

8]Y'Gd]hna \emptyset \`Y']b'6i gY \underline{W} .'HfUX]h]cbY``Yg A U\`Yb'Z \emptyset f'X]Y'FY[]cb

8]Y'Gd]hna Ø\`Y']b'6i gYW_'a U\`h'gY]h'') \$'\\J\fYb'A\Y\``i bX j\Yfgcf[\h'D]nn\Yf]Yb'a\]h'\c\\k\Yfh][\Ya\\\Z'fY[\]cb\U`\Ya\';\\YhfY]\X\''

9]bY'VYgcbXYfY'HfUX]h]cb'XYg'A Ø``Yf\UbXk Yf_g'`YVh']b'XYf
_`Y]bYb'; Ya Y]bXY'6i gYW_ž'k c'X]Y'Gd]hna Ø\`Y'k Y]hYf\]b'A Y\``Ui g
fY[]cbU`Ya '; YhfY]XY'a U\`h"'G]Y']gh'Y]bY'XYf'`YhnhYb'A Ø\`Yb']b
<YggYbž'X]Y'bcW\'Ui Z'X]Y'hfUX]h]cbY``Y'5fh'?cfb'ni 'A Y\`
j YfUfVY]hYh"'5i » Yb'_Ubb'a Ub'XUg'A Ø\`fUX']b'gY]bYa '9`Ya Ybh
gY\Ybž'k À\fYbX'Xf]bbYb'GYVUgh]Ub'6U`gYf!?i hh'a]h'Y]bYa 'GUW_
K Y]nYb_ÒfbYfb'Ub'XYf'A Ø\`Y'VYgW\ÀZh][h']gh"'8]YgY'A Ø\`Y']gh'gY]h
ØVYf'') \$'\\J\fYb'Y]b'ZYghYf'6YghUbXhY]``XYf'FY[]cb"

; $Y[f\emptysetbXYh^{\circ}]gh^{\circ}X]Y^{\circ}; YgWX]WXhY^{\circ}XYf^{\circ}Gd]hna \emptyset^{\circ}Y^{\circ}VYfY]hg^{\circ}]a^{\circ}J\sqrt{f}$ %**) 'Xc_i a Ybh]Yfh"^8 Ug^{\overline}Yi h][Y^{\overline}Ui k Yf_^{\overline}ghUa a h^{\overline}i cf^{\overline}fbX '\$\$^{\overline}J\fYbz^{\overline}UUXXYa ^{\overline}XUg^{\overline}i fgdfØb[^{\overline}]WXY^{\overline}; YVAi XY^{\overline}JbYa ^{\overline}GfUbX ni a ^{\overline}ZgY^{\overline}S]YgY^{\overline}A \@\^{\overline}Y\Uh^{\overline}J\h^{\overline}JY^{\overline}NY]h^{\overline}VYfghUbXYbz gcbXYfb^{\overline}Ui WX^{\overline}X]Y^{\overline}YfUi gZcfXYfi b[Ybz^{\overline}X]Y^{\overline}NU\^{\overline}YJ\h^{\overline}Yb^{\overline}NY^{\overline}DhYb^{\overline}ni a GWX^{\overline}Yb^{\overline}Yhr\b^{\overline}Yb^{\overline}\UVYb"

8]Y < YfUi gZcfXYfi b[Yb XYg A Ø\ YbghYfVYbg

a '@Ui ZY'XYf'≯J\fY'g]bX'j]Y`Y'A Ø\`Yb']b'XYf'FY[]cb']b

J Yf[YggYb\Y]h'[YfUhYbž'cZh'Ui Z[fi bX'XYf'hYW\b]gW\Yb

9bhk]W_`i b[Ybž'X]Y'X]Y'K UggYfa Ø\`Yb'cVgc`Yh'a UW\hYb"

Ni gÀhn`]W\'\UVYb'ghfi _hi fY``Y'J YfÀbXYfi b[Ybž'k]Y'XYf'6Ui 'j cb

: Yfbk UggYf`Y]hi b[Ybž'XUni '[YZØ\fhž'XUgg'j]Y`Yb'A Ø\`Yb'X]Y

K UggYffYggci fW\b'Ybhnc[Yb'k i fXYb"'5i W\'X]Y'Gd]hna Ø\`Y'V`Y]Vh

j cb'X]YqYb'<YfUi qZcfXYfi b[Yb'b]W\h'j YfgW\cbhz'XU'XUg'K UgqYf

XYg'? fYVgVUW\g'ghUf_'j cb'XYf'B]YXYfgW\`U[ga Yb[Y'UV\Àb[h"' \delta hfcW_YbYb'\delta\fYb'`Y]XYh'X]Y'K UggYfj Yfgcf[i b['XYf'A Ø\ `Yž'k Ug GYVUgh]Ub'6U`gYf!? i hh']b'XYb'`YhnhYb'\d\fYb'VYa Yf_h'\Uh"'I a g]W\Yfni ghY``Ybž'XUgg'X]Y'A Ø\ `Y'Ui W\ k À\fYbX'K UggYf_bUdd\Y]h VYhf]YVYb'k YfXYb'_Ubbž'YbhgW\`cgg'a Ub'g]W\ž'9`Y_hfca chcfYb Y]bni ZØ\fYbž'k cVY]'XUg'A Ø\`fUX'k Y]hYf\]b'X]Y'bÒh][Y'9bYf[]Y YfnYi [h"

 $8 \ Yf: \ cfhV \ YghUb \ X \ XYf`A \ \emptyset \ `Y`]gh`Y]b \ YW \ hYg`? `Y]bc \ X \ XYf`fY[\]cb \ U`Yb?i \ `hi f`i b \ X`k i f \ XY`a \ U \ [\ YV`]W \ 'j cb `GY \ Ugh]Ub `6 U`gYf!?i hh`i b \ X \ gY]b \ Yf: fUi \ `[\ Yg]W \ Yfh" \ `G]Y \ `ØV \ Yfb \ U \ a \ Yb \ X]Y`A \ Ø \ `Y`]a \ `$J \ f` \ $\%(i b \ X`]bj \ Ygh]YfhYb \ _cbh]bi \]Yf`]W \ `]b`] \ fY \ `9fbYi \ Yfi \ b[\ 'i b \ X \ FYbcj]Yfi \ b[\ '' \ 8]Y`A \ Ø \ `Y`k]fX`GhØW_ \ ZØf`GhØW_ \ gUb]Yfh \ Z`Yf_`Afh \ 6 U`gYf!?i \ hh`ghc`n"$

$E i U^h h h i b X B U W V h [Y] h a c c j g$

8]Y'Gd]hna Ø\`Y'j YfUfVY]hYh'WU"'%ž) 'HcbbYb'A Y\``dfc'HU['i bX j Yfk YbXYh'XUVY]'[fÒ» hYbhY]`g'Y][YbYg'; YhfY]XY"'Fi bX'+\$'DfcnYbh XYg'j YfUfVY]hYhYb'; YhfY]XYg'ghUa a h'Ui g'Y][YbYa '5bVUi "'8Yf FYgh'k]fX'j cb'@UbXk]fhYb'Ui g'XYf'I a [YVi b['ni [Y_Ui Zh"'+b'XYb G]`cg'Ub'XYf'A Ø\`Y'\UVYb'V]g'ni '') \$'HcbbYb'D`Uhnž'[Ybi [ži a XYb'*J\fYgVYXUfZ'ni 'XYW_Yb"'<c\Y'HmdYbnU\`Yb'XYg'A Y\`g [UfUbh]YfYb'Y]bY'[fc» Y'A Yb[Y'A]bYfU`ghc\ZZY"' \X'\O\Yf'X]Y HmdYbnU\`ž'XYghc'[YgØbXYf'XUg'A Y\` ž'Yf_`Àfh'6U`gYf!?i hhž'XYf K Yfh'Ui Z'E i U`]hÀh'`Y[h"

9]b VYgcbXYfYg A Yf_a U`XYf Gd]hna Ø\`Y]gh XYf A U\`j cf[Ub[" <]Yf k]fX]b Y]bYa a Y\fghi Z][Yb DfcnYgg [YUfVY]hYh Ni bÀW\gh k]fX XUg \Y`Y A Y\`[Ya U\`Yb i bX UV[Yg]YVh" 8 Yf j YfV Y]VYbXY HY]`k]fX ni fØW_]b X]Y A Ø\`Y [Y[YVYbži a 'Y]bY \Ò\YfY E i U`]hÀh ni 'Yfn]Y`Yb" 8]YgY @]YVY ni a '8 YhU]`gcf[hXUZØfž XUgg]a a Yf a Y\f D]nnUVÀW_Yf i bX 6ÀW_Yf]b XYf F Y[]cb 'Ui Z XUg A Y\`XYf Gd]hna Ø\`Y ni fØW_[fY]ZYb" K À\fYbX XYf DUbXYa]Y k Uf X]Y B UW\ZfU[Y gc [fc » ž XUgg X]Y A Ø\`Y fY[Y YYW\h'ØVYffUbbhk i fXY"

6YgcbXYfg'[YgW\Ahnh'k]fX'XUg'A Ø\`Yba Y\`'j cb'fY[]cbU`YbD]nnYf]Yb'i bX'6A\W_Yfbž'X]Y'q]W\'Ui Z'X]Y

I bhYfgWXY]Xi b[ga Yf_a U`Y`XYg`BUhi fdfcXi _hg`j Yf`UggYb"`5i WX]a '9]bnY`\UbXY`ž'k]Y`Gi dYfa Àf_hYb`]b`6i gYW_'i bX`XYf
I a [YVi b[ž'Z]bXYb`J YfVfUi WXYf`X]YgVYnØ[`]WX`]a a Yf`a Y\f
5b[YVchY"'6U`gYf!?i hh`\YVh`\Yfj cfž'XUgg`X]Y`_`Y]bghY
DUW_i b[gY]b\Y]h`&ž) '?]`c[fUa a `VYhfÀ[hži a `XYb`5VZØ``Ui Zk UbX
ni `fYWXhZYfh][Yb"'8Ug`A Y\``a i gg`XUfØVYf`\]bUi g`f]WXh][`[Y`U[Yfh k YfXYbži a `X]Y`E i U`]hÀh`ni `Yf\U`hYb"

 $: \emptyset f `GYVUgh]Ub `6U`gYf!?i ~hh`]gh`Yg`Y]bY`< YfnYbgUb[Y`Y[Yb\Y]hž`XUg \\ 9fVY`XYf`A \emptyset\`Y`k Y]hYfni ZØ\fYb"` 5a ``]YVghYb`YggY`]W\`Y]b`[i hYg \\ Fc[[YbVfch`cXYf`Y]bY`D]nnU`j cb`XYb`D]nnYf]Ybž`X]Y`]W\`VY`]YZYfY ž gU[h`Yf`i bX`j YffÀh`XUVY]`Y]b`_`Y]bYg`; Y\Y]a b]g`gY]bYf dYfgÒb`]W\Yb`J cf`]YVY"$

=bbcj Uh]cb i bX HfUX]h]cb j YfY]bh

#D'Y]bYf'NY]hž']b'XYf'j]Y'Y'a Ø\'YbVYhf]YVYbYb'HfUX]h]cbYb
j Yf`cfYb'[Y\Ybž'nY][h'X]Y'Gd]hna Ø\'Yž'XUgg'a]h'#bbcj Uh]cb'i bX
XYf'@]YVY'ni f'HfUX]h]cb'Xi fW\Ui g'Y]bY'Ni _i bZh'a Ò[`]W\']gh''8]Y
9f\U`hi b[ga U» bU\a Yb'i bX'X]Y'a cXYfbY'5i gf]W\hi b['XYg
6Yhf]YVg'ghY``Yb'g]W\Yfž'XUgg'X]Y'A Ø\'Y'b]W\h'bi f'Y]b'FY`]_h
j Yf[Ub[YbYf'NY]hYb'V`Y]Vhž'gcbXYfb'Ui W\'U`g'U_h]j Yf'HY]``XYf
a cXYfbYb'@YVYbgk Y]gY'VYhfUW\h'k YfXYb'_Ubb''

8]YFc``YXYfK UggYfa Ø\`Yb']b'XYfFY[]cb

 $\label{eq:continuous_continuou$

Ni XYa 'g]bX'K UggYfa Ø\`Yb'Y]b'Gma Vc`'ZØf'bUW\\U`h][Y

9bYf[]Y[Yk]bbib["G]Y'bihnYb'X]Y'bUhØf`]W\Y'?fUZh'XYg'K UggYfgžia 'a YW\Ub]gW\Y'9bYf[]Y'ni 'YfnYi [YbžX]Y'a Y]ghYb'a cXYfbYb6Yhf]YVY'j Yf`UggYb'g]W\'YXcW\'Ui Z'Zcgg]`Y'6fYbbghcZZY'cXYf9`Y_hf]n]hÀh'Ui g'XYa 'BYhn"'8Yf'HfYbX'ni f'BUW\\U`h][_Y]h'\Uh'XUg\bhYfYggY'Ub'hfUX]h]cbY``Yb'A Ø\`Yb'bYi 'VY`YVhž'i bX'Y]b][Y6YhfY]VYfž'k]Y'GYVUgh]Ub'6U`gYf!?i hhž'_ca V]b]YfYb'U`hVYk À\fhYHYW\b]_Yb'a]h'a cXYfbYb'HYW\bc`c[]Ybž'i a 'XYb'6Yhf]YVYZZ]n]YbhYf'i bX'i a kY`hZfYi bX`]W\Yf'ni '[YghU`hYb"

5_hi Y``Y 6YXYi hi b['j cb FY[]cbU`dfcXi _hYb

± XYb `YhnhYb '≯J\fYb `\Uh'g]W\ 'Y]b 'k UW\gYb XYg '6Yk i gghgY]b 'ZØf fY[]cbU`Y 'i b X 'b UW\\U`h]['dfc Xi n]YfhY '@Y VYbga]hhY` `Ybhk]W_Y`h" J YfVfUi W\Yf'`Y[Yb 'ni b Y\a Yb X 'K Yfh'Ui Z'X]Y '< Yf_i b Zh']\fYf B U\fi b[ga]hhY` ž'k Ug'ni 'Y]b Ya '5bgh]Y['XYf'B UW\ZfU[Y'b UW\'`c_U`dfc Xi n]YfhYb 'Dfc Xi _hYb'[YZØ\fh'\Uh"'8]Y 'Gd]hna Ø\`Y'dfc Z]h]Yfh j cb 'X]YgYa 'HfYb Xž'XU'j]Y`Y']\fYf'?i b XYb ž'XUfi bhYf``c_U`Y 6ÀW_YfY]Yb'i b X'D]nnYf]Yb ž'Ui Z'XUg'A Y\``Ui g'XYf'F Y[]cb 'gYhnYb"

8 UfØVYf`\]bUi g`V]YhYh`XUg`A Y\``Ui g`XYf`Gd]hna Ø\`Y`b]W\h`bi f`c_U`Y`E i U`]hÀhž`gcbXYfb`Ui W\`Y]bY`[Yk]ggY`9I_`i g]j]hÀh"`8]Y
J Yfk YbXi b['j cb`fY[]cbU`Yb`Fc\ghcZZYb`i bX`X]Y`hfUX]h]cbY``Y
J YfUfVY]hi b[ghYW\b]_`n]Y\Yb`J YfVfUi W\Yf`Ubž`X]Y`Ui Z`XYf`Gi W\Y
bUW\`Ui h\Ybh]gW\Ybž`i bj YfZÀ`gW\hYb`@YVYbga]hhY`b`g]bX"`8]Yg`\Uh
XUni `[YZØ\fhž`XUgg`X]Y`A Ø\`Y`b]W\h`bi f`A Y\``dfcXi n]Yfhž`gcbXYfb
Ui W\`Y]b`HY]``XYf`fY[]cbU`Yb'; Ya Y]bgW\UZh`[Yk cfXYb`]ghž`]bXYa
g]Y`g]W\`U_h]j``Ub``c_U`Yb`A Àf_hYb`i bX`J YfUbghU`hi b[Yb`VYhY]`][h"

8 Ug 9fVY XYf A Ø\ Ybk]fhqWX UZh

8]Y'A Ø\`Ybk]fhgW\UZh'\Uh']b'8Yi hgW\`UbX'Y]bY'`Ub[Y'; YgW\]W\hYžX]Y'V]g']bg'A]hhY`U`hYf'ni fØW_fY]W\h''A Ø\`Yb'k UfYb'b]W\h'bi f'CfhYXYf'DfcXi_h]cbž'gcbXYfb'Ui W\'gcn]U`Y'HfYZZdi b_hY'ZØf'X]Y8cfZ[YaY]bgW\UZh"8]Y': À\][_Y]hž'gY`Vgh'AY\``ni 'aU\`Ybž'k Uf'Y]bYbhgW\Y]XYbXYf': U_hcf'ZØf'X]Y'GY`Vghj Yfgcf[ib['XYf6Yj O`_Yfib["'A]h'XYf'NY]h'ibX'XYb'JYfAbXYfib[Yb']b'XYf@UbXk]fhgW\UZh'ibX'XYf'\DX'XYf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'Yf'\DX'YYb'Y'YXcW\[YgW\fiadZhž'gcXUgg'j]Y`Y'A Ø\`Yb'UiZ[Y[YVYb'kifXYb'

8]Y'Gd]hna Ø\`Y']gh'Y]b'6Y]gd]Y``ZØf'X]Y'9f\U`hi b['X]YgYg'9fVYg"

K À\fYbX'UbXYfY'A Ø\`Yb'[YgW\`cggYb'k i fXYbž'\UVYb'X]Y

6YhfY]VYf']b'6i gYW_'Ub'XYf'HfUX]h]cb'ZYgh[Y\U`hYb'i bX

[`Y]W\nY]h]['bYi Y'K Y[Y'[YZ bXYbž'i a 'X]Y'A Ø\`Y'k]fhgW\UZh`]W\
hfU[ZÀ\]['ni 'a UW\Yb"8]Y'FØW_gW\Øhha Ø\`YbhYW\bc`c[]Y'i bX'X]Y

Ni gUa a YbUfVY]h'a]h'`c_U`Yb'@UbXk]fhYb'g]bX'HY]`']\fYf

GhfUhY[]Yž'X]Y'HfUX]h]cb'XYf'A Ø\`Ybk]fhgW\UZh']b'XYf'FY[]cb

Ui ZfYW\hni Yf\U`hYb"

8 Y hU1`c

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