

8]Y'BUa Ybg[YgWX]WXhY'j cb'C`XYbVi f[...9]b': Y\`Yf'cXYf'HfUX]h]cb3

8]Y 'GhUXh'C `XYbVi f['g]Y\h'g]W\ 'a]h'Y]bYf'< YfUi gZcfXYfi b[
_cbZfcbh]Yfhž'X]Y 'X]Y 'cZZ]n]Y ``Y 'GW\ fY]Vk Y]gY ']\fYg'B Ua Ybg'VYhf]ZZh"

±b 'XYf'8]g_i gg]cb 'XfY\h'g]W\ 'U``Yg'i a 'X]Y '_cffY_hY '6YnY]W\ bi b[
 C `XYbVi f['fC `XYbVi f[Ł ž'X]Y 'gY]hYbg'XYf'GhUXhj Yfk U`hi b[
 Ub[Ynk Y]ZY `h'k]fX"'CVk c\ `a Ub'g]W\ 'i a ZUb[fY]W\ 'a]h
 \]ghcf]gW\ Yb'8 c_i a YbhYb'Ui gY]bUbXYf[YgYhnh'\Uhž'V`Y]Vh'X]Y
[YbUi Y'< Yf_i bZh'X]YgYf'GW\ fY]Vk Y]gY'i b_`Uf"'8]Y'GhUXh'\Uh
ZYgh[YghY``hž'XUgg'VYfY]hg'j cf']\fYf'< Ui dhgUhni b['j cb'%- (* 'XYf
6Y[f]ZZ' C `XYbVi f['fC `XVŁ ']b'XYf'FY[]cb'j Yfk YbXYh'k i fXY"

8]Y'U_hi Y``Y'8YVUhhY'VYfØ\fh'b]W\h'bi f'VchUb]gW\Y'GW\k\ÀW\Yb']b
XYf'; YgYhn[YVi b[ž'gcbXYfb'k]fZh'Ui W\'Y]bYb'6`]W_'Ui Z'X]Y'h]YZYb
K i fnY'b'XYf'GhUXh']b'XYf'; YgW\]W\hY'B]YXYfgUW\gYbg'''K]Y
<]ghcf]_Yf'VYhcbYbž'_ObbhY'Yg'g]W\'\]YfVY]'i a 'Y]b'JYfgÀi a b]g
\UbXY`bž'XUg'k\A\fYbX'XYf'; YgYhn[YVi b[gdfcnYggY'XYf'%-+\$Yf
\\J\fY'VY]'XYb'; YV]YhgfYZcfa Yb'YbhghUbXYb']gh''8]YgY'FYZcfa Yb\\UVYb']b'j]Y`Yb'XYi hgW\Yb'Gh\XhYb'i bX'; Ya Y]bXYb'Y]bY
I a VYbYbbi b['cXYf'5bdUggi b['XYf'BUa Yb'bUW\'g]W\'[Ync[Ybži bX'C`XYbVi f['gW\Y]bh'\]Yf'_Y]bY'5i gbU\a Y'ni 'gY]b''

? Uf Yh Xi f W [YgYhn]W Y J cf[UVYb]

8 Ug'B]YXYfgÀWxg]gWxY'A]b]ghYf]ia 'ZØf' \DYfYg'i bX'Gdcfh'\Uh'Y]bY _`UfY'Dcg]h]cb']b'X]YgYf'5b[Y`Y[Yb\Y]h"'9g'j Yfhf]hh'X]Y'5i ZZUggi b[ž XUgg'XYf'cZZ]n]Y``Y'BUa Y'XYf'GhUXh' C`XYbVi f['fC`XYbVi f[k']ghž

VUg]YfYbX'Ui Z'XYa '?ca a i bU'j YfZUggi b[g[YgYhnž'XUg'Ua '%" Bcj Ya VYf'&\$\%']b'?fUZh'hfUh" \dagga X]YgYa '; YgYhn'k]fX'ZYgh[Y`Y[hž XUgg'\YXY'?ca a i bY'XYb'BUa Yb'Z\Ø\fYb'a i ggž'XYb'g]Y']a A ca Ybh'XYg'\dagga b_fUZhhfYhYbg'XYg'; YgYhnYg'\UhhYž'k Ug'X]Y':fU[YbUWX'XYb'Zf\Ø\YfYb'6YnY]WXbi b[Yb'Ui Zk]fZh"

 $6YfY]hg`]b`Zf\emptyset\backslash YfYb`; YgYhnYbž`k]Y`XYa `; YgYhn`\emptysetVYf`X]Y \\ C`XYbVi f[]gW\Y`@UbXgW\UZh`j cb`%- +(`i bX`XYa `5W\hYb`; YgYhn ni f`JYfk U`hi b[g!`i bX`; YV]YhgfYZcfa `j cb`%- ++ž`k i fXY`X]Y \\ [Y[Ybk Àfh][Y`GW\fY]Vk Y]gY`j Yfk YbXYh''`Gca]h`_\ObbhY`a Ub Uf[i a Ybh]YfYbž`XUgg`X]Y`[YgYhn`]W\Y`9fk \A\bi b[`Y]bY`cZZ]n]Y``Y 6Ygh\h][i b[`XYg`BUa Ybg`]gh''$

$8]Y \setminus ghcf]gWXY8]a Ybg]cb$

6Y] XYb F YW Y FW Y b XY f GhUXh k i f XYb a Y\ f Y f Y \]ghc f]gW Y 8c_i a YbhY Y bhXY W_hz X]Y X]Y GW f Y]V k Y]gY C XYb V i f['fC XV k VY Y [Yb "'Gc Z]b XYh g]W X]Y gY : cfa 'i bhY f Ub XY f Ya ']b Y]b Ya Cf][]b U Y f]Y Z_cd Z U i g XYa '\lambda \f \%- ' - z ']b 'Dfc hc_c ``Yb 'XY f :]b Ub n V Y]f AhY 'U i g XYa '\lambda \f \%- (% gck]Y ']b Y]b Ya '8 c_i a Ybh XY f A]`]h Aff Y []Y f i b ['j cb '%- () "'9g ']gh 'Y X c W 'b]W h a O[`]W '[Yk Yg Y b z XYb '[Yb U i Yb 'N Y]h d i b_h XY f '9]b Z \forall \f b ['XY f '5 V_Ø f n i b [b U W n i j c ``n]Y \ Y b z k Ug : f U [Yb 'n i f '\lambda Y b h h h i b X G Y `V ghk U \ f b Y \ a i b ['XY f 'GhUX h 'U i Z k] f Z h "

8]Y 'XYg\U'V'Ui Z[Yk cfZYbY': fU[Yž'cV' C`XYbVi f['fC`XVŁ'cXYf C`XYbVi f['fC`XVŁ'cXYf C`XYbVi f['fC`XYbVi f[Ł'X]Y'_cffY_hY'6YnY]W\bi b[']ghž'nY][hž k]Y 'Yb['j Yfk cVYb'; YgW\]W\hggW\fY]Vi b['i bX' \Rightarrow XYbh]hÀh'g]bX"' \Rightarrow bY]bYa 'ÒZZYbh`]W\Yb'8]g_i fg']gh'Yg'VYfY]hg'ni 'Y]bYf'J]Y`nU\`'j cb \Rightarrow bhYfdfYhUh]cbYb'[Y_ca a Ybž'X]Y'X]Y'9]bk c\bYf'i bX; YgW\]W\hgk]ggYbgW\UZh`Yf'[`Y]W\Yfa U \Rightarrow Yb'VYgW\ÀZh][Yb"

8 UgʻA]b]ghYf]i a ʻZUgghʻni gUa a YbžʻXUggʻYXYʻŸbXYfi b[ʻXYg B Ua Ybgʻk Y]hfY]WXYbXYʻ?cbgYei YbnYbʻZØfʻX]YʻGhUXhʻCʻXYbVi f[\UVYbʻ_ObbhYžʻk UgʻUi WXʻX]YʻVYfY]hgʻVYghY\YbXY GhUXhj Yfk Uʻhi b[ʻi bXʻX]Yʻ?ca a i b]_Uh]cbgghfUhY[]YbʻVYhf]ZZh'' <]Yf _ObbhYʻXYfʻ8 fi W_ʻUi ZʻX]YʻGhUXhj Yfk Uʻhi b[ʻghY][Ybžʻ]\fYʻ=XYbh]hAh _`Ufʻni ʻXYZ]b]YfYbži a ʻA]ggj YfghAbXb]ggYʻ]bʻXYfʻOZZYbh`]WXYb 9]b'_`Uf'i a f]ggYbYf'BUa Y'gWXY]bh'b]WXh'bi f'Y]bY': fU[Y'XYf
VØfc_fUh]gWXYb'; YbUi][_Y]h'ni 'gY]bž'gcbXYfb'gd]Y`h'Ui WX'Y]bY
Fc``Y']a 'Ni [Y'j cb'i fVUbYf'9bhk]W_`i b['i bX'fY[]cbU`Yb

XYbh]hÀhYb"'K Ybb'6Øf[Yf'i bX'<]ghcf]_Yf'g]WX'XUfUi Z'Y]b][Yb
_ÒbbYbž'k Y`WXY'GWXfY]Vk Y]gY'ni hfYZZYbX']ghž'k ÀfY'X]Yg'Y]b'GWXf]hh
]b'F]WXhi b['[fÒ»YfYf'?`Uf\Y]h'i bX'a Ò[`]WXYfk Y]gY'gc[Uf
<Ufa cb]Y']bbYf\U`V'XYf'GhUXh[Ya Y]bqWXUZh"

K]WX h][Y', VYf`Y[i b[Yb'ZØf'X]Y'ni $_$ ØbZh][Y =XYbh]hÀh

 $5b[Yg]WWhg`XYf`^{f}f]gh]gWWYb`ibX`^]ghcf]gWWYb`=ad`]_Uh]cbYb`]ghcYb[Yg]WWhg`XYf`^{f}f]gh]gWWYb`=ad`]_Uh]cbYb`]ghcYbYbYg`XYbVif[g`BUaYb`b]WWh'bifY]bY`:fU[Y`XYgGWWfY]VYbg`VYhf]ZZh"`J]Y`aY\f`gd]Y[Y`h`Yf`X]Y`=\XYbh]h\Ah`XYf`GhUXhk]XYf`ibX`^Uh`9]bZigg`UiZ`X]Y`KU\fbY\aib[\z̄'X]Y`6\Øf[Yf'jcb]^fYf`GhUXh`^UVYb"`9]b`ZYgh[Y`Y[hYfz̄'fYWWh`]WWYf`BUaY`_\ObbhYgWW`]Y\ni\Y]bYf`bYiYb`GY`VghXYZ]b]h]cb`XYf`GhUXh`VY]hfU[YbibX`XYb`KY[`Z\Øf`Y]bY`_cbg]ghYbhYfY`8UfghY``ib[`]b`XYf^2ZYbh`]WW_Y]h`YVbYb"$

8]Y'9bhk]W_`i b['XYf'GhUXh'C`XYbVi f['i bX]\fY'BUa Ybg[YVi b[Yb

 $B] WAhini `Yhnhi ZØ \ fhY `X] Y `hYff] hcf] U`Y `BYi cfXbi b[`i bX `FYZcfa Yb `] b XYf `BUWA_f] Y [gnY] hini `Y] bYf `k Y] hYfYb `? `Àfi b[`XYf UXa] b] ghfUh] j Yb `i bX `fYWAh`] WAYb `6YnY] WAbi b[Yb "'<math>\pm$ b `XYb '%- +\$Yf \\ \J\fYb `ZUb XYb `i a ZUggYb XY '; YV] Y hgfYZcfa Yb `] b `B] Y XYfgUWA gYb ghUhhž `X] Y `Ui WA `X] Y `Ghfi _hi f `i b X `B Ua Ybg[YVi b[`XYf '; Ya Y] b XYb VYhfUZYb "'<] Y fVY] `k i f XY `X] Y `B chk Yb X] [_Y] h` XYi h`] WA Ž'_` UfY `i b X Y] b \Y] h`] WAY 6YnY] WA bi b[Yb `ZØf `X] Y `? ca a i b Yb `ni `YhUV`] Y f Yb \\ k Ug `g] WA ``Yhnh`] WA `Ui WA `] b `XYb `fYWAh`] WAYb '; fi b X`U[Yb k] XYfgd] Y [Y`h"

FYWXhg`U[Y'i bX'X]Y'6YXYi hi b['XYf BUa YbgZØ\fi b[

8]Y'fYW\h`]W\Yb'; fi bX`U[Ybž'X]Y'X]Y'BUa YbgZØ\fi b['XYf'GhÀXhY i bX'; Ya Y]bXYb'VYhfYZZYbž'g]bX']a 'B]YXYfgÀW\g]gW\Yb ?ca a i bU`j YfZUggi b[g[YgYhn'j YfUb_Yfh"BUW\'z'%-'5VgUhn'%'GUhn %'B?ca J; ']gh'YXY'?ca a i bY'j YfdZ]W\hYhž']\fYb' V]g\Yf][Yb BUa Yb'Zcfhni ZØ\fYb"'8]Y'[YbUi Y'fYW\h`]W\Y'8YZ]b]h]cb'XYg V]g\Yf][Yb 'BUa Ybg'k]fX'XUVY]'U`g'YbhgW\Y]XYbX'YfUW\hYh"'\\$b X]YgYa '?cbhYl h`]gh'Yg'VYXYi hgUa ž'XUgg'C`XYbVi f['fC`XYbVi f[Ł]b'j YfgW\]YXYbYb'; YgYhnYb'n]h]Yfh'k]fXž'k Ug'X]Y'cZZ]n]Y``Y 5bYf_Ybbi b['X]YgYf'6YnY]W\bi b['i bhYfa Ui Yfh"

8]Y'fYW\h`]W\Yb'5i gk]f_i b[Yb'XYf'BUa YbgZØ\fi b['[Y\Yb
XUfØVYf'\]bUi g'i bX'_ObbYb'X]Y'\RYbh]h\Ah'i bX'XUg
GY`Vghj Yfgh\AbXb]g'XYf'6Øf[Yf]bbYb'i bX'6Øf[Yf'VYY]bZi ggYb"'\D
XYf'OZZYbh`]W\Yb'K U\fbY\a i b['gd]Y`h'X]Y'_cffY_hY
BUa YbgVYnY]W\bi b['Y]bY'nYbhfU`Y'Fc``Y'ZØf'X]Y'_i `hi fY``Y
\RYbh]h\Ah'XYf'GhUXh'i bX']\fYf'6Yk c\bYf"'8]Yg'k]fX'VYgcbXYfg
XYi h`]W\']b'XYf'gh\Axh]gW\Yb'^2 ZZYbh`]W_Y]hgUfVY]h\z'k c'X]Y': fU[Y
XYf'f]W\h][Yb'6YbYbbi b[']a a Yf'k]YXYf'Ui Z_ca a h'i bX'Ui W\']b
gcn]U`Yb'BYhnk Yf_Yb'i bX'8]g_i gg]cbgZcfYb'h\Ya Uh]g]Yfh'k]fX''

6YXYi hi b[ZØf X]Y 6Øf[Yf]bbYb i bX 6Øf[Yf

 $: \emptyset f X]Y GYj O`_Yfib['j cb'C `XYbVif[']gh'X]Y c ZZ]n]Y ``Y GWX fY]VkY]gY XYf GhUXh'b]WXh'bif'Y]b'fYWXh`]WXYg'8YhU]`ž'gcbXYfb'\Uh'UiWX$

dfu_h]gWkY:=a d`]_Uh]cbYb:ZØf:5``hU[gUb[Y`Y[Yb\Y]hYbž'k]Y
VY]gd]Y`gkY]gY:X]Y:Bi hni b['j cb:5XfYggYbž'X]Y:VY]a :Dcghj YfgUbX
i bX:VY]:VY\ÒfX`]WkYb:5b[Y`Y[Yb\Y]hYb'j cb:6YXYi hi b['g]bX"
9VYbgc:k]fX:]b:XYf:GhUXhYbhk]W_`i b['i bX:VY]:XYf'JYfa Uf_hi b[
XYf:GhUXh:U`g:GhUbXcfh:X]Y:BUa Ybg[YVi b['U`g
]XYbh]hÀhggh]ZhYbXYg:9`Ya Ybh'k U\f[Ybca a Yb"

Ni gàhn`]W\ 'gd]Y`h'X]Y`X][]hU`Y`DfàgYbn`XYf`GhUXh`Y]bY`Fc``Y"`Cb`]bY!
D`UhhZcfa Yb`i bX'gcn]U`Y`A YX]Yb`k Y]gYb`X]Y`GhUXh`cZh`i bhYf
j YfgW\]YXYbYb`GW\fY]Vk Y]gYb`Ui gž'k Ug`X]Y`J Yfk]ffi b[
\]bg]W\h`]W\ 'XYf`_cffY_hYb`B Ua YbgZØ\fi b['k Y]hYf'j Yfghàf_Yb
Ubb"'8]YgY`9bhk]W`i b[Yb`ZØ\fYb`ni 'Y]bYf'j Yfghàf_hYb
8]g_i gg]cb`ØVYf'X]Y`G]bb\UZh][_Y]h`XYf'U_hi Y``Yb`B Ua YbgZØ\fi b[
i bX`XUfØVYfž'cV`Y]bY`fYW\h`]W\Y`5bdUggi b['bOh][']ghž'i a '?`Uf\Y]h
i bX`9]b\Y]h`]W\ Y]h`ni 'qW\UZYb"

8 Y hU]`g

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