

BU[Y`ga Ubbg`f]g_UbhY`K YWXgY`. 8Yi hgWX`UbX`V`Ua]Yfh`g]WX`[Y[Yb Dcfhi [U`°

8 Yi hgWX`UbX`j Yf`]Yfh`]a `B Uh]cbg!@YU[i Y!<U`VZ]bU`Y`[Y[Yb Dcfhi [U`'%.&"'HfU]bYf`BU[Y`ga Ubb`g]Y\h`g]WX`\YZh][Yf`?f]h]_ Ui g[YgYhnh"

A Øb WX b Yf '5 f Y b U ž'8 Y i hg WX `Ub X '! =a '< U`V Z]b U`Y 'X Y f'B Uh]c b g @Y U[i Y 'a i gghY 'X]Y 'X Y i hg WX Y :: i » V U``b Uh]c b U`a Ub bg WX U Zh ii b hY f Hf U]b Y f' \Rightarrow `]Ub 'B U[Y`ga Ub b 'Y]b Y 'V]hhY f Y 'B]Y X Y f` U[Y'\]b b Y \a Y b" ; Y[Yb 'Dc fhi [U``j Yf`c f' X Ug'8: 6! HY Ua 'b U WX 'Y]b Y f nk]g WX Y b n Y]h`] WX Y b :: Ø\ fi b ['j c b '% \$ 'a]h '% & ']b 'X Y f' A Øb WX b Y f 5 f Y b U": `c f] Ub 'K]f hn 'V f U WX hY 'X]Y '8 Y i hg WX Y b ']b 'X Y f 'Y f g hY b < U`V n Y]h 'a]h 'Y]b Ya '? c d Z V U``h f Y Z Z Y f ']b :: Ø\ fi b ["'8 c WX 'X]Y ': f Y i X Y k À\ f h Y 'b] WX h ``Ub [Y ž' X Y b b 'b U WX 'X Y f' < U`V n Y]h'_c b b h Y b 'X]Y Dc f hi [] Y g Y b 'X U g' 6 `Uhh 'k Y b X Y b 'i b X 'X]Y 'D U f h] Y 'g d À h 'Z Ø f 'g] WX Y b 'hg WX Y] X Y b "

8]Y'dYfgcbY``Yb'DfcV`Ya Y']a '8: 6!?UXYf'k UfYb'j cf'XYa 'Gd]Y`VYfY]hg'XYi h`]W\"Ni a '5i Z[YVch'[Y\OfhYb'j]Y`Y'Gd]Y`Yfž'X]Y']b'XYf JYf[Ub[Yb\Y]h'Y]bY'nYbhfU`Y'Fc``Y'[Ygd]Y`h\UhhYbž'YXcW\
ZY\`hYb'Y]b][Y'k]W\h][Y'5_hYi fY'k]Y'5bhcb]c'FØX][Yfž'\Ja U`Aig]U`U'i bX'?U]'<Uj Yfhn'Ui Z[fi bX'j cb'JYf`Yhni b[Yb"'8]YUb[YgdUbbhY'DYfgcbU`g]hi Uh]cb'gcf[hY'ZØf'ni gÀhn`]W\Y</p>
YfUi gZcfXYfi b[Ybž']bgVYgcbXYfY'XU'BU[Y`ga Ubb'[Ynki b[Ybk Ufž'XfY]'K YW\gY`'j cfni bY\a Yb'''Y]bY'9bhgW\Y]Xi b[ž'X]Y']b'XYf
c`[Y'U`g'fÀhgY`\UZh'_f]h]g]Yfh'k i fXY"'8]YgY'K YW\gY``ZUbXYb'ghUhhž k À\fYbX'X]Y'A UbbgW\UZh'bcW\']b': Ø\fi b['`U[ž'k Ug'X]Y'GhUh]_'XYg
Gd]Y`g'Xi fW\Y]bUbXYf'VfUW\hY"

I a ghf]hhYbY'K YWXgY`ibX'hU_h]gWXY': Y\`Yf

8]Y'K YW\gY\ž'X]Y'BU[Y`ga Ubb'j cfbU\a ž'k i fXYb'U`g'b]W\h
bUW\j c``n]Y\VUf'Ub[YgY\Yb"'Gd]Y`Yf'k]Y'FcV]b'; cgYbg'i bX'GYf[Y
; bUVfm'_cbbhYb']\fYb'5i Z[UVYb'b]W\h'[YfYW\h'k YfXYb'i bX
k UfYb'Ub'XYb'; Y[YbhcfYb'YbhgW\Y]XYbX'VYhY]`][h"'BUW\'XYf
DUfh]Y'[Yf]Yh'BU[Y`ga Ubb'i bhYf'8fi W_ž'XU']\a 'j cf[Yk cfZYb
k i fXYž'gY]bY'A UbbgW\UZh'c\bY'Bch'[YgW\k\AW\h'ni '\UVYb"'GhUhh
X]Y'[i hYb'5bgAhnY'XYg'Gd]Y`g'Ui Zni VUi Ybž'k i fXY'X]Y'XYi hgW\Y
9`Z'Xi fW\'hU_h]gW\Y': Y\`Yf'i bX'i b[`\Ø\W_`]W\Y'9bhgW\Y]Xi b[Yb'Ui g
XYa '?cbnYdh'[YVfUW\h"

 $B \ UWX \ "XYf"B \]YXYf"U[Y"Ai \ "YfhY"XYf"6i b XYghfU]b Yf"gY]b Y \\ I \ bni \ Zf]YXYb \ Y]h"a \]h"gY]b Yb "Gd]Y `Yfb "ZØf"XYfYb "hU_h]gWX Yb ": Y\ `Yfž k \ A\ fYb X "Yf" \ YXc WX "X]Y "J YfUb hk cfhi b ["ZØf"X]Y "K c WX Yb "]a "J cfZY `X i b X "X]Y "j cf[Yb ca a Yb Yb "K YWX gY `"bi f"VYX]b [h"ØVYfb U\ a ""\ \delta "XYf DfYggY "Ai \"YfhY "Yf"g]WX "VYnØ[`]WX "XYf"Df]cf]hAh"XYg"Hi fb]Yfg. "K]f gY\Yb "X]Y "9b hk]\ W_`i b ["XYf"A Ub b gWX UZh"U`g"k]\ WX h]["Ub \ Z'Ui WX "k Yb b XUg"9f[YVb]g"Yb hgWX Y]XYb X"]gh" "8]Yg"j YfXYi h`]WX h"X]Y "Gd Ub bi b [nk]gWX Yb "Zcfh`Ui ZYb XYf"5i gV]`Xi b ["i b X "XYf"B c hk Yb X][_Y]h\ Z 9f[YVb]ggY "ni "`]Y ZYfb"$

8Yf'8: 6!?UXYf']a ' VYfV']W_

 $8 \ Yf'8: 6!? \ UXYf'i \ a \ ZUgghY'Y]b][Y'hU`Ybh]YfhY'Gd]Y`Yf'bYVYb'XYb \ UVk \ YgYbXYb'@Y]ghi \ b[ghfÀ[Yfb'''+b'XYf'Hcfk Ufhdcg]h]cb'ghY\h'A UfW \ 5bXfÅ'hYf'GhY[Ybž'XYf'U`g'_`UfY'Bi a a Yf'Y]bg'[]`hž'k À\fYbX'Ui Z \ XYf'5Vk Y\fgY]hY'i bhYf'UbXYfYa '\xig\'a\ g\i U'?]a a]W\'i bX'8Uj]X \ FUi a ']b'XYf'GhUfhY`Z'ghUbXYb'''-a 'A]hhY`ZY`X'gcf[Yb'BUa Yb'k]Y @Yfcm'GUbÅ'i bX'XYf'VYfY]hg'Yfk À\bhY': `cf]Ub'K]fhn'ZØf ni gÀhn`]W\Y'C ZZYbg]j _fUZh''$

?UhY[cf]Y	Gd]Y`Yf
Hcf\ØhYf	C`]j Yf 6Ui a Ubbž 5`Yl UbXYf
	BØVY`ž'A UfW5bXfÅ hYf'GhY[Yb
5Vk Y\fgd]Y`Yf	FcVYfh'5bXf]W\ž'K U`XYa Uf
	5bhcbž'∝g\iU'?]a a]W\ž'FcV]b
	?cWXžAUI]a]`]Ub`A]hhY`ghÀXhž
	8 Uj]X F Ui a ž ≈bUh\Ub HU\ž
	H\]`c'?Y\fYf

A]hhY`ZY`Xgd]Y`Yf	?Uf]a 5XYmYa]žHca 6]gWkcZž
	GYf[Y'; bUVfmž'@Ycb'; cfYhn_Už
	FcV]b'; cgYbgž'DUgWU`; fc»ž
	: Y`]I 'Ba YW\Už'5`Y_gUbXUf
	DUj `cj]Wž'@Yfcm'GUbÅž': `cf]Ub
	K]fhn
GhØfa Yf	B]WUg': Ø``_fi [ž'8Yb]n'I bXUj ž
	B]W_Kc`hYa UXY

A]h'6`]W_'Ui Z'X]Y'_ca a YbXYb'<YfUi gZcfXYfi b[Yb'VYfY]hYh'g]WX X]Y'XYi hgWXY'A UbbgWXUZh'bi b'Ui Z'XUg'Gd]Y`'i a 'XYb'Xf]hhYb'D`Uhn j cfž'k Ug'ZØf'j]Y`Y'Gd]Y`Yf'X]Y'; Y`Y[Yb\Y]h'V]YhYhž'g]WX']b'XYb J cfXYf[fi bX'ni 'gd]Y`Yb'i bX'Y]b'dcg]h]j Yg'9bXY'XYf'BUh]cbg @YU[i Y'ni 'Zcfa i `]YfYb"

8]Y'Gh]a a i b[']bbYf\U`V'XYg'HYUa g'gWXY]bh'ghUV]``ni 'gY]bž'k]Y X]Y'dcg]h]j Yb'FØW_a Y`Xi b[Yb'Ui g'XYf'DfYggY'nY][Yb''Fi X]'J Ò``Yfž XYf']a 'J cfZY`X'X]Y'HY]`bY\a YbXYb'Ub'XYb'A YX]Yb'k YfhYhYž'\YVh XUg'HU`Ybh'j cb'B]W_K c`hYa UXY'\Yfj cf'i bX'g]Y\h']b']\a 'Y]bY GhØfa Yf\cZZbi b['ZØf'X]Y'Ni _i bZh''BU[Y`ga Ubb'\Uh'VYfY]hg Ub[YXYi hYhž'XUgg'K c`hYa UXY'X]Y'7\UbWY'Ui Z'Y]b'8YVØh']a BUh]cbg!@YU[i Y!Dc_U``\UVYb'_ObbhYž'k Ug'ZØf'Zf]gWXYb'K]bX']a 8:6!HYUa 'gcf[Yb'_ObbhY''

8]Y'_ca a YbXYb'Gd]Y`Y'k YfXYb'YbhgW\Y]XYbX'XUZØf'gY]bž'k]Y
g]W\'XUg'HYUa'k Y]hYfYbhk]W_Y`h'i bX'cV'*i\]Ub'BU[Y`ga Ubb'Ui g
XYb': Y\`Yfb'XYf'JYf[Ub[Yb\Y]h'[Y`Yfbh'\Uh"'CV'g]W\'X]Y
_f]h]gW\Yb'Gh]a a Yb'ni f'Gd]Y`Yfk U\`'i bX'HU_h]_']b'XYf'Ni _i bZh
ÀbXYfb'k YfXYbž'V`Y]Vh'UVni k UfhYb"'

 $\begin{array}{l} K Y]hYfY \stackrel{*}{\to} Zcfa \ Uh]cbYb \stackrel{``}{:} \ bX \stackrel{``}{\cdot} 8YhU] \stackrel{``}{\cdot} g^{`}Z]bXYb \stackrel{``}{\cdot} G]Y \stackrel{``}{\cdot}]b \stackrel{``}{\cdot} XYb \stackrel{``}{\cdot} 6Yf]WXhYb \\ j cb \stackrel{``}{\cdot} F Ya \ gnY]hi \ b[\ \check{z}^{``}N8: \stackrel{``}{\cdot} i \ bX \stackrel{``}{\cdot} G\emptyset XXYi \ hgWX Y \stackrel{``}{\cdot} NY]hi \ b[\ " \end{array}$

8YhU]`g	
JcfZU``	Gdcfh
Cfh	A ØbW\bYf^5fYbUž'8Yi hgW\`UbX
EiY``Yb	• k k k "fYa gnY]hi b["XY

8 YhU]`g	
	• k k k "nXZ\Yi hY"XY
	• k k k "gi YXXYi hgWXY"XY

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