

# 6`Y]VYb'G]Y']bZcfa ]Yfh.'9]`a Y`Xi b[ Yb X]fY\_h'Ui Z'=\f'< UbXm°

 $8 ]Y `GhUXh'6]Y `YZY `X'g]Y \ h'g]W `Ub[Yg]W hg'ghY][YbXYf'5i g[UVYbibX'g]b_YbXYf'9]bbU \ a Yb'[Ynkib[YbžY]bYb'gdUfYbXYb \ < Ui g \ U `h'Ui ZnighY ``Yb''8]YgY'VYj cfghY \YbXY'Z]bUbn]Y``Y \ laghfi_hif]Yfib[`\Uh'ni'Y]bYf']bhYbg]j Yb'8]g_igg]cb']b'XYf GhUXhj Yfk U `hib['ibX'ibhYf'XYb'6Øf[Yfb'[YZØ\fhž'X]Y'X]Y \ A O[`]WX_Y]hYb'ibX'<YfUigZcfXYfib[Yb'Y]bYg'8cddY`\Uig\U`hYg ZØf'X]Y'\J\fY'&$\&\)ibX'\&\$\&\*VY`YiW\hYh''$ 

#### 8]Y < YfUi gZcfXYfi b[Yb XYg < Ui g\U`hgd`Ubg

 $\begin{tabular}{ll} \hline & ? Yfb `XYf' < Ui g \ U`hgX]g_i gg]cb `ghY \ h`X]Y : fU[Yž'k]Y `X]Y `GhUXh k Y]hYf \]b `] \ fY `J Yfd Z]W hi b[Yb `YfZØ``Yb `_Ubb" `&gVYgcbXYfY `X]Y gcn]U`Yb `8]YbghYž'X]Y `6]`Xi b[gY]bf]W hi b[Yb i bX `X]Y `&ZfUghfi _hi f g]bX `VYhfc ZZYb" `9I dYfhYb k UfbYbž'XUgg `Y]b i bVYXUW hYf I a [Ub[a]h`? Øfni b[Yb ini `Y]bYf J YfgW `YW hYfi b[ `XYf @YVYbgei U`]hÀh`XYf \end{tabular}$ 

8]Y'GhUXh'6]Y'YZY'X'\Uh'g]W\'V]g\Yf'Xi fW\'Y]bY'X]j Yfg]Z]n]YfhY
9]bbU\a Yei Y''Y'Ui g[YnY]W\bYh"'\XXcW\']gh'X]YgYf'JcfhY]'']b'XYb
'YhnhYb'\XJ\fYb'gW\k\AW\Yf'[YkcfXYb"'8]Y'DUbXYa]Y'\Uh'X]Y
9]bbU\a Yg]hi Uh]cb'j]Y'Yf'Gh\AXhY'i bX'; Ya Y]bXYb'bUW\\U`h][
VYY]bhf\AW\h][h"'5i W\'X]Y'N]bgYb'ZØf'?fYX]hY'g]bX'[Ygh]Y[Yb\Z'k Ug
X]Y'Z]bUbn]Y''Y'D`Ubi b['ni g\Ahn']W\'YfgW\k\Yfh"

9]b 'nYbhfu`Yf'Di b\_h']b 'XYf'8]g\_i gg]cb']ghž'k Y`W\Y'GYfj]W'g df]cf]hÀf'VY\UbXY`h'k YfXYb 'gc'`hYb": Ygh'ghY\hž'XUgg'X]Y J YfUbhk cfhi b['b]W\h'bi f'VY]'XYb '9bhgW\Y]Xi b[ghfÀ[Yfb'XYf GhUXhj Yfk U`hi b['`]Y[hž'gcbXYfb'Ui W\'X]Y'6Øf[Yf'gY`Vgh'U\_h]j']b XYb'DfcnYgg'Y]bVYnc[Yb'k YfXYb'a ØggYb"'6Øf[Yfj YfgUa a `i b[Yb\_\ObbhYb'Y]bY'D`UhhZcfa 'V]YhYbž'i a 'X]Y'A Y]bi b[Yb'i bX 6YXØfZb]ggY'XYf'5bk c\bYf'ni '\OfYb'i bX']b'X]Y'D`Ubi b[Yb Y]bni VYn]Y\Yb"

## 5i gk ]f\_i b[ Yb 'Ui Z'X]Y '6Øf[ Yf'i bX 8]Ybgh`Y]ghi b[ Yb

: Øfij ]Y`Yi6]Y`YZY`XYfik ]fXiXYfi8 cddY`\Ui g\UihiX]fY\_hY
?cbgYei YbnYbia ]hig]W\iVf]b[Yb"i6Y]gd]Y`gk Y]gYi\_ObbhYbi]biXYb
6YfY]W\Ybi6]`Xi b[ii bXiGcn]U`Ygi? Øfni b[Ybij cf[Ybca a Yb
k YfXYbžiX]Yi`Yhnh`]W\id [YbX`]W\Yii bXi: Ua ]`]YbiVYgcbXYfgi\Ufh
hfYZZYb"il a iX]YgYi9ZZY\_hYini ij Yfa Y]XYbžid`AX]YfYbiY]b][Y
9bhgW\Y]Xi b[ghfA[YfiZØfi\_fYUh]j Yi@Ogi b[YbžiYhk UiXi fW\
?ccdYfUh]cbYbia ]hi`c\_U`Ybi+b]h]Uh]j YbicXYfiXi fW\iX]YiGhAf\_i b[
i cbi9\fYbUa hqdfcY hYb"

 $\label{eq:localizero} $$Jcf^X]YgYa^-<]bhYf[fibX^YadZ]Y^hYg^g]W^zXUgg^X]Y^GhUXh^UiZ$ $$hfUbgdUfYbhY^?caaib]_Uh]cb^gYhnh''Bif^XifW^cZZYbY^; YgdfAW^YibX^XYb^5ighUigW^a]h^XYf^6Yj O^_Yfib[^_Ubb^Y]b^[YaY]bgUaYg $$JYfghAbXb]g^ZØf^X]Y^VYjcfghY^YbXYb^AU^bU\aYb^[YgWWUZZYb kYfXYb''8]Y^FUX]c^6]Y^YZY^X!5dd^gd]Y^h^\]YfVY]^Y]bY^k]W^h][YFC^YZ^jbXYa^g]Y^U_hiY^Y^\dangle^2cfaUh]cbYb^ibX^9]^aY^Xib[Yb^X]fY_hUb^X]Y^BihnYf^gYbXYh''$ 

± X]YgYf'D\UgY'XYf'<Ui g\U`hgUi ZghY``i b[']gh'Yg'j cb
YbhgW\Y]XYbXYf'6YXYi hi b[ž'XUgg'X]Y'GhUXhj Yfk U`hi b['b]W\h'bi f
X]Y'<YfUi gZcfXYfi b[Yb'UXfYgg]Yfhž'gcbXYfb'Ui W\'dcg]h]j Y
DYfgdY\_h]j Yb'Ui ZnY][h"'5i W\'k Ybb'9]bgdUfi b[Yb'i bUi gk Y]W\`]W\
YfgW\Y]bYbž'\_ÒbbYb']bbcj Uh]j Y'5bgÀhnY'XUni 'VY]hfU[Ybž'X]Y
@YVYbqei U`]hÀh']b'6]Y`YZY`X'ni 'VYk U\fYb"

; YgY``gWXUZh`]WXY'JYfUbhk cfhi b['i bX'XUg ; Ya Y]bk c\`

9g'V`Y]Vh'UVni k UfhYbž'k ]Y'X]Y'GhUXhj Yfk U`hi b['X]Y
VYj cfghY\YbXYb'< YfUi gZcfXYfi b[Yb'`Yhnh`]W\'UbbY\a Yb'k]fX"
8]Y'\_ca a YbXYb'A cbUhY'k YfXYb'YbhgW\Y]XYbX'XUZØf'gY]bž'cV
6]Y`YZY`X']b'XYf'@U[Y']ghž'Y]bYb'< Ui g\U`h'Ui Zni ghY``Ybž'XYf'b]W\h
bi f'X]Y'Z]bUbn]Y``Y'GhUV]`]hÀh'g]W\Yfhž'gcbXYfb'Ui W\'X]Y
6YXØfZb]ggY'gY]bYf'6Yk c\bYf'VYfØW\_g]W\h][h"'9g']gh'Y]bY
; fUhk UbXYfi b['nk]gW\Yb'bchk YbX][Yb'9]bgdUfi b[Yb'i bX'XYf
J YfdZ']W\hi b['ni f': ÒfXYfi b['XYq'gcn]U`Yb'Ni gUa a Yb\U`hg"

8]Y'\_ca a YbXY'NY]h'k]fX'nY][YbžcV'X]Y'GhUXh'a]h'\_fYUh]j Yb

XYYb'i bX'Y]bYa 'hfUbgdUfYbhYb'5i ghUi gWX'XUg'J YfhfUi Yb'XYf
6Øf[Yf'[Yk]bbYb'\_Ubb"'9g']gh'YggYbn]Y``ž'XUgg'VY]a 'H\Ya U

<Ui g\U`h'b]W\h'bi f'Ui Z'X]Y'NU\`Yb'[YgWXUi h'k]fXž'gcbXYfb'Ui WX
Ui Z'X]Y'A YbgWXYbž'X]Y']b'6]Y`YZY`X'`YVYb'i bX'UfVY]hYb"'→f
K c\`ghUbX'i bX']\fY'Ni Zf]YXYb\Y]h'gc``hYb']a 'A]hhY`di b\_h'YXYf
9bhgWXY]Xi b['ghY\Ybž'X]Y']b'XYf'<Ui g\U`hgX]g\_i gg]cb'[YhfcZZYbk]fX"

±0 'XYb '`YhnhYb '≠J\fYb '\Uhrg]W\ 'X]Y 'A YX]Yb`UbXgW\UZh`Yf\YV`]W\
[Yk UbXY`hž'VYY]bZi ggh`Xi fW\ 'hYW\bc`c[]gW\Y': cfhgW\f]hhY'i bX
g]W\ 'j YfÀbXYfbXY'J YfVfUi W\YfdfÀZYfYbnYb"'8][]hU`Y'D`UhhZcfa Yb
\UVYb'X]Y 'hfUX]h]cbY``Y'6Yf]W\ hYfghUhhi b['\YfUi g[YZcfXYfh`i bX
X]Y'5fh`i bX`K Y]gYž'k]Y`BUW\f]W\ hYb'\_cbgi a]Yfh`k YfXYbž
fYj c`i h]cb]Yfh"'8]Yg'\Uh`k Y]hfY]W\YbXY'5i gk]f\_i b[Yb'Ui Z'X]Y
; `Ui Vk ØfX][\_Y]hž'X]Y'H\Ya YbUi gk U\``i bX'X]Y'5fh`XYf
BUW\f]W\ hYbj Yfa]hh`i b["

 $6 YgcbXYfg "gY]h "XYf "7CJ = 8! \% -!DUbXYa ]Y "\ Uh "g]W "X]Y "6 YXYi hi b[$ 

j cb '9Wk hnY]h]b Zcfa Uh]cbYb 'i bX 'gWk bY ``Yb 'I dXUhYg'j YfghÀf\_h"
B UWk f]Wk hYbcf[ Ub]gUh]cbYb '\ UVYb 'X][ ]hU`Y '? UbÀ`Y '[ Ybi hnhži a
]\ fY 'N]Y`[ fi ddYb 'Y ZZY\_h]j Yf'ni 'YffY]Wk Yb " 8 ]Y 'J YfVfY]hi b[ 'j cb

♣ Zcfa Uh]cbYb 'ØVYf'gcn]U`Y 'A YX]Yb '\ Uh'Yg'Bi hnYfb 'Yfa Ò[`]Wk hž
g]Wk 'gWk bY ``Yf'ØVYf'U\_hi Y``Y '9fY][ b]ggY 'ni ']b Zcfa ]YfYbž'\ Uh
YXcWk 'Ui Wk '<YfUi gZcfXYfi b[ Yb ']b '6Yni [ 'Ui Z'X]Y 'J YfVfY]hi b[
j cb '8 Yq]b Zcfa Uh]cb 'a ]h'q]Wk '[ YVfUWk h"

## K ]Y X][ ]hU`Y D`UhhZcfa Yb X]Y B UWX f]WX hYb V Yf]WX hYfghUhhi b [ 'V Y Y]b Z`i ggYb

8]Y'Bi hni b['j cb'GcW]U`'A YX]U'U`g'df]a ÀfY'BUW\f]W\hYbei Y``Y'\Uh]b'XYb'`YhnhYb'\J\fYb'ghUf\_'ni [Ybca a Yb"'@Ui h'Y]bYf'I a ZfU[Y XYg'F Yi hYfg'\Dgh]hi hY'ZØf'XYb'\si fbU`]ga i g'Ui g'XYa '\J\f'\&\\$\&' [UVYb'(, 'i 'XYf'\6YZfU[hYb'Ub\z']\fY'\BUW\f]W\hYb'j cf'U``Ya '\ØVYf gcn]U`Y'\BYhnk Yf\_Y'ni 'VYn]Y\Yb"'\8]YgY'\9bhk ]\W\_`i b['\Uh'ni 'Y]bYa DUfUX][a Ybk YW\\gY``[YZØ\fh\z'\Y]'XYa 'hfUX]h]cbY``Y'\A YX]Yb j Yfgi W\Yb\z'\g]W\`Ub'\X]Y'\Df\AZYfYbnYb'\Y]bYg'\Øb[YfYb'\Di V`]\_i a g Ubni dUggYb"

9]b k Y]hYfYf j Yfk UbXhYf 5gdY\_h jgh X]Y ghY][ YbXY 6YXYi hi b[ j cb a cV] Yb 5bk YbXi b[ Yb B UWX f]W hYb!5ddgž k ]Y X]Y j cb F UX]c 6]Y YZY Xž V]YhYb Bi hnYfb X]Y A  $\hat{O}[\hat{A}]$  by Di g\!B UWX f]W hYb ni Yf\ U`hYbž k cXi fWX \[U\_hi Y`Y \Diz Zcfa Uh]cbYb X]fY\_h i bX \[gWX bY``]a < UbXm 6]`XgWX ]fa \[YfgWX Y]bYb \]8 ]Yg \[ghY][ Yfh b]W h bi f X]Y \[FY]W k Y]hY XYf B UWX f]W hYb \[ZgcbXYfb Ui WX X]Y \Dix bhYfU\_h]j ]h h nk ]gWXYb A YX]Yb i bX Bi hnYfb \]

#### 8]Y < YfUi gZcfXYfi b[ XYf =bZcfa Uh]cbg]bhY[f]hÀh

A ]h'XYf'ghY][ YbXYb'Bi hni b['j cb'X][ ]hU`Yb'D`UhhZcfa Yb'ghY\h'X]Y A YX]Yb`UbXgW\UZh'i bhYf'8 fi  $\underline{W}$ \_Z'X]Y' $\pm$ bhY[ f]hÀh'XYf' $\pm$ bZcfa Uh]cbYb ni '[Yk À\f`Y]ghYb": U`gW\]bZcfa Uh]cbYb'i bX'7`] $\underline{W}$ \_VU]h!5fh]\_Y`'g]bX ni 'Y]bYa 'Yfbgh\UZhYb'DfcV`Ya '[Yk cfXYb"'@Ui h'Y]bYf'Ghi X]Y'XYf < cW\gW\i `Yb']b'GhUbZcfX'k ]fX'[YgW\Ahnh\z'XUgg'Yhk U'+\$'i 'XYf Bi hnYf'GW\k]Yf][\_Y]hYb'\UVYb\z'nk ]gW\Yb'j YfhfUi Ybgk \ØfX][Yb'i bX'k Yb][Yf'j YfhfUi Ybgk \ØfX][Yb'i Ei Y``Yb'ni 'i bhYfgW\Y]XYb"'8]Yg qhY``h'Y]bY'Yf\YV`]W\Y'<YfUi gZcfXYfi b['Z\ØfX]Y'\sei fbU`]qhYb'XUf\z'

 $X]Yg]WXVYa \emptyset YbžZibX]YfhYžcVY_h]jY6Yf]WXhYfghUhhib[iniY]ghYb"$ 

I a 'XYa 'Ybh[ Y[ Ybni k ]f\_Ybž'\UVYb'j ]Y`Y'A YX]Ybi bhYfbY\a Yb

b]h]Uh]j Yb 'Yf[ f]ZZYbži a 'g]WX'Ui Z': U\_hYbØVYfdfØZi b[ 'i bX

hfUbgdUfYbhYg'F Ydcfh]b[ 'ni '\_cbnYbhf]YfYb"' b]h]Uh]j Yb 'k ]Y'XYf

xi fbU`]ga 'Hfi gh' b]h]Uh]j Y 'n]Y`Yb 'XUfUi Z'UVž'j YfhfUi Ybgk ØfX][ Y

E i Y``Yb 'ni 'ZÒfXYfb' i bX'B i hnYf'Ui Z'X]Y'6YXYi hi b[ '\_f]h]gWXYb

8 Yb\_Ybg']a '?cbgi a 'j cb'BUWXf]WXhYb'Ui Za Yf\_gUa 'ni 'a UWXYb"

8 ]YgY'A U» bU\a Yb'g]bX'YbhgWXY]XYbXž'i a 'X]Y'; `Ui Vk ØfX][ \_Y]h
j cb'BUWXf]WXhYbcf[ Ub]gUh]cbYb']b'Y]bYf'NY]h'ni 'VYk U\fYbž']b'XYf

A ]gghfUi Yb'[ Y[ YbØVYf'XYa 'A YX]Ybk YgYb'k Y]h'j YfVfY]hYh']gh"

8 Y hU]`g

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