

8 fYgXYb 'Ui Z'XYa 'F UX. 'Dcg]h]j Y Nk]gWXYbV]`Ubn i bX [YZÀ\fXYhY F UX`Yf°

8 fYgXYb'n]Y\h'dcg]h]j Y'Nk]gWXYbV]`Ubn'ni f FUXj Yf_Y\fgg]hi Uh]cb'&\$&) .'J YfVYggYfi b[']a ': U\ffUX_`]a U! HYgh'i bX'\c\Y'Bi hnYfni Zf]YXYb\Y]h"



8fYgXYbži8Yi hgWX`UbX`!`\diray\YfigWX\ObYb`GhUXh`8fYgXYb`n]Y\YbX]Y`FUXZU\fYfY]bY`Xi fWXkY[g`dcg]h]j Y`Nk]gWXYbV]`Ubn`ni fU_hi Y``Yb`FUXj Yf_Y\fgg]hi Uh]cb"`@Ui h`XYa `U_hi Y``Yb`6Yf]WXh`XYg`KcWXYb_i f]Yf`gWXbY]XYh`X]Y`gÀWXg]gWXY`@UbXYg\Ui dhghUXhVY]a `: U\ffUX_`]a U!HYgh`XYg`5``[YaY]bYb`8Yi hgWXYb`: U\ffUX!7`i Vg`fb8: 7Ł`YfZfYi`]WX`UV"`8]Y`GhUXh`YffY]WXhY`]a `FUb_]b[`jcb%)`; fc>ghÀXhYb`a]h`aY\f`U`g`)\$\$"\$\$\$`9]bkc\bYfb`XYb`gYWXghYbD`Uhnž'kcVY]`X]Y`; YgUahVYkYfhi b[`XYf`: U\ffUXg]hi Uh]cb`Ui ZY]bYf`G_U`U'jcb`%'V]g`*`VY]'' ž-'``]Y[h"`8Ua]h`\Uh`g]WX`8fYgXYb`Ui h`XYf`I aZfU[Yž`X]Y`nk]gWXYb`GYdhYaVYf`i bX`BcjYaVYf`&\$&(XifWX[YZØ\fh`kifXYž`]a`JYf[`Y]WX`ni`XYb`Jcf'U\fYb`XYih`]WXjYfVYggYfh"

 $\label{thm:convenience} Hfchn'X]YgYf'dcg]h]j Yb'9bhk]$W_ib['\UVYb'+, 'DfcnYbh'XYf' 6YZfU[hYb'XYbbcW\'XUg'; YZØ\`ž'Ui Z'8fYgXYbg'GhfU\'Yb'[YZ\A\fXYh'ni 'gY]b'''6YgcbXYfg'X]Y'U[[fYgg]j Y'; fi bXgh]a a i b[']a 'JYf_Y\f a UW\h'XYb'FUXZU\fYfb'ni 'gW\UZZYb.', &'DfcnYbh'Yf`YVYb'X]YgY'U`g VY`UghYbX'''Ni XYa 'VYf]W\hYb', '''DfcnYbh'XYf'HY]`bY\a Yfž'XUgg 5i hcg'g]Y'cZh'ni 'Yb['\ØVYf\c`Ybž'k\A\fYbX', +'DfcnYbh'fY[Y`a \A\'][?cbZ]_hY'a]h'5i hcZU\fYfb'Yf`YVYb'''\deltahYfYggUbhYfk Y]gY'[]Vh'Yg i bhYf'XYb'FUX`Yfb'gY`Vgh'bi f'gY`hYb'5i gY]bUbXYfgYhni b[Ybž'XU *('DfcnYbh'j cb'gY`hYbYb'?cbZ]_hYb'VYf]W\hYb''$

: U\ffUXj Yf`Y]\gmghYa `Ui Z`XYa `J cfa UfgW\

9]b @]W hV`]W_ ZØf F UXZU\fYf]b 8 fYgXYb]gh XUg 6]_Yg\Uf]b[!
GmghYa A C 6 → V]_Y Ž XUg X]Y GhUXh]b GUW gYb Ub X]Y Gd]hnY
Vf]b[h"A]h, + DfcnYbh Ub dcg]h]j Yf F ØW_a Y Xi b['\ U `hYb X]Y
Bi hnYf XUg J Yf Y]\gmghYa ZØf Y]b ZUW bi hnVUfž ni j Yf Agg][i b X
dfY]gk Yfh" 8]Yg gW Ahnh Ui W XYf 58: 7]b gY]b Ya A\ f`]W Yb
: U\ffUX_`]a U!HYghž XYf X]Y Ni Zf]YXYb\Y]h j cb F UXZU\fYb XYb]b
XYi hgW Yb GhAXhYb Yf ZfU[h" 8 Yf HYgh]gh a]hh Yfk Y] Y Y]b Y XYf
[fÒ» hYb I a ZfU[Yb ni f: U\ffUXZfYi b X`]W _Y]h k Y`hk Y]h i b X gc ``
XYb J Yf_Y\fgd `Ub Yfb k]W h][Y <]b k Y]gY ni f J Yf V YggYfi b[XYf

♣ Zf Ughfi _hi f [YVYb"

#bg[YgUa h'VYk YfhYb'X]Y'F UXZU\fYf.]bbYb'XUg'A]hY]bUbXYf']a
J Yf_Y\f'_f]h]gWX"'A]hY]bYf'6Yk Yfhi b['j cb'(ž\$) 'ZÀ``h'X]Y
9]bgWXÀhni b['XYg'J Yf_Y\fgj Yf\U`hYbg'Y\Yf'a Ui 'Ui g"'8]YgYg
H\Ya U']gh'VYgcbXYfg'k]WXh][ž'k Ybb'a Ub'VYXYb_hž'XUgg']a a Yf
a Y\f'GhAXhYž'X]Y'U_h]j 'XYb'F UXj Yf_Y\f'ZÒfXYfbž'Ui WX
YbhgdfYWXYbX'VYggYf'UVgWXbY]XYbž'k]Y'9f[YVb]ggY'XYg'58: 7
nY][Yb"'<]Yf'gWXbY]XYb'; fc*ghAXhY'k]Y': fUb_Zi fh'Ua 'A U]b'i bX
<Ubbcj Yf'\Yfj cffU[YbX'UVž'k A\fYbX'X]Y'6Yk Yfhi b[']b'6Yf`]b
Ui Z[fi bX'a Ub[Y`bXYb'9b[U[Ya Ybhg'[Ygi b_Yb']gh"</pre>

5 i gV`]W_ Ui Z'ni _ØbZh][Y'9bhk]W_`i b[Yb

 $9g'V'Y]Vh'UVnikUfhYbž'k]Y'g]WX'X]Y'FUXjYf_Y\fgg]hiUh]cb']b$ $8fYgXYb'kY]hYfYbhk]W_Y`b'k]fX"'8]Y'9f[YVb]ggY'XYg'58:7!$: U\ffUX_`]a U!HYghq'gd]Y`Yb'XUVY]'Y]bY'YbhgWXY]XYbXY'Fc``Yž'XU

g]Y`XYb`dc`]h]gWXYb`9bhgWXY]Xi b[ghfÀ[Yfb`i bX

JYf_Y\fgd`UbYf.]bbYb`\Y`ZYbž`X]Y`@YVYbgei U`]hÀh`ZØf`FUXZU\fYbXY

ni 'j YfVYggYfb"'9]b`ghÀf_YfYf': c_i g`Ui Z'XUg`A]hY]bUbXYf`]a

JYf_Y\f'_ObbhY`XUni 'VY]hfU[Ybž`X]Y`Gcf[Yb`XYf`FUX`Yf`ni
a]`XYfb`i bX`XUg`FUXZU\fYb`]b`XYf`GhUXh`bcWX`UhhfU_h]j Yf`ni
[YqhU`hYb"

8YhU]`g	
Cfh	8 fYgXYbž'8 Yi hgW\`UbX
EiY``Yb	• k k k "k c W Y b _ i f]Y f "] b Zc
	ZU\ffUX_`]a U!hYgh"UXZWXY
	• k k k "UXZWXY

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