

$CX]b gi WhY]b ``]YVYj c``Yg`Ni \Ui gY.`J ca H]Yf\Y]a ``]bg'; `<math>ØW_3$

A]gWk`]b['CX]b'ZUbX'bUWk'gWk`YWkhYa 'GhUfh'U`g'K Y`dY ni $f\emptyset W_{}$ ']bg'H]Yf\Y]a 'C`dY"'8cfh'UfVY]hYh'a Ub'Ub'gY]bYb < YfUi gZcfXYfi b[Yb"

8]Y; YgW]W hY j cb < i bX C X]b k]fZh Y]b Yb YfbghYb 6`]W_ 'Ui Z'X]Y < YfUi gZcfXYfi b[Ybža]h XYbYb j]Y`Y < Ui gh]YfY bUW]\fYf J Yfa]hh`i b['_cbZfcbh]Yfh k YfXYb" 5`g ' 1 b[Yf A]gW `]b['Ui g Fi a Àb]Yb \ Uh C X]b Y]bY FY]\ Y j cb 'GW k]Yf][_Y]hYb Xi fW [Ya UW hž X]Y]\ b 'ni fØW_ ']bg 'H]Yf\ Y]a 'C `dY '[YZØ\ fh \ UVYb" 8 cfh 'ZfYi Yb 'g]W X]Y A]hUfVY]hYf XUfUi Zž]\ a 'ni '\Y`ZYbž XcW gY]bY k YgYbh`]W ghY < YfUi gZcfXYfi b[']gh X]Y Gi W Y bUW 'Y]bYa dUggYbXYb 'Ni \ Ui gY"

$CX]b.~9]b~k~Y]hYfYf~GWX]W_gU~ggWX~U[~ZØfH]YfgWXi~hn$

8 Yf K Y['j cb 'C X]b 'VY[Ubb 'VYfY]hg 'U 'g 'K Y 'dYž'U 'g 'Yf ']b 'Y]b H]Yf\Y]a 'b UW '8 Yi hg W `Ub X '_ Ua "'B UW 'Y]b Yf _i fn Yb 'N Y]h 'VY] Y]b Yf : Ua] `]Y ž' X]Y ']\ b 'U X c dh]Yfh Y ž' gh Y ``h Y 'g] W '\ Yf Ui g ž' X Ugg 'X]Y \

\$\delta h Y [f Uh] c b '[Yg W Y]h Yfh 'k Uf" '9g ']gh 'g Y \ f 'h f U[]g W ž' X Ugg 'C X]b 'Yhnh k]Y X Yf ']a ']gh ž' g c 'X]Y '< i b X Y! H f U]b Y f]b ž' X]Y 'a U `'Ø V Y f g Y]b Y 'Yfgh Y 'J Yfa]hh i b ['Yf_ `A f h Y ž' X Ugg 'X]Y 'X Ua U`][Yb '6 Yg]h Y Yf b] W h ']b 'X Y f '@ U[Y 'k Uf Y b ž' g] W 'U X A e i Uh 'i a 'g Y]b Y b '7 \ Uf U_h Y f 'n i _ Ø a a Y f b "

9]b gW a Yfn\UZhYf I a [Ub[a]h Ÿb[ghYb

 $CX]b`VfUWXhY`b]WXh`bif`d\mg]gWXYž`gcbXYfb`UiWX`Yach]cbU`Y \\ H\YaYb`a]h"`gY]bY`YfghY`: Ua]`]Y`_cbnYbhf]YfhY`g]WX`fØW_g]WXhg`cg$

Ui Z'gY]bY'Ÿb[ghYž'k Ug'XUni 'ZØ\fhYž'XUgg'Yf'ni bY\a YbX
j YfgW\`cggYbYf'i bX'fYZ'Yl Ufh][Yf'fYU[]YfhY" '9f'\UhhY'Y]b'[fc»Yg
DfcV`Ya 'a]h'`Ui hYb'; YfÀi gW\Ybž'k Ug'gY]bY'GW\ØW\hYfb\Y]h
k Y]hYf'j YfghÀf_hY ž'VYf]W\hYh'gY]bY'HfU]bYf]b'i bX'ZØ[h'\]bni ž'XUgg
C X]b']b'Y]bYa 'ghfYgq][Yb'l a ZY`X'`YVhY"

: cfhgW f]hhY]a H]Yf Y]a

 $\label{thm:gy]byf:gwkkYfk]Y[YbXYb^DfcV^YaY^\Uh^CX]b^]a^H]Yf\Y]a\\ C^dY^:cfhgWkf]hhY^[YaUWkh''GY]bY^@Ub[nY]h!; Ugg][Åb[Yf]b^\Uh]bhYbg]j^a]h^]\a^[YUfVY]hYh''^9g^[UV^gc[Uf^Y]bY^dcg]h]j^Y\\ 9bhk]W_`ib[XifWk^XUg^HfU[Yb^Y]bYg^AUi^_cfVg^XYYf^a]hh^Yfk^Y]^YU``hÂ[^]Wk^ZØf^]\b^[Yk^cfXYb^]gh''^8Ug^5bn]Y\Yb^XYg^AUi^_cfVg^]gh^ZUgh^gc^bcfaU``k]Y^XUg^5b^Y[Yb^j^cb^<U`gVUbX^ibX^@Y]bY^ZgU[hX]Y^HfU]bYf]b^YfZfYih''$

8]Y'Gi WXY'bUWX'XYa']XYU`Yb'Ni \Ui gY

9]b [YY][bYhYf bYi Yf 6Yg]hnYf ZØf C X]b k]fX bUW ?f]hYf]Yb [Ygi W hž X]Y Ui Z 9fZU\fi b['i b X 'GhUV]`]hÀh VUg]YfYb " 9f VfUi W h Ya Ub XYb ž XYf J YfhfUi Yb 'Ui gghfU\ `h i b X]XYU Yfk Y]gY '9fZU\fi b[a]h < i b XYb \ Uh ž VYhc bh X]Y 'HfU]b Yf]b " 5 V[YgY\Yb 'j c b 'XYb Ya ch]c bU `Yb '5 b Zc f XYfi b [Yb ž X]Y C X]b 'Ub 'gY]b Yb 'b Yi Yb '6 Yg]hnYf ghY ``hž k]f X 'Ui W 'XUfUi Z \]b [Yk]YgYb ž XUgg 'gY]b 'b Yi Yg 'Ni \ Ui gY _]b XYf ZfY] 'gY]b 'gc ``hY " @Ui h 'HfU]b Yf]b 'k ÀfY 'Y]b '`Àb X `]W '[Y `Y[Yb Yg I a ZY `X ']b '5 V[YgW]Y XYb \ Y]h c d h]a U `"

$8Yf^5igk]f_ib[Yb^XYg^@YVYbg^]a^H]Yf^Y]a$

 $B] Whib i f'C X] b'V f Ui WhiX f] b [Yb X Y] b'Ni \ Ui gY'''Ui WhiV Ub XY f Y H] Y f Y k] Y'XY f'G WhiAZY f \ i b X'H] WU'] a 'H] Y f \ Y] a 'C `dY' k U f h Y b'Ui Z'Y] b k U f a Yg'D` À h n WhiY b ž'XU''Ui WhiZØ f'g] Y'X U g'@Y V Y b'\] b h Y f';] h h Y f'Y] b Y < Y f Ui g Z c f X Y f i b ['X U f g h Y'``h''' \ \ f Y'; Yg WhiY b' i b X'X] Y'\ U f h Y b 6 Y X] b [i b [Yb ž'i b h Y f' X Y b Y b' g] Y''Y V Y b ž'j Y f X Y i h`] WhiY b' X] Y k] WhiN h] [Yb': f U [Yb'f i b X'i a 'H] Y f g Whih z 5 X c d h] c b'i b X'X] Y J Y f U b h k c f h i b [ž'X] Y' a] h'X Y f'D Z Y [Y'Y] b Y g' < Ui g h] Y f Y g' j Y f V i b X Y b] g h''$

8]Y'G]hi Uh]cb'j cb'CX]b'i bX'gY]bYf'5fh[YbcggYb']gh'Y]b'5i Zfi Z'UbX]Y'; Ya Y]bgW\UZhžij YfUbhk cfhi b[gVYk i gghY'9bhgW\Y]Xi b[Yb'nihfYZZYb'i bX'XYb'H]YfYb'X]Y'@]YVY'i bX'5i Za Yf_gUa _Y]h'nigW\Yb_Ybž'X]Y'g]Y'j YfX]YbYb"

8 Y hU]`q

6Ygi WXYb G]Y i bg Ui Z b!U["XY