_i gg]cb'fi bX'i a 'XUg'6Øf[Yf[Y`X'k]fX'Xi fWX'X]Y' cfXYfi b[Yb'j cb'l b]cb'i bX': 8 D'bUWX'? Øfni b[Yb'Ub[Y\Y]nh'' 5_hi Y``Y'D`ÀbY'j cb'&$&' gY\Yb'9]bgdUfi b[Yb']b'<Ò\Y'j cb'%ž) A]``]UfXYb'9i fc'j cf''l a ZfU[Yb'nY][Ybž'XUgg'nk Y]'8 f]hhY``XYf 6Øf[Yf'9]bgdUfi b[Yb'VY]a '6Øf[Yf[Y`X'i bhYfghØhnYb'''\delta Y\]bYa [fÒ» YfYb'? cbhYl h']gh'ni 'VYfØW_g]WX h][Ybž'XUgg'X]Y 6i bXYgfY[]Yfi b['a Y\f']b'gcn]U`Y'@Y]ghi b[Yb']bj Ygh]Yfh'U`g'j cf XYf'7cfcbU!DUbXYa]Y'''Gcn]U`dc`]h]_Yf'k Y]gYb'XUfUi Z'\]bž'XUgg Yhk U') ž) 'A]``]cbYb'A YbgWXYb']b'8 Yi hgWX`UbX'6Øf[Yf[Y`X VYn]Y\Ybž'XUfi bhYf'%ž, 'A]``]cbYb'?]bXYf'i bX'*[YbX`]WXY''$

8]Y'<YfUi gZcfXYfi b[Yb'ZØf'6Øf[Yf[Y'X!9a dZÅb[Yf'g]bX
j]Y`gW\]W\h]["', VYf'nk Y]'A]``]cbYb'g]bX'Ui g'[Ygi bX\Y]h`]W\Yb
; fØbXYb'cXYf'k Y[Yb'ZY\`YbXYf'?]bXYfVYhfYi i b['b]W\h'ZØf'XYb
5fVY]hga Uf_h'j YfZØ[VUfž'k À\fYbX'%ž+'A]``]cbYb'U`g'UfVY]hg`cg
[Y`hYbž'YXcW\'cZh'b]W\h'X]Y'bchk YbX][Yb'E i U`]Z]_Uh]cbYb
VYg]hnYb"'9]b'6`]W_'Ui Z'X]Y'XYa c[fUd\]gW\Y'Ni gUa a YbgYhni b[
nY][h'ni XYa ž'XUgg'* &'DfcnYbh'XYf'<Ui g\U`hY']a '6Øf[Yf[Y`XVYni [
_Y]bYb'XYi hgW\Yb'DUgg'\UVYbž'k Ug'ni 'k Y]hYfYb'J cfi fhY]`Yb'i bX
G][bU`k]f_i b[Yb']b'XYf'; YgY``gW\UZh'ZØ\fh"

JcfifhY]`Y'i bX'FYU`]hÀh'XYf

@Ub[nY]hUfVY]hg`cg][_Y]h

Jcfi fhY]`Y`ØVYf`gc[YbUbbhY`ZUi `Y`@Ub[nY]hUfVY]hg`cgY`g]bX`kY]h
j YfVfY]hYh"`Gcn]c`c[Yb`VYZØfk cfhYb`Y]bY`X]ZZYfYbn]YfhY`G]W\hkY]gY
i bX`VYhcbYbž`XUgg`j]Y`Y`6YhfcZZYbY`GW\k]Yf][_Y]hYb`\UVYbž`g]W\
]b`XYb`5fVY]hga Uf_h`Y]bni [`]YXYfb"`8]Y`5gdY_hY`k]Y`gcn]U`Y
<Yf_i bZhž`8Yi hgW_Ybbhb]ggY`i bX`X]Y`5bYf_Ybbi b[`j cb
6]`Xi b[gh]hY`b`g]bX`YbhgW\Y]XYbX`ZØf`X]Y`\DhY[fUh]cb`]b`XYb
5fVY]hga Uf_h"`CV[`Y]W\`bi f`\\$ž(`DfcnYbh`XYf`6Øf[Yf[Y`XVYn]Y\Yf
X]Y`5fVY]h'j YfkY][Yfbž`[]Vh`Yg`]a a Yf`bcW\`j]Y``I bk]ggYb\Y]h
ØVYf`X]Y`FYU`]hÀh'j cb`@Ub[nY]hUfVY]hg`cgYb"

 $6 \varnothing f[\ Yf[\ Y`X`V]YhYhY]bYb`VYggYfYb`GW\ i \ hn`VY]`5fVY]hg`cg][\ _Y]h'i \ bXi \ bhYfgh\varnothing hnh`A \ U* bU\a Yb`ni f`K Y]hYfV]`Xi \ b[\ "`8]Y`FY[\ Y`gAhnYk i fXYb`&$&(`i a `%&`DfcnYbh`Yf\`O\hž`k Ug`\ØVYf`XYf`\bZ`Uh]cbgfUhY`]Y[\ h"'; `Y]W\nY]h][\ ']gh`XYf`8fi \\ W_`Ui \ Z`9a \ d\ ZAb[\ Yf`[\ YgYb_h`k cfXYbž \ gcZcfh`Y]bY`bYi Y`5fVY]h`Ubni \ bY\a Yb"`8]Yg`gc```XUni \ `VY]hfU[\ Ybž \ XUgg`a Y\f`A YbgW\Yb`Y]bY`DYfgdY_h]j Y`Ui Z``Ub[\ Zf]gh][\ Y 6YgW\AZh][\ i \ b[\ 'Z]bXYb"$

=b '5bVYhfUW\h'X]YgYf'_ca d`Yl Yb 'H\Ya Uh]_']gh'Yg'i bYf`Àgg`]W\ž
b]W\h'bi f'X]Y']bX]j]Xi Y``Yb'; YgW\]W\hYb'j cb'9a dZ\h[Yfb'k]Y'B]Wc
i bX'\lb]bY'ni 'VYhfUW\hYb\z'gcbXYfb'Ui W\'X]Y
[YgUa h[YgY``gW\UZh`]W\Yb'FU\a YbVYX]b[i b[Yb'i bX
< YfUi gZcfXYfi b[Yb\z'X]Y'a]h'XYa '6\Øf[Yf[Y`X'j YfVi bXYb'g]bX"'8]Y
8]g_i gg]cb'XUf\ØVYf'k]fX'Ui W\']b'Ni _i bZh'a U\[YV`]W\'X]Y
dc`]h]gW\Y'5[YbXU'i bX'X]Y'\OZZYbh`]W\Y'K U\fbY\a i b['j cb'gcn]U`Yf
G]W\Yf\Y]h'VYY]bZi ggYb"</pre>

8 YhU]`g	
J c f ZU``	Gcbgh][Yg
Cfh	D`Ui 'Ua 'GYYž'8Yi hgW\`UbX
EiY``Yb	• k k k "XYfk YghYb"XY
	• k k k "nXZ\Yi hY"XY
	kkk"XYihgW\`UbXZib_"XY

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