

8 Ya c_fUh]YV]`Xi b[']a ': c_i g. 'A]b]ghYf]b C`gWkck g_]'X]g_i h]Yfh'Ni _i bZhgZfU[Yb°

5a ("'* b]'&\$&) 'X]g_i h]YfhYb'K]ggYbgWXUZhga]b]ghYf]b C`gWXck g_]'i bX'Ghi X]YfYbXY'Ub'XYf'D<'; a ØbX'ØVYf ni _i bZhgZÀ\][Y'@Y\f_fÀZhYV]`Xi b["



Ni 'XYb'nYbhfU`Yb'H\Ya Yb'XYg'GcZUhU`_g'nÀ\`hYb'X]Y 8Ya c_fUh]YV]`Xi b[ž'X]Y'6YXYi hi b['XYf'_Øbgh`]W\Yb'≢bhY``][Ybn']b XYf'@Y\fYfV]`Xi b['gck]Y'FYZcfa]XYYb'ni f'JYfnU\bi b['j cb H\Ycf]Y'i bX'DfUl]g']a '@Y\fUa hgghi X]i a "'6YgcbXYfg'X]Y Ghi X]YfYbXYb'Ài » YfhYb']\fY'5b`]Y[Yb'ni f'5fa i hg[YZÀ\fXi b['i bX gdfUW\Yb'XYb'K i bgW\'bUW\'ZYl]V`YfYb'FYZYfYbXUf]Uhgk YW\gY`b Ub"'A]b]ghYf]b'C`gW\ck g_]'VYhcbhY'X]Y'6YXYi hi b['XYg'X]fY_hYb 5i ghUi gW\g'a]h'XYb'Ghi X]YfYbXYb'i bX'XYfYb'U_h]j Y'HY]`bU\a Y Ub'XYf'j YfZUgghYb'Ghi X]YfYbXYbgW\UZh"

$8]YFc^YXYfDAXU[c]gWXYb^< cWXgWXi^Yb$

A]b]ghYf]b 'C `gWk ck g_]'\cV'X]Y 'GhÀf_Yb 'XYg'@Y\fUa hgghi X]i a g']b 6UXYb!K ØfhhYa VYf[ž']bgVYgcbXYfY'X]Y 'DfUI]gd\UgYb'i bX'X]Y : UWk X]XU_h]_ž'\Yfj cf"'G]Y 'ghY``hY'_`Ufž'XUgg'X]Y 'DÀXU[c[]gWk Yb < cWk gWki 'Yb'k]Wk h][Y '5bgdfYWk dUfhbYf'ZØf'6]'Xi b[gdc`]h]_'i bX \rightleftharpoons di 'g[YVYf'ZØf'OZZYbh']Wk Y '8 YVUhhYb'g]bX"'Dfc ZYggcf'GWk ObY d`ÀX]YfhY'ZØf'X]Y 'GhÀf_i b['XYf'8 Ya c_fUh]YV]'Xi b['gck c\`']b GWki 'Yb''U'g'Ui Wk' < cWk gWki 'Yb"'8]Yg']gh'b]Wk h'bi f'Y]b V]'Xi b[gdc`]h]gWk Yg'5b']Y[Ybž'gcbXYfb'Ui Wk'Y]bY'FYU_h]cb'Ui Z [YgY``gWk UZh`]Wk Y'J YfÀbXYfi b[gdfcnYggYž'X]Y'X]Y 8 Ya c_fUh]YV]'Xi b['j cf'k UWk gYbXY' < YfUi gZcfXYfi b[Yb'ghY``Yb"

8 UgʻNYbhfi a 'ZØf'@Y\fYfV]'Xi b['XYf'I b]j Yfg]hÀh'Hf]Yf'\Uh'g]W\
XYa 'H\Ya U'8Ya c_fUh]YV]'Xi b['YVYbZU``gʻ]bhYbg]j '[Yk]Xa Yh"
@Ui h'Y]bYf'U_hi Y``Yb'8 UfghY``i b['k YfXYb'=a d`]_Uh]cbYb'XYg
X][]hU`Yb'K UbXY`g'Ui Z'X]Y'8Ya c_fUh]YV]'Xi b['VYfØW_g]W\h][hž'k Ug
]b'5bVYhfUW\h'XYf'ni bY\a YbXYb'JYfVfY]hi b['j cb': U_Y'BYk g'i bX
Ubh]XYa c_fUh]gW\Yb'GhfÒa i b[Yb'j cb'YbhgW\Y]XYbXYf'6YXYi hi b[
]gh"8 Ug'? cbnYdh'@Y\fUa h' 8 'gc```X]Y'8Ya c_fUh]YV]'Xi b['U`g
nYbhfU`Yb'6]'Xi b[gUi ZhfU['Ub'GW\i `Yb'i bX'<cW\gW\i `Yb
j YfUb_Yfb'i bX'ZØf'6]'Xi b[gdfcnYggY'bi hnVUf'a UW\Yb"'8 UVY]'k]fX
Ui Z'j YfgW\]YXYbY'? UhY[cf]Yb'k]Y'7]j]W9Xi WUh]cb'i bX'X]Y
DUfh]n]dUh]cb'j cb'GW\Ø`Yf.]bbYb'Y]b[Y[Ub[Ybži a 'Y]bY
XYa c_fUh]qW\Y'GW\i `_i `hi f'ni 'ZÒfXYfb"

<]ghcf]gWXY'DYfgdY_h]j Y'Ui Z
8Ya c_fUh]YdÀXU[c[]_</pre>

 $8]Y : 8]g_i gg]cb : \emptyset VY f : 8 Ya c_fUh]Y V] `Xi b[`` Uh :] ` fY `K i fnY `b :] b : XY b % + $Y f : $U f Y b :a]h :Y]b Ya : 8]g_i fg :ni f :dc `]h]gW XY b Gcn]U`]gUh]cbgZi b_h]cb : XY f :GW i `Y ":Ni : Y b Y f :NY]h : k i fXY b :A Àb [Y`]a :GW i `gmghYa ž :k]Y :X]Y : ZY \ `Y b XY : 7 \ Ub W :b [Y f Y W h][_Y]h :i b X D f c V `Ya Y :a]h : XYa : X f Y][`]Y X f][Y b :GW i `gmghYa ž : XY i h :] W :" K]`` m 6 f Ub X h : df À [hY : XY b :6 Y [f]ZZ : a Y \ f :8 Ya c_fUh]Y : i b X :ghY `` hY : X]Y GW i `Y : U`g :nY b h f U`Y : \dangle gh]hi h]cb :ni f :G]W : Y f i b [: XYa c_fUh]gW : Y f J Y f \ À`hb]ggY :] b : XY b :J c f X Y f [fi b X ":8]Y g Y :\]ghc f]gW : Y :DY f g d Y _h]j Y]gh: ZØf :X]Y :\ Y i h][Y b :6]`Xi b [gX]g_i f g Y :j c b :6 Y X Y i hi b [:i b X :n Y] [h ž X Ugg :X]Y : 5 b g d f Ø W Y : Ub :X]Y :GW i `Y b ž :a Ø b X][Y :6 Ø f [Y f .] b b Y b Ui gni V]`XY b ž b]W : h b Y i :q]b X "$

8 Ybbc W. 'V`Y]Vh'X]Y'I a gYhni b['j cb'8 Ya c_fUh]YV]`Xi b['c Zh'Y]bY < YfUi gZcfXYfi b["'8 Yf'6 Yi hY`gVUW.Yf'? cbgYbg'VY]gd]Y`gk Y]gY n]Y`hY'XUfUi Z'UVž'XUgg'dc`]h]gW.Y' , VYfk À`h][i b[']b'XYf'GW.i `Y j Yfa]YXYb'k YfXYb'a i ggž'k Ug'c Zh'ni 'VØfc_fUh]gW.Yb'@YYf`Ui Z ZØ\fhY"'8]Y'9bhk]W_`i b[Yb']b'XYf'dc`]h]gW.Yb'6]`Xi b['i bX'X]Y _f]h]gW.Yb'8]g_i fgY'nY][Ybž'XUgg'X]Y'GW.UZI b['XYa c_fUh]gW.Yf Ghfi _hi fYb']b'GW.i `Yb'U_h]j Yg'9b[U[Ya Ybh'i bX'_`UfY'GhfUhY[]Yb YfZcfXYfh"

#bg[YgUa hij YfXYi hi]Wk hiXYfiGc ZUhU`_'Ub 'XYfiDAXU[c[]gWk Yb
<cwk.gWki 'Y'GWkk AV]gWki; a ØbXžiXUgg 'XYfi8]U`c[ink]gWk Yb
Dc`]h]_ž'<cWk gWki 'Ybii bX'Ghi X]YfYbXYbij cbi[fc» YfiK]Wkh][_Y]h
]ghži a 'U_hi Y``Y'<YfUi gZcfXYfi b[Yb'YfZc`[fY]Wkini 'VYk A`h][Yb
i bX'X]Y'8Ya c_fUh]YV]`Xi b[']b'XYfi@Y\fYfV]`Xi b['j cfUbni hfY]VYb"
8YfiK i bgWkibUWkif YZcfa Ybii bX'X]Y'5i gY]bUbXYfgYhni b['a]h
Y]bYa 'g]Wkik UbXY`bXYb'6]`Xi b[ggmghYa 'g]bX'nYbhfU`Y'5gdY_hYž
X]Y']b'XYb'_ca a YbXYb'\$J\fYb'k Y]hYf\]b'Y]bYb'\c\Yb'GhY``Ybk Yfh
Y]bbY\aYb'k YfXYb"</pre>

: Øf'k Y]hYfZØ\fYbXY' ⇒ Zcfa Uh]cbYb'ni f'8Ya c_fUh]YV]`Xi b[']a @Y\fUa h'g]bX'X]Y' < ca YdU[Y'XYg'NYbhfi a g'ZØf'@Y\fYfV]`Xi b[gck]Y'XUg'8Yi hgWXY'GWXi `dcfhU`'Ya dZY\`YbgkYfh"

8]Y'<cW\gW\i`Y'GW\kÀV]gW\; a ØbX']bZcfa]Yfh'fY[Y`a À»]['ØVYfU_hi Y``Y'H\Ya Yb'i bX'JYfUbghU`hi b[Ybž'k cXi fW\'=bhYfYgg]YfhYghYhg'Ui Z'XYa '@Ui ZYbXYb'V`Y]VYb'_ÒbbYb"'<]Yfni 'g]bX'X]Y

DZcfa Uh]cbYb'Ui Z'XYf'K YVgY]hY'XYf'DÀXU[c[]gWXYb < c WX gWX i `Y'ni 'Z]bXYb" </pre>

8 Y hU]`g	
Cfh	GWXkÀV]gWX; a ØbXž8Yi hgWX`UbX
EiY``Yb	• k k k "d\![a i YbX"XY
	k k k "i b]!hf]Yf"XY
	XYi hgWX Yg!gWXi `dcfhU`"XY

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