

# %\$ 'ZU`gW\ 'Ui g[ YgdfcW\ YbY '@AbXYfbUa Yb

Jcb?]f]VUh]V]g?]f[]g]ghUb`]ghYb`k]fX]Y`Ua `\ài Z][ghYb
ZU`gWX`Ui g[YgdfcWXYbYb`@\abXYfbUa Yb`Ui Z'5`g`8cbU`X
Hfi a d`BUa]V]U`&\$%+`ZU`gWX`U`g` BUa V]U`Ui ggdfUW\\\^z
ki fXY`Yf`ni a '; Y[YbghUbX`kY]h'j YfVfY]hYhYb`Gdchhg"
\(\sifbU`)]ghYb`ZfU[hYb`g]WX\\^zcV`Yf`GUa V]U`cXYf`; Ua V]U
a Y]bhY\\^zk\a\fYbX`GcW]U`!A YX]U!Bi hnYf`A Ya Yg`j YfgdchhYhYb
i bX`Y]b`i bhYfbY\a i b[g`i gh][Yf`<cWkh\\^bYfX]Y`; Y`Y[Yb\Y]h
bi hnhY\\^zi a 'Y]bYb`bYi Yb`H]hY``Z\\^f`@cbY`m`D`UbYh
j cfni ghY``Yb''K]f`VY]\\^5h`Ug'\ Ua d\Ua d\\^6cchg`\UhhYb`A]h`Y]X
a ]h`Hfi a d\\^kY]\``k]f`]b`i bgYfYf`NY]h`U`g`FY]gYbXY`Y]b`cXYf
nk Y]`@\abXYf`ZU`gWX`Ui g[YgdfcWXYb`\UVYb''\\\\\^b`i bgYfYa
bYi YghYb`J]XYc`gdf]WXh`DYhYf`X]Y`; Ug\\YfVfi a `FUb[Y`ZU`gWX
U`g`; Ug\\YfVfck b`Ui g\\\^cVk c\``Yf`g]WX`XYggYb`[YbUi
\\Yki ggh`]gh'\\ Ua d\\\Y``]d\\

5`g`8cbU`X`Hfiad`BUa]V]U`&\$%+`ZU`gW\`U`g`BUaV]U`UiggdfUW\žkifXY`Yf`nia; Y[YbghUbX`kY]hijYfVfY]hYhYb`Gdchhg"∵≲ifbU`]ghYbZfU[hYb`g]W\ž`cV`Yf`GUaV]U`cXYf; UaV]U`aY]bhYž`kÀ\fYbX`GcW]U`!AYX]U!BihnYf`AYaYg`jYfgdchhYhYb`ibX`Y]bibhYfbY\aib[g`igh][Yf'<cW\hÒbYf`X]Y`;Y`Y[Yb\Y]h`bihnhYž`iaY]bYb`bYiYb`H]hY``ZØf`@cbY`m`D`UbYh'jcfnighY``Yb"

K ]f'VY]'5h`Ug'/ '6cchg'\UhhYb'A ]h`Y]X'a ]h'Hfi a dž'k Y]`'k ]f']b i bgYfYf'NY]h'U`g'FY]gYbXY'Y]b'cXYf'nk Y]'@ÀbXYf'ZU`gW\Ui g[YgdfcW\Yb'\UVYb"

# i bgYfYa 'bYi YghYb'J]XYc'gdf]W\h'DYhYf'X]Y'; Ug\YfVfi a 'FUb[YZU`gW\'U`g'; Ug\YfVfck b'Ui gž'cVk c\`'Yf'g]W\'XYggYb'[YbUi

VYk i gghi]ghiflyfij YfVf]b[ hi[ Ybi [ 'NY]hiXUa ]hžini '`YgYbii bXij cb 6Yf[ Ybini 'hfÀi a Ybži[ `Ui VYbiG]Yia ]fŁ" 8]Ygij YfUb`UgghYii bgž Y]b][ YiXYfiUa '\Ài Z][ ghYbiZU`gWXiUi g[ Ygdfc WXYbYbi@ÀbXYfbUa Ybni ii bhYfgi WXYbiii bhYbiUi Z[ YZØ\fhžii a 'G]YiXUj cbiUVni \U`hYbž Y]bYbi: Ui I dUgini 'VY[ Y\YbžiZU``giG]Yik ]YiHfi a dia ]hiXYa DfÀg]XYbhYbiXYgi@UbXYgini 'A ]hhU[ 'YggYb"

### %"'? ]f]VUh]

'U`h1 ?]f]VUh]']gh'Y]bYf'XYf'Ua '\Ài Z][ ghYb 'ZU`gWX
Ui g[ Ygdfc WX YbYb '@ÀbXYfbUa Yb 2 HfUi a nY]h'?]f]VUh]']gh'Y]bYf
XYf'Ua '\Ài Z][ ghYb 'ZU`gWX 'Ui g[ Ygdfc WX YbYb '@ÀbXYfbUa Yb

5`g`k]f`]a `FU\a Yb`i bgYfYf`K Y`hfY]gY`ØVYf`XYb`GØXdUn]Z]\_ Ui ZVfUW\Ybžj Yfgi W\hYb`k]fžY]bYb`K Y[ `bUW\`?]f]VUh]`ni `Z]bXYb" @Y]XYf`k Uf`Yg``c[]gh]gW\`Y]bZUW\`ni `gW\k]Yf][ `i bX`gc`\UVYb`k]f`Yg Ui Z`Y]bYb`gdÀhYfYb`NY]hdi b\_h`j YfgW\cVYb"`GY]bY`UV[Y`Y[YbY @U[Y`Yf\_`Àfh`j]Y``Y]W\hž`k Ufi a `?]f]VUh]`Y]bYg`XYf`Ua `k Yb][ghYb VYgi W\hYb`@\bXYf`XYf`K Y`h`]gh`fi bX`k Ufi a `b]Ya UbX`k Y]» ž`k]Y a Ub`gY]bYb`BUa Yb`gU[hŁ"

8 Ugʻ@UbX`VYghY\h'Ui gʻ'ʻʻ=bgY`bʻi bX`\Uh'Y]bYʻ; YgUa hZÀWXYʻj cb, \$\$`\_a &žYfghfYW\_h'g]WX`UVYfʻØVYfʻ'ž) 'A]``]cbYbʻ\_a &`CnYUb"`8]Yg VYXYi hYhž`XUggʻ?]f]VUh]`XUgʻY]bn][Y`@UbX`XYf`KY`h']ghž`XUgʻ]bʻU``Yj]Yfʻ<Ya]gd\ÀfYbʻZÀ``hžXYbʻŸei UhcfʻØVYfgdUbbhii bX`g]WX`]b`X]Y Ògh`]WXY`i bX`kYgh`]WXY`<Ya]qd\ÀfY`YfghfYW\_h''

#### &" '? UhUf

:  $U^gWX$ .  $W'h!hUUfF]WXh][. WhhU'fl]b_Ł$ 

 $\label{eq:continuity} $$ U'h = K \left[ \frac{g}{g} \right] + \frac{1}{2} \left[ \frac{g}{g} \right] + \frac{1$ 

&\$%+`hfUZYb`DYhYf'ibX`]WX`UiZ'ibgYfYf`FY]gY`bUWX`8gWX]Vih]

fUi g[YgdfcWXYb']Vcch]ŁY]bYb'Ua Yf]\_Ub]gWXYb'5\_UXYa ]\_Yf"'9f YfnÀ\`hY'i bg'j cb'gY]bYf'NY]h'VY]' 7i hhYf 'i bX'Yg'XUi YfhY'Y]bYb A ca Ybhž'V]g'i bg'\_`Uf'k i fXYž'XUgg'Yf'? UhUf'a Y]bhY"'K ]f'bU\a Yb Ubž'XUgg'Yf'XYb'BUa Yb'ZU`gWX'Ui g[YgdfcWXYb'\UhhY"

K ]f'k i fXYb'XUbb'ni fYW\h[Yk]YgYbž'U`g'k]f'j cf'\_i fnYa \YfUi gZUbXYbž'XUgg'b]W\h'Yfž'gcbXYfb'k]f'?UhUf'ZU`gW\ Ui g[YgdfcW\Yb'\UhhYb"'8]Y'nkY]hY'G]`VY']gh'`Y]W\h'j Yf`Àb[Yfhž UVYf'b]W\h'gc'ghUf\_ž'k]Y'k]f'XUW\hYbž'kUg'XYb'BUaYb'Y\Yf W'hhYf'U`g' W'h!H55F 'a UW\h'

# ' "'@Ygch\c

 $: U^*gWX.^*Y^!gc^!hc^F]WXh][.^*Y^!gcc!hcc^ff]b_Ł$ 

'U`h1 8 Y f'\_i fj Y b f Y ] W\ Y 'G U b ] 'D U g g '] b '@ Y g c h\ c . 'Z U`g W\
Ui g [ Y g d f c W\ Y b Y '@ \and b X Y f b U a Y b 2 @ \_ U g '6 ] g W\ c Z Z # G\ i h h Y f g h c W\_
8 Y f'\_i fj Y b f Y ] W\ Y 'G U b ] 'D U g g '] b '@ Y g c h\ c

⇒W. 'k Uf'Ui W. 'ØVYffUgW. h'ni 'YfZU\fYbž'XUgg'@Ygch\c'XUg'\ÒW. ghY@UbX'XYf'K Y`h']gh'']f[YbXk]Y"'9g'\Uh'XYb'\ÒW. ghYb'h]YZghYbDib\_h'U``Yf'UbXYfYb'@ÀbXYf. '%"(\$\$`a'f(")-'':i» Łž'XU\Yf'XYfGd]hnbUaY'?Òb][fY]W. 'XYg'<]aa Y`g''

# ( " '? ]f[ ]ghUb '

 $: U `g W . ~\_ Y f! ~] g! h U b F ] W h ] [~~ \_ Y f! [~] g! h U b ~ f i ] b \_ Ł$ 

 $\begin{tabular}{ll} $ ``U`h1 ? ]f[ ]ghUb`k ]fX`Ui W. `X]Y`GW.k Y]n`NYbhfU`Ug]Ybg \\ [ YbUbbh 2 @][ \h ]Y`X`Ghi X]cg\#G\i hhYfghcW_`? ]f[ ]ghUb`k ]fX`Ui W. X]Y`GW.k Y]n`NYbhfU`Ug]Ybg`[ YbUbbh \\ \end{tabular}$ 

?]f[]g]ghUb`]gh'Y]bYg'j cb`bi f`nk Y]`@ÀbXYfbž'X]Y`]a `8 i fWkgWkb]hh ØVYf'&"\$\$\$`a `ff\*") \*%'ZhŁ``]Y[Ybž'XUg`UbXYfY`]gh'@Ygch\c"`8]Y
[YV]f[][Y`H]Ub!G\Ub!FY[]cb`VYXYW\_h`, \$`i `XYg`@UbXYgž'k Ug`]\f
XYb`6Y]bUa Yb` GWkkY]n`NYbhfU`Uq]Ybg `Y]bVfUWkhY"

? ]f[ ]g]ghUb `]gh'Y]b `6]bbYbghUUh'flY]bYf'j cb `( ) `]b `XYf'K Y`h½ž dfcZ]h]Yfh'UVYf'j ca `=ggm\_!?i `ž'XYa `nk Y]h[ fÒ» hYb '< cW [ YV]f[ ggYY XYf'K Y`h'fl\]bhYf'XYa `H]h]WUWU!GYY`]b `GØXUa Yf]\_UŁ"

## ) "'B][Yf

:  $U^*gWX.^bmY![U\F]WXh][.^bYY!n\Yf^*fl]b_E$ 

'U`h1 ZU`gW\'Ui g[YgdfcW\YbY'@\AbXYfbUa Yb.'B][Yf'\Uh'gY]bYb BUa Yb'j ca ': `i gg'B][Yf 2 7 UhUm#G\i hhYfghcW'B][Yf'\Uh'gY]bYb BUa Yb'j ca ': `i gg'B][Yf

B][Yf']gh'k]Y'?]f[]ghUb'Y]b'6]bbYbghUUh"8Ug'@UbX'\Uh'gY]bYbBUaYb'jca': `i gg'B][Yfž'XYf'Xi fW\'XYb'gØXk Ygh`]W\Yb'HY]`'gY]bYgHYff]hcf]i a g'Z]Y»h"8Yf'BUaY'B][Yf'\_ca a h'j cb'XYa'5i gXfi W\_[\Yf'b![\YfYbž'k Ug']b'XYf'HUaUg\Y\_!GdfUW\Y': `i gg'i bhYf: `ØggYb' VYXYi hYh"

B][Yf'k]fX'jcb'XYf'IBC'U`g'Y]bYg'XYf'Ua'kYb][ghYb'Ybhk]W\_Y`hYb@ÀbXYf'XYf'KY`h'Y]b[YghiZh"'9g']gh'XUg'j]YfhÀfaghY'@UbX'XYf'KY`h"NiXYa'g]bX'; fibXfYWkhgZfU[Yb'k]Y'X]Y'Yfgh'&\$\$'jYfVchYbYG\_`UjYfY]Y']b'8UiYfdfcV`Ya"

### \* " ? c`i a V]Yb

 $: U^gWX. Wc`!i \ a \ !V]UF]WXh][..Wc`!ca \ !V]U'fl]b\_E$ 

'U`h1 ?c`i a V]Yb']gh'Y]bYf'XYf'Ua '\Ài Z][ghYb'ZU`gWX Ui q[YgdfcWXYbYb'@ÀbXYfbUa Yb 2 A Uf\_'D]hh#G\i hhYfghcW\_ ?c`i a V]Yb`]gh'Y]bYf'XYf'Ua `\Ài Z][ ghYb`ZU`gW\`Ui g[ YgdfcW\YbYb @ÀbXYfbUa Yb

?c`i a V]Yb']gh'X]Y'Y]bn][Y'Ua Yf]\_Ub]gW\Y'BUh]cbž'X]Y'bUW\
7\f]ghcd\'?c`i a Vi gž'XYa ' 9bhXYW\_Yf 'XYf'BYi Yb'K Y'hž'VYbUbbh
]gh"'9g']gh'Y]b'@UbX'j cb'VYa Yf\_Ybgk YfhYf'J]Y`ZU'h']b'6Yni ['Ui Z
: `cfU'i bX': Ui bU'i bX'k ]fX'U`g'Y]bYg'j cb'bi f'%+' a Y[UX]j YfgYb
@\AbXYfb'Y]b[Yghi Zh"'HUhg\AW\`]W\']gh'Yg'bUW\'6fUg]\`]Ybž'XUg
nY\ba U`'gc'[fc\"]ghž'XUg'@UbX'a ]h'XYf'nk Y]h[f\O\"h'b'5fhYbj]Y`ZU'h
XYf'K Y'h"

### +"'@Ucg

 $: U^gWA.^Uck cXYf^Uck eggF]WAh][.^@Uig^fPb_ž^IG!5iggdfUWAYk]$ 

'U`h1 ZU`gW\`Ui g[YgdfcW\YbY`@\bXYfbUa Yb.`@Ucg`\Uh'Y]bY`FY]\Y j cb`ZU`gW\Yb`5i ggdfUW\Yb 2 BUh\Udcb Hf]fUhUbUW\Uh#G\i hhYfghcW\_`@Ucg`]gh`Y]bYf`XYf`k Yb][Yb j YfV`]YVYbYb`\_ca a i b]gh]gW\Yb`GhUUhYb`XYf`K Y`h

8 Ugʻ6]bbYb`UbXʻ@Ucgʻ]ghʻbYVYbʻ7\]bUžʻ?i VUʻi bXʻJ]YhbUaʻY]bYf XYfʻk Yb][Ybʻj YfV`]YVYbYbʻ\_ca a i b]gh]gW\YbʻGhUUhYbʻXYfʻK Y`h"

8]Y @UbXk]fhgWkUZhi]ghiX]Y < Ui dhghØhnY XYfiK]fhgWkUZhiXYg
@UbXYgžiUVYfiX]Y '9I dUbg]cbik i fXY 'Xi fWkiX]Y 'f]Yg][ YbiA Yb[ Ybb]WkhiYI d`cX]YfhYfi6ca VYbi[ YVfYa ghžiX]Y 'XUgi5W\_YfiUbX
j Yfi bfY]b][ Ybiii\Ui dhgÀWk`]Wkij ca iI G!A]`]hÀfik À\fYbXiXYg
J]YhbUa\_f]Y[ giUV[ Yk cfZYb" '8 U\Yfik i fXYibi fiY]bi\_`Y]bYfiHY]`iXYf
`UbXk]fhgWkUZh`]WkYbiBi hnZÀWkYiXYgi@UbXYgi\_i `h]j ]Yfh"

# , "'@]YWX hYbghY]b

 $: U`gWX. ``]WX!hYb!gh]bYF]WXh][. ``]W\_!hYb!gh]bY`ft]b\_Ł$ 

"U`h1 @]YW\hYbghY]b`k]fX`a]h`Y]bYa`\UfhYb`W Uig[YgdfcW\Yb2Gh]Zcg#G\ihhYfghcW\_`@]YW\hYbghY]b`k]fX`a]h Y]bYa`\UfhYb`W`Uig[YgdfcW\Yb @|YW\hYbghY]b']gh'Y]b'k]bn][Yf'XcddY`hYf'6]bbYbghUUhž'XYf
nk]gW\Yb'XYf'GW\kY]n'i bX'2 ghYffY]W\'`]Y[hž'X]Y'VY]XY'gY`Vgh
6]bbYbghUUhYb'g]bX"'@|YW\hYbghY]b'[]`h'U`g'Y]bYg'XYf'g]W\YfghYb
@\AbXYf'XYf'K\Y`h\'8]Y';\YZ\Ab[b]gdcdi\Uh]cb'`]Y[h'XYfnY]h'VY]
]bg[YgUa\h'\&\fbV\kc\``X]Y\Yb][Ybž'X]Y'`\Ab[Yf'U`g'nk\Y]'\\J\\fY
j\YfVØ\Ybž'X]Yg']b'2 ghYffY]W\'cXYf'XYf'GW\k\Y]n'h'\b\!"

## - "Gh"?]hhg i b X B Y j ] g

: U`gWX. bYj!]ggF]W\h][. bYY!j]gg^ff]b\_Ł

"U`h1 ZU`gW\`Ui g[YgdfcW\YbY`@AbXYfbUa Yb. BYj]g`DYU\_'Ui Z'XYf

DgY`BYj]g 2 GYUb DUj cbY#G\i hhYfghcW\_BYj]g'DYU\_'Ui Z'XYf'DgY`BYj]g'fUi g[YgdfcW\Yb'bYY!j]ggŁ

8]Y'\_Uf]V]gW\Yb'\DgY\b'Gh"'?]hhg'i bX'BYj ]g'k i fXYb'%-, ' 'j cb; fc»Vf]hUbb]Yb'i bUV\\Ab[]["'9g'[UV'Y]b][Y'I bni Zf]YXYb\Y]hž'UVYfY]b'FYZYfYbXi a 'j cb'%--, ']b'BYj ]g'\_cbbhY'b]W\h'X]YNk Y]Xf]hhY\a Y\f\Y]h'g]W\Yfbž'X]Y'ZØf'Y]bY'5VgdU\hi b['YfZcfXYf\]W\k Ufž'i bX'gc'V\]YVYb'X]Y'\DgY\b'ni gUa a Yb"

#### %\$"'BYdU`

 $: U^gWX.^bY\setminus [dUU^F]WXh][.^b]!dUi^f]b\_k$ 

'U`h1 8Yf'; ]dZY``XYg`A ci bh'9j YfYgh'j ca '6Ug]g`U[ Yf'Ui g [ YgY\Yb 25h`Ug'/ '6cchg'8Yf'; ]dZY``XYg`A ci bh'9j YfYgh'j ca

#### 6Ug]g`U[Yf'Ui g'[YgY\Yb

BYdU``[fYbnh'Ub'7\]bU'i bX'\\X]Yb'i bX'VY\YfVYf[h'UW\h'XYf\\OW\ghYb'6Yf[Y'XYf'K Y\hz'XUfi bhYf'XYb'A ci bh'9j YfYgh'fk Ug\Yf\_`ÀfYb'\_ObbhYz'k Ufi a 'Yg'cZZ]n]Y```DYhYfg'@]YV`]b[g`UbX']ghz'''9f\VYgi W\hY'5bZUb['X]YgYg'\J\fYg'i bX'k Uf'j cb'XYf'<]a U`UmU!\@UbXgW\UZh'j YfnUi VYfh''

@Y]XYf'V`Y]Vh'BYdU``hfchn'gY]bYf'9]bbU\a Yb'Ui g'XYa 'Hci f]ga i g Y]bYg'XYf'Àfa ghYb'@ÀbXYf'5g]Ybg" = a '5df]``&\$%) '\_Ua Yb'VY] Y]bYa 'j Yf\YYfYbXYb'9fXVYVYb'HUi gYbXY'A YbgW\Yb'i a g'@YVYb i bX'nYfghÒfhYb'nU\`fY]W\Y'\]ghcf]gW\Y'GhÀhhYb'i bX'8 ÒfZYf" A ]``]UfXYb'j cb'8c``Uf'k i fXYb'j YfgdfcW\Ybž'UVYf'dc`]h]gW\Y A UW\h\_Àa dZY'\UVYb'Y]bYb'; fc\*hY]``XYg'K ]YXYfUi ZVUi g j YfnÒ[Yfh"

< Ui dhV]`X.'GUbh]D\chcGG#G\i hhYfghcW\_

8 Y H I 1 `c

6Ygi WXYb G]Y i bg Ui Z Y]bY!fY]gY "XY