

## GWk YfYf: fcbhU`ni gUa a Ybghc» 'VY] 9VYfX]b[Yb. 'Nk Y]'J Yf`YhnhY'bUWk 'I bZU``

6Y]'Y]bYa ': fcbhu`Wfug\']b'9VYfX]b[Yb'kifXYb'Y]b'A UbbibX'Y]bY': fUi'gWkYf'j Yf`Yhnh"'8]Y'I bZU``i fgUWkY']gh'bcWkib\_`Uf"

8]Y'Dc`]nY]'@i Xk][gVi f['VYghÀh][hY'X]Y'GWkkYfY'XYg'I bZU``g'i bX]bZcfa]YfhY'XUfØVYfž'XUgg'X]Y'VY]XYb'j Yf`YhnhYb'DYfgcbYb']bjYfgWk]YXYbY'i a`]Y[YbXY'?fUb\_Yb\Ài gYf'hfUbgdcfh]Yfh'k i fXYbžkc'g]Y'bi b'VY\UbXY`h'k YfXYb"'8Yf'I bZU```YfY][bYhY'g]Wk'`Ui hYfghYb'9fa]hh`i b[Yb'[Y[Yb'%+.()'I\f"8]Y'[YbUi YbIbZU``i fgUWkYb'g]bX'bcWk'; Y[YbghUbX'\_f]a]bU`dc`]nY]`]WkYfIbhYfgi Wki b[Yb"

#### FYhhi b[ga U»bU\a Yb i bX 9fghY <] ZY

8 Yf'B chfi Z'[]b['i ba]hhY`VUf'bUW\'XYa'I bZU```VY]'XYf'Dc`]nY]'Y]bžibX'i a [Y\YbX'k i fXYb'i a ZUb[fY]W\Y'FYhhi b[ga U» bU\a YbY]b[Y`Y]hYh": Yi Yfk Y\f\_fÀZhY'i bX'FYhhi b[gX]YbghY'a]hFYhhi b[g\i VgW\fUi VYf'k UfYb'gW\bY```j cf'Cfhž'i a 'XYb'JYf`YhnhYbni '\Y`ZYb"'8 Ug'6]`X'Ua'I bZU``cfh'k Uf'XfUa Uh]gW\' 'VY]XY': U\fYf

8 Yf'; YgUa hgWk UXYbž'XYf'Ui g'X]YgYa 'Zc`[ YbgWk k YfYb'I bZU``fYgi `h]YfhYž'k ]fX'Ui Z'W]fWU') \$"\$\$\$'9i fc'[ YgWk Àhnh"'6Y]XY VYhY]`][ hYb': U\fnYi [ Y'k i fXYb'gWk k Yf'VYgWk ÀX][ h'i bX'a i gghYb j cb'5VgWk `YddX]YbghYb'UVhfUbgdcfh]Yfh'k YfXYb"'8]Y GhfU» Ybj Yf\À`hb]ggY'k UfYb'ni a 'NY]hdi b\_h'XYg'I bZU``g'ZØf'X]Y 9]bgUhn\_fÀZhY'Y]b'ni gÀhn`]Wk Yg'DfcV`Ya ž'XU'g]Y'g]Wk YfghY``Yb a i gghYbž'XUgg'Ui Wk'bUWk Zc`[ YbXY'J Yf\_Y\fghY]`bY\a Yf'b]Wk h']b X]Y'G]hi Uh]cb'j Yfk ]W\_Y`h'k i fXYb"

### Dc`]nY]`]W\Y 9fa ]hh`i b[Yb ni f I bZU``i fgUW\Y

 $8 ]Y `9fa ]hh`Yf`XYf`Dc`]nY]``\UVYb`X]Y`I bZU``ghY``Y`i bk Y]h`j cb \\ 9VYfX]b[Ybž']a `@UbX_fY]g`@ Xk ][gVi f[ž'[Yg]W\Yfhži a `X]Y [YbUi Yb`<]bhYf[fØbXY`ni '_`ÀfYb"`8]Y`: fU[Yž'k Ufi a `Yg`ni `XYf ?c``]g]cb`_Ua ž'ghY\h`bi b`]a `: c_i g`XYf`I bhYfgi W\i b[Yb"`A <math>O[`]W$ Y : U\_hcfYb`\_ObbhYb`UV[Y`Yb\_hYg`: U\fYbž'ØVYfa A\*][Y ; YgW\k]bX][\_Y]h`cXYf`gc[Uf`hYW\b]gW\Y`8YZY\_hY`Ub`Y]bYa `XYf : U\fnYi [Y`gY]b"`6]g`Ub[`[]Vh`Yg`\_Y]bY`[YbUi Yb`<]bk Y]gY`Ui Z`X]Y XYZ]b]h]j Y`I fgUW\Yž'k Ug`X]Y`9fa ]hh`i b[Yb`ZØf`X]Y`Dc`]nY] VYgcbXYfg`\YfUi gZcfXYfbX`a UW\h"

Jcf'Cfh'k UfYb'Ui W. ZØbZ'GhfY]ZYbk U[Yb'XYg'Dc`]nY]dfÀg]X]i a g @ Xk ][gVi f[']a '9]bgUhnži a 'X]Y'G]hi Uh]cb'ni 'ØVYfk UW.Yb'i bX ni gÀhn`]W.Y'I bhYfghØhni b['ni 'V]YhYb"'9]b'k ]W.h][Yf'5gdY\_h'ZØf'X]YG]W.Yf\Y]h'`]Y[h'XUf]bž'XUgg'gc`W.Y'I bZÀ``Y'cZh'XfUgh]gW.Y': c`[YbZØf'X]Y'A YbgW.Yb'\UVYbž'X]Y'XUfUb'VYhY]`][h'g]bXž'i bX'Ui W. 'ZØf X]Y'; Ya Y]bgW.UZhž']b'XYf'g]Y'`YVYb"'8]Y'5bk c\bYf']b'XYf I a [YVi b['nY][Yb'g]W. 'VYgcf[hi bX'\cZZYb'Ui Z'Y]bY'gW.bY``Y; YbYgi b['XYf'JYf`YhnhYb"

 $\label{eq:continuous} $JYf_Y\backslash fgg]W\&Yf\backslash Y]h'ibX'X]Y'6YXYihib['XYf'5iZ_`Afib['jcblbZU``ifgUW\&Yb'fØW_Yb'XifW\&'gc`W\&Y'JcfZA``Y']aaYf'aY\fjb'XYb:c_ig'XYf'^2ZZYbh`]W\&_Y]h''* $\fixXYf'JYf_Y\backslash fgibZU```k]fZh'X]Y':fU[Y'UiZ^z$ 

k ]Y 'X]Y 'GhfU» Yb 'g]W YfYf'[ Ya UW h'k YfXYb'\_ObbYb'i bX 'k ]Y : U\fYf'XUni 'Yfa i h][ h'k YfXYb'\_ObbYbž'dfÀj Ybh]j 'ni '\UbXY`bž'i a I bZÀ``Y 'ni 'j Yfa Y]XYb" 8]Y '\_ca a YbXYb'HU[ Y'k YfXYb'nY][ Ybž k Y`W Y'k Y]hYfYb' \ddot Zcfa Uh]cbYb'X]Y'dc`]nY]`]W Yb'9fa ]hh`i b[ Yb Ubq'@]W h'Vf]b[ Yb"

#### 

8 Yf 'hfu[ ]gWX Y 'J cfZU```VY] '9VYfX]b[ Yb 'Yf]bbYfh'i bg'U``Y 'Ub 'X]Y Zfu[ ]`Yb'I a ghÀbXYž'i bhYf'XYbYb'k ]f']a 'GhfU» Ybj Yf\_Y\f'u[ ]YfYb" G]WX Yf\Y]h'gc``hY']a a Yf'Ub'YfghYf'GhY``Y'ghY\Yb"'K À\fYbX'k ]f XUfUi Z'k UfhYbž'XUgg'X]Y'I fgUWXY'X]YgYg'I bZU``g'[ Y\_`Àfh'k ]fXž'fi Zh Yf'i bg']bg'6Yk i gghgY]bž'k ]Y'k ]WXh][ 'Yg']ghž'ghYhg'UWXhgUa 'ni ZU\fYb'i bX'X]Y'J YfUbhk cfhi b[ ']a 'GhfU» Ybj Yf\_Y\f'Yfbgh'ni bY\a Yb"

→bYf\U`V`XYf``YhnhYb`\*J\fY`[]Vh`Yg`]b`8Yi hgW\`UbX`]a a Yf`k]YXYf
6Yf]W\hY`ØVYf`X]Y`ghY][YbXY`5bnU\``gW\kYfYf`JYf\_Y\fgi bZ\``Yž
]bgVYgcbXYfY`Ui Z`@UbXghfU» Yb"`8]YgY`GhfU» Yb`g]bX`\Ài Z][
k Yb][Yf`[Yg]W\Yfh`U`g`5i hcVU\bYbž`k Ug`XUg`F]g]\_c`j cb
: fcbhU`ni gUa a YbghÒ» Yb`i bX`UbXYfYb`gW\kYfYb`I bZ\``Yb`Yf\Ò\h"
BUW\`5b[UVYb`XYg`GhUh]gh]gW\Yb`6i bXYgUa hYg`k Uf`]a `\*J\f
&\$&&`X]Y`NU\``XYf`JYf\_Y\fghchYb`]a `JYf[`Y]W\`ni a `Jcf'U\f`i a
%ž) `DfcnYbh`[Ygh]Y[Yb"`8]YgY`U`Ufa ]YfYbXYb`GhUh]gh]\_Yb
j YfXYi h`]W\Yb`X]Y`Bchk YbX][\_Y]hž
JYf\_Y\fgg]W\Yf\Y]hga U» bU\aYb`ni 'j YfVYggYfb`i bX`X]Y
6Yk i gghgY]bgV]`Xi b[`i bhYf`XYb`: U\fYfb`ni 'ZÒfXYfb"

K Y]hYf\]b gd]Y`h XUg J Yf\U`hYb XYf 5i hc ZU\fYf Y]bY
YbhgW\Y]XYbXY F c``Y VY] XYf I b ZU``j Yf\Øhi b[ "FY[ Y`a À»][ Y
GW\i `i b[ Yb i b X 5i Z\_`Àfi b[ ga U» b U\a Yb ini `H\Ya Yb k ]Y
5V`Yb\_i b[ `]a `GhfU» Ybj Yf\_Y\f\u00e4
; YgW\k ]bX][ \_Y]hgØVYfgW\fY]hi b[ Yb i b X XUg : U\fYb i b hYf
9]bZi gg j cb 5`\_c\c``\_ÒbbhYb XUni `VY]hfU[ Yb\u00e4X]Y`NU\``XYf
J Yf\_Y\fgi bZ\u00e4``Y`ni `fYXi n]YfYb"`Dc`]nY] i bX
J Yf\_Y\fgg]W\Yf\Y]hgcf[ Ub]gUh]cbYb gYhnYb j YfgW\]YXYbY
?Ua dU[ bYb Y]b\u00e4i a `XUg 6Yk i gghgY]b `Z\u00f4fg]W\YfYg : U\fYb ini
gW\\u00e4fZYb"

# $9]bV^]W_^]b^X]Y^JYf_Y^fgg]WXYf^Y]h^]b$ 8Yi hgWX^UbX

± XYb ``YhnhYb '\*J\fYb `\Uh'X]Y 'XYi hgWXY FY[]Yfi b[ 'a Y\fYfY ± h]h]Uh]j Yb `[ YghUfhYhži a 'X]Y 'J Yf\_Y\fgg]WXYf\Y]h'ni 'j YfVYggYfb" < ]Yfni '[ Y\ÒfYb 'A U» bU\a Yb 'k ]Y 'X]Y 'J YfVYggYfi b[ 'XYf GhfU» Yb]b ZfUghfi \_hi fž'X]Y '9]b ZØ\fi b[ 'j cb ; YgWX k ]bX][ \_Y]hg\_cbhfc``Yb i bX 'X]Y 'j YfghÀf\_hY', VYfk UWXi b[ j cb 'J Yf\_Y\fggØbXYfb"'5i WX 'X]Y '9]b ZØ\fi b[ 'j cb 'a cXYfbghYf HYWX bc`c[]Y ']b': U\fnYi [ Ybž'k ]Y 'n"6" '5bh]!6`c W\_]Yf!GmghYa Yb f56GŁ'i bX': U\fYfUgg]ghYbngmghYa Ybž'\Uh'XUni 'VY][ YhfU[ Ybž'X]Y G]WXYf\Y]h'ni 'Yf\Ò\Yb"

±b 'Y]bYf'U\_hi Y``Yb'I a ZfU[Y'XYg'5857'[UVYb'\*\$'DfcnYbh'XYf6YZfU[hYb'Ubž'XUgg'g]Y'g]W\'Ui Z'@UbXghfU» Yb'i bg]W\Yf'ZØ\`Yb"8]YgYf'5gdY\_h']gh'VYgcbXYfg'VYgcf[b]gYffY[YbXž'XU'@UbXghfU» YbcZh'j cb': U\fYfb'ZfYei Ybh]Yfh'k YfXYbž'X]Y'Ui Z'XYf'Gi W\Y'bUW\gW\bY``YfYb'JYfV]bXi b[Yb'g]bX"'8Ug'; YZØ\`'j cb'I bg]W\Yf\Y]h\_Ubb'XUni 'ZØ\fYbž'XUgg': U\fYf'f]g\_UbhYfY'A UbÒj Yf'j Yfgi W\Ybž k Ug'X]Y'K U\fqW\Y]b`]W\\_Y]h'j cb'I bZÀ``Yb'k Y]hYf'Yf\Ò\h"

8 YhU]`q

6 Y gi W Y b 'G ] Y 'i b g 'U i Z 'b ! U [ "X Y