

FY[]Yfi b[gVYUa hY`\UVYb`X]Y`?fmdhc!JYfdZ]W\hi b[Yb`XYfGhUXh`VY]a`<cb[`?cb[`K YV'`: Ygh]j U``X]YgY`K cW\Y
VYgh\h][h\tix\U`Yg`XUfUi Z`UVn]Y`h\tiy]b`j c``gh\hbX][`fY[i`]YfhYg
?fmdhc!NYbhfi a`ni `k YfXYb\tix\Ug`\bj Ygh]h]cbYb`i bX
K YV'!GhUfhi dg`Ubn]Y\h"5a`'\&\"5df]``VY_f\tix\][hY
:]bUbna]b]ghYf`DUi``7\Ub`Ac!dc\tix\Ugg`Ub[Ya YggYbY
JcfgW\f]ZhYb`i bX`5i Zg]W\hj cb`[f\tix)\hyf`6YXYi hi b[`gY]Yb"
\(\delta\W`[`Ui VY\tix\Ugg`YXYf`Ui g`XYb`'\Øb[ghYb`9fY][b]ggYb
[Y`Yfbh`\Uh\tix\Ugg`Ub[Ya YggYbY`JcfgW\f]ZhYb`Y]b`A i gg`g]bX\tix
i a`Y]b`I a ZY`X`Z\Of`bUW\\U`\h][Y`9bhk]\W_`i b[`i bX`Y]bYb
]XYU`YfYb`FUi a`Z\Of`9bhk]\W_`i b[`ni `gW\UZYb"`<cb[_cb[k]``8Y:]'fY[i`]YfYb`6Yf]W\hYb`ni Zc`[Y`k]```Ui W\X]Y`<cb[
?cb[`GYW`f]h]Yg`UbX`: i hi fYg`7ca a]gg]cb`fG: 7\tix]Y
XYnYbhfU`Y`:]bUbn]Yfi b[`fY[i`]YfYb"8]Y`5[Ybhi f`[`Ui Vh\tix
XUqq'\Ua d\Y``]d\



 $\label{eq:final_system} FY[\]Yfi\ b[\ gVYUa\ hY `\ UVYb `X]Y ? fmdhc! J YfdZ]WX hi\ b[\ Yb `XYf `GhUXh \ h]$

VY]a < cb['?cb['K YV' ': Ygh]j U``X]YgY'K cW\Y'VYghÀh][hž:XU'Yg
XUfUi Z'UVn]Y`hž'Y]b'j c``ghÀbX]['fY[i `]YfhYg'?fmdhc!NYbhfi a 'ni
k YfXYbž'XUg' = bj Ygh]h]cbYb'i bX'K YV'!GhUfhi dg'Ubn]Y\h"

5a '%&"'5df]``VY_fÀZh][hY':]bUbna]b]ghYf'DUi``7\Ub'Ac!dcž'XUggUb[YaYggYbY'JcfgWxf]ZhYb'ibX'5iZg]Wxh'jcb'[fÒ»hYf'6YXYihib[gY]Yb"

→W. [``Ui VYž'XUgg'`YXYf'Ui g'XYb'`Øb[ghYb'9fY][b]ggYb'[Y`Yfbh\Uhž'XUgg'Ub[Ya YggYbY'JcfgW.f]ZhYb'Y]b'Ai gg'g]bXž'i a 'Y]bIa ZY`X'ZØf'bUW.\U`h][Y'9bhk]W_`i b['i bX'Y]bYb']XYU`YfYb'FUi a ZØf'9bhk]W_`i b['ni 'gW.UZZYb"

<cb[_cb['k]``'8Y:]'fY[i `]YfYb</pre>

6Yf]WXhYb ni Zc`[Y'k]```Ui WX'X]Y'<cb['?cb['GYW'f]h]Yg'UbX': i hi fYg 7ca a]gg]cb'fG: 7Ł'X]Y'XYnYbhfU`Y':]bUbn]Yfi b['fY[i`]YfYb"'8]Y 5[Ybhi f'[`Ui Vhž'XUgg'8Y:]!D`UhhZcfa Yb'Y]bY'@]nYbn'VYbÒh][YbkYfXYbž'kUg']a 'KYgYbh`]WXYb'VYXYi hYhž'XUgg'g]Y'_Y]b'8Y:]'gY]bkYfXYb"

?Y]h\`7\cmž'@Y]hYf`XYf`5VhY]`i b[`\delta hYfa YX]ÀfY`VY]`XYf`G: 7ž`gU[hYž 8Y:]`gc``hY`U`g`XUggY`VY`k]Y`7Y:]`fhYbhfU`]g]YfhY`cXYf`hfUX]h]cbY``Y:]bUbnYbŁ`VYhfUW\hYh`k YfXYb"

8U\Yf'k ØfXY'X]Y'8Y:]!5_h]j]hÀhž'gc`Ub[Y'g]Y']a 'FU\a Yb'j cb K YfhdUd]YfYb'i bX': i hi fYg'ghUhhZ]bXYhž'XYbgY`VYb'fY[i `Uhcf]gW\Yb 5bZcfXYfi b[Yb'i bhYf`]Y[Ybž'X]Y'ZØf'hfUX]h]cbY``Y :]bUbnU_h]j]hÀhYb'[Y`hYb"

@]`m'?]b[ž'7CC'XYg'JYfk U\fYfg'jcb'?fmdhc!JYfa Ò[Ybgk YfhYb7cVcž'_ca a Ybh]YfhY.' K Ybb'<cb[_cb['k]f_`]W\'VYUVg]W\h][hž8Y:]'ni 'fY[i`]YfYbž'VYXYi hYh'X]Ygž'XUgg'Yg'ghfYb[YfY'FY[Y`b'\UhO'bj]fcba YbhQU`q'G]b[Udif"

 ahfYb[Yb.5bZcfXYfib[Yb.Ub.X]Y.Hc YbžX]Y.a]Y.UiZ]ahYb. ObbYb"

HfchnXYa 'ÒZZbYb'g]WX'FY[]cbU`VUb_Yb'ZØf'?fmdhcž'k Ug'a Ub'ZØf XYb'K YghYb'b]WXh'gU[Yb'_Ubb"'5bZUb['X]YgYf'K cWXY'_ØbX][hY <cb[_cb[g'[fÒ»hY'Cb`]bY!6Ub_'Ubž'XUgg'g]Y', VYfk Y]gi b[Yb'i bX I a fYWXbi b[Yb'j cb'i bX'ni '?fmdhc!'i bX':]Uh!K À\fi b[Yb UbV]YhYb'k]fX"

8]Y`N5`6Ub_`k]fX`U`g`5Vk]W_`i b[gVUb_`ZØf`?i bXYb`Zi b[]YfYb`i bX 5V\YVi b[Yb`]b`< cb[_cb[Yfž`W\]bYg]gW\Yf`i bX`I G!K À\fi b['j cb ?fmdhc!9]b`U[Yb`VY]`6ÒfgYb`Yfa Ò[`]W\Ybž`gU[hY`79C`FcbU`X`\#\"

$B \ W h \ Z O f \ X Y b \ W \] b Y g] g W Y b \ 9] b n Y \ U b X Y \$

8 Yf'?fmdhca Uf_h'j cb'<cb[_cb['k]fX'YXcW\'Ui Z[fi bX'XYf Xcfh][Yb'6YgW\fÀb_i b[Yb'XYg'FY[]a Yg'ZØf'9]bnY`\ÀbX`Yf'Ui Z XYa 'W\]bYg]gW\Yb': Ygh`UbX'b]W\h'j YfZØ[VUf'gY]b"

9g'k]fX'W\]bYg]gW\Yb'6Ub_Ybž'\pgh]hi h]cbYb'i bX'l bhYfbY\a YbY]bYb'K Y['V]YhYbž'\Y[U\']b'?fmdhca Àf_hY'Y]bni ghY][Yb"

 $8 \ Y \ fn Y \]h'[\]V \ h' Y \ g']b' < cb[\ _cb[\ 'bi \ f'nk \ Y]'j \ c````]n Y \ bn] Y \ fh Y'? \ fmd \ hc!$ $6 \ Ofg Y \ b'' < Ug \ Y \ m'i \ b \ X' \ C \ G @''$

C?L!DfÀg]XYbh'<cb[::Ub[:nY][hY'g]W\'cdh]a]gh]gW\'i bX'gU[hY.' 9g]gh'Y]bY'gY\f'i bVYghÀbX][Y'G]hi Uh]cbž'UVYf']W\'gY\Yž'XUgg <cb[_cb[:ni gUa a Yb'a]h'XYb'l G5'i bX'Y]b][Yb'UbXYfYb'6Øfcg Y]b'gY\f'k]W\h][Yf'?bchYbdi b_h'ZØf'i bgYf'HYUa ']gh"

C?L'_ØbX][hY'D`ÀbY'Ubž'gY]bY'DfÀgYbn']b'<cb[_cb['Xi fWX'X]Y6YUbhfU[i b['j cb'@]nYbnYb'ZØf'j]fhi Y``Y'5ggYhg'9bXY'A ÀfnUi gni VUi Yb"

. . 11

6Ygi WXYb'G]Y'i bg'Ui Z'_fmdhc!bYk g"Uh