

7ci fgY^{*}Cj Yfj]Yk

GHJZZ:7cbHJWh:8YHJ]`g

7cbj Ybcfg

BUa Y	9a U]`	5j U]`UV]`] m	@cWUh]cb	D\cbY
A]WkUY``GhYj Ybg	h\Yg]g"V]ca YXYb[4 i bgk "YXi " <u>Ui</u>	6m5ddc]bha Ybh		
H]Ubfi c ; i c	M'[ic4ibgk"YXi"Ui			
A UHNYK '6fcX]Y	<u>U"a "VfcX]Y4 i bgk "YXi "Ui</u>			

GWXcc``7cbhUWhʻ±bZcfa Uh]cb

Ghi XYbhGYfj]WYg WUb VY WcbhUWYX j]U <u>i bgk "hc#k YV7cfa g</u>"

7ci fgY 8YHJ] g

I b]hg cZ7 fYX]h'(

Gi a a UfmcZh\Y 7ci fgY

H\Y'h\Yg]g'dfcj]XYg'Ub'cddcfhi b]miZcf'mci 'hc'Vf]b['hc[Yh\Yf'Yb[]bYYf]b['df]bW]d'Yg'YUfbYX'cj Yf mci f'dfYj]ci g'mYUfg'cZghi XmUbX'Udd'mh\YgY'df]bW]d'Yg'hc']bbcj Uhji Y'mgc'j Y'dfcV'Ya g'gi W\'Ug'h\Y XYj Y'cda YbhcZU'gdYW]ZJWXYg][bž'dfcWYgg'UbX#cf'h\Y']bj Ygh][Uhjcb'cZU'\mdch\Yg]g''H\Yg]g'dfc YWg'UfY Wca d'Yl ž'cdYb!YbXYX'dfcV'Ya g'h\UhU`ck 'fcca 'Zcf'mci f'WfYUhji]mž'UbX'h\Y'UWei]g]hjcbž'UbU'mg]g'UbX]bhYfdfYhUhjcb'cZfYgi 'hg''H\YfY'UfY'a i 'hjd'Y'dcgg]V'Y'gc'i hjcbg'cf'WcbWi g]cbg'Uhh\Y'ci hgYhUbX'gi ZZJW]Ybh Wca d'Yl]mhc'fYei]fY'U'XY[fYY'cZdfc YWhd'Ubb]b["'H\Y'h\Yg]g'fYei]fYg'mci 'hc'Zcfa i 'UhY'dfcV'Ya g']b gW]Ybh]ZJWcf'Yb[]bYYf]b['hYfa gž'a UbU[Y'Ub'hYW\b]WU''dfc YWhUbX'Z]bX'gc'i hjcbg'VmUdd'm]b['gW]Ybh]ZJWUbX Yb[]bYYf]b['a Yh\cXg''Mci 'k]`''U'gc'XYj Y'cd'mci f'UV]`]mhc'k cf_']b'U'fYgYUfW\'UbX'XYj Y'cda Ybh Ybj]fcba Ybh''Mci 'a i gh]XYbh]ZmU'gi dYfj]gcf'UbX'dfc'YWhdf]cf'hc Ybfc'`]b[']b'h\]g'Wci fgY"

7 ci fgY 5]a g

H\Y'h\Yg]g'dfcj]XYg'Ub'cddcfhi b]hmZcf'h\Y'ghi XYbhhc'Vf]b['hc[Yh\Yf'Yb[]bYYf]b['df]bWjd'Yg'YUfbYX'cj Yf h\Y]f'dfYj]ci g'mYUfg'cZghi XmUbX'Udd`mh\YgY'df]bWjd`Yg'hc']bbcj Uhji Y`mgc'j Y'dfcV'Ya g'gi W\'Ug'h\Y XYj Y`cda YbhcZU'gdYWjZJWXYg][bž'dfcW\'gg'UbX#cf'h\Y']bj Ygh][Uhjcb'cZU'\mdch\Yg]g''H\Yg]g'dfc'YWg'a i gh VY'Wca d'YI ž'cdYb!YbXYX'dfcV'Ya g'l\UhU\'ck 'fcca 'Zcf'ghi XYbhWYUhji]hmž'UbX'h\Y'UWei]g]hjcbž'UbU'mg]g UbX']bhYfdfYhUhjcb'cZfYgi 'hg''H\YfY'a i ghVY'a i 'hjd'Y'dcgg]V'Y'gc'i hjcbg'cf'WcbWi g]cbg'Uhh\Y'ci hgYhUbX gi ZJW]YbhWca d'YI]hmhc'fYei]fY'U'XY[fYY'cZdfc'YWid'Ubb]b['Zfca 'h\Y'ghi XYbh''H\Y'h\Yg]g'fYei]fYg'h\Y ghi XYbhhc 'Zcfa i 'UhY'dfcV'Ya g']b'Yb[]bYYf]b['hYfa gž'a UbU[Y'Ub'Yb[]bYYf]b['dfc'YWiUbX'Z]bX'gc'i hjcbg'Vm Udd`mjb['Yb[]bYYf]b['a Yh\cXg''Ghi XYbhg'U`gc'XYj Y`cd'h\Y]f'UV]`]hmhc'k cf_']b'U'fYgYUfW\'UbX'XYj Y`cda Ybh Ybj]fcba Ybh'

7 ci fgY @YUfb]b['Ci hWca Yg

- %" 8 Yj Y`cd`U`XYg][b`cf`U`dfcWrgg`cf`]bj Ygh][UhY`U`\mdch\Yg]g`Zc``ck]b[`]bXi ghfmUbX`dfcZYgg]cbU` Yb[]bYYf]b[`ghUbXUfXg"`
- &" 7 f]h]wU``mfYZYWicb'U'gdYw]U`]ghVcXmcZ_bck `YX[Y'fY`UhYX'hc'h\Y]f'h\Yg]g'hcd]w''
- ' " 5dd`mgWYbhjZWUbX'Yb[]bYYf]b[a Yh\cXg'hc'gc`j Y'Ub'Yb[]bYYf]b['dfcV`Ya "'
- ("5bU`mgY`XUHU`cV'YWhji Y`mii g]b[ei UbhjHuhji Y`UbX`a Uh\Ya UhjWU``a Yh\cXg"`
-) "8 Ya cbglfUlY cfU`UbX k f]lhYb Wca a i b]WUljcb]b dfcZ/gg]cbU`UbX `UmXca U]bg"
- *" Hc 'gc'j Y'V]ca YX]\W\`dfcV`Ya g'VmUdd`m]b['7 @C '\%\)

HYUW]b[GhfUhY[]Yg

H\Y`Wci fgY`]g`HJi [\h'Ug`Ub`]bX]j]Xi U``fYgYUfW\`dfc`YWžhc`XYj Y`cd`U``Yj Y``cZfYgYUfW\`g_]``g`UbX Ui hcbca m'

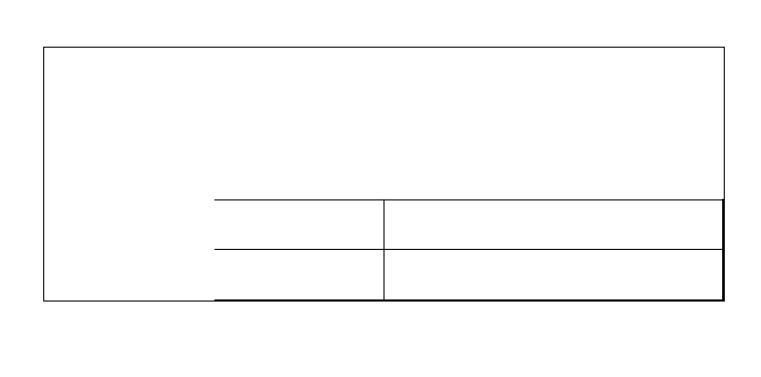
5ggYgga Ybh

 $\label{thm:continuous} $H\Yg]g'6."H\Y'df]a$ Ufmi]bhYbh]cb'VY\]bX'H\Yg]g'6"]g'hc'Ybgi fY'ghi XYbhg'ghUmcb'hfU_ik\]h\'h\Y]f'dfc'Y\\\g\\ UbX'dfc'Y\\\h\K']h\'h\Y]f'dfc'Y\\\g\\ UbX'dfc'Y\\h\K'\\\h\Y'm\Y\Uf''$

5ggYgga YbhhUg_	K Y][\h	8i Y [.] 8UHY	7ci fgY`@YUfb]b[

.

5ggYggcf'Bca]bUhjcb': cfa



]bXi glfm" < ck Yj Yfž]ZWcbZ]XYbh]U`]hm]g fYei	i]fYXžU`WcbZ]XYbh]U``X]gWcg	gi fY`U[fYYa Ybhff785½]g`cV`][Uhcfm

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

@UVcfUlrcfmfYdcflrg*UbX*a U*cf*Ugg][ba Yblrg*k]***fYei]fY*U*Bcb*D*U[]Uf]ga *8YWUfUlr]cb*7cj Yf*G\YYlr"

5gg][ba Ybhgʻg\ci `X`VYʻgi Va]hhYXʻcbʻhja Y"`5`XU]`mdYbU`hmcZ) ı `cZh\Y`a Uf_gʻUj U]`UV`YʻZcfʻh\Uh Ugg][ba Ybhk]```Udd`m'Zcfʻk cf_ fYVW]j YX`UZhYfʻh\Y`Xi Y`XUhY"`5bmUgg][ba Ybha cfYʻh\Ubʻ) `XUmg``UhYʻk]``bch VY`UWWdhYX"'H\Y`cb`mYl Ya dhjcbʻk]```VYʻk \Ybʻdf]cfʻdYfa]gg]cbʻZcf``UhYʻgi Va]gg]cbʻ\UgʻVYYbʻ[fUbhYX`Vm h\Y`7 ci fgY`WccfX]bUhcf"'9I hYbg]cbgʻk]```VY`[fUbhYX`cb`mcbʻa YX]WU``cf`Wca dUgg]cbUhYʻ[fci bXgʻi bXYf YI hYa Y`W]fW a ghUbWfg"

5 WUXYa]W<cbYglmUbX D`U[]Uf]ga

D@5; =5F €A

6Yk UfY"5b"Ugg][ba Ybhih Uh']bWi XYg'd`U[]Uf]gYX'a UhYf]U`k]```fYWY]j Y'U'\$ı :: U]`ž'UbX'ghi XYbhg'k \c d`U[]Uf]gY'a UmZJ]`ih\Y'Wti fgY"'Ghi XYbhg'k \c d`U[]Uf]gY'k]``\Uj Y'h\Y]f'bUa Yg'YbhYfYX'cb'U'd`U[]Uf]ga fY[]ghYf'UbX'k]``VY``]UV'Y'hc X]gW]d`]bUfmUW]cbž]bWi X]b['YI Wi g]cb'Zfca 'Ybfc`a Ybh'''

#i]g YI dYWYX 'h\Uh'U```ghi XYbhgʻa i gh'Uh'U```h]a Ygʻgi Va]hh\Y]fʻck bʻk cf_`ZcfʻUggYgga YbhʻʻGi Va]hh\b k cf_`cf`]XYUgʻcZgca YcbY`Y`gY`k]h\ci h\WYUf`mUW_bck `YX[]b[`h\Y`gci f\W`cZVcffck YX`a UhYf]U``cf`]XYUgʻ]g d`U[]Uf]ga "

 $5 ```UggYgga Ybhg`k \] W. `mci `` \UbX`]b`a i gh`\Uj Y`U`<u>Bcb`D`U[]Uf]ga `8YWUfUh</u>cb`7 cj Yf`G\YYh'`H\]g`]g`Zcf Vch\`]bX]j]Xi U``UbX`[fci d`k cf_"`5HUW.`]h'hc`mci f`Ugg][ba Ybh'VYZcfY`gi Va]hhb[`]h'hc`h\Y`7 ci fgY 7 ccfX]bUhcf`cf`Uh'h\Y`GW\cc``C Z[W''$

 $D`U[]Uf]ga ~ [g'h Y'i gY'cZUbch Yf'dYfgcb'g'k cf_cf']XYUg'Ug']Zh Ymk YfY'mci f'ck b'''K ~ Yb']h]g'bYWfggUfmcf XYg]fUV'Y'hc'i gY'ch Yf'dYcd'Y'g'a UhYf]U`'mci 'g\ci `X'UXYei UhY`mU_bck `YX[Y'k \cgY'k cfXg'cf']XYUg'h Ym$

5 WUXYa]W = DZcfa Uhjcb

7CI FG9'9J5@I 5H€B'5B8'89J9@CDA 9BH

Ghi XYbhZYXVUW_`\Ug`\Y`dYX'hc`g\UdY`UbX`XYj Y`cd`h\]g`Wci fgYž`]bWi X]b[`ZYYXVUW_`cVhJ]bYX`Zfca `cb! `]bY`Yj U`i Uh]cbg`Ug`dUfhcZl BGK 'g`Ug`dUfhcZl BGK 'g`a m9l dYf]YbWi`dfcWigg"`Mci `UfY`\][\`m YbWci fU[YX`hc`Wca d`YhY`gi W\`Ub`cb!`]bY`Yj U`i Uh]cb`hck UfX`h\Y`YbX`cZHYfa "`: YYXVUW_`UbX`gi [[Ygh]cbg dfcj]XYX`k]```VY`]a dcfhUbh`]b`]a dfcj]b[`h\Y`Wci fgY`Zcf`Z hi fY`ghi XYbhg"

.

85H9G'HC'BCH9

FYZYfihciA ml BGK iZcfi a dcfhUbhi8UhYgžiUj UjiUViYiUh \hdg.##a mii bgk "YXi "Ui #ghi XYbh#Ygci fWYg#! Ym8UhYg"\ha_i

.

57589A = 758J = 79

: cf]bZcfa Uh]cb UVci h

- "Bchyg'cb'Uggygga Ybhg'UbX'd'U[]Uf]ga ž
- · · · · GdYWJU` · 7 cbg]XYfUh]cbgž
- "GWXcc"Gh XYbh9h\]Wa'CZZWYfž'UbX
- 69GG

.

Gi dd Ya YbhUfm9l Ua]bUh]cbg.

GiddYa YblUfm91Ua]bUl]cbg'Zcf'HYfa '%&\$&&k]``VY'\Y`X'cb'fH67Eg\ci`X'mci 'VY'fYei]fYX'lc'g]hcbY"

H\]g`Wci fgY`ci h]bY`gYhg`ci hXYgWf]dh]cb`cZWUggYg`Uhih\Y`XUhY`h\Y`7 ci fgY`Ci h]bY`]g`di V`]g\YX"`H\Y bUhi fY`cZWUggYg`a UmW\Ub[Y`Xi f]b[`h\Y`HYfa `UZhYf`h\Y`7 ci fgY`Ci h]bY`]g`di V`]g\YX"``A ccX`Y`g\ci `X`VY Wcbgi`h\X`Zcf`h\Y`i d`hc`XUhY`WUgg`XYgWf]dh]cbg"``=Zh\YfY`]g`Ubm]bWcbg]ghYbWn]b`h\Y`XYgWf]dh]cb`cZ UWhj]hjYg`VYhk YYb`h\Y`I b]j Yfg]lmiha YhUV`Y`UbX`h\Y`7 ci fgY`Ci h]bY`fUg`i dXUhYX`]b`A ccX`Y\Z`h\Y XYgWf]dh]cb`]b`h\Y`7 ci fgY`Ci h]bY#A ccX`Y`Udd`]Yg"

=a U[Y 7 fYX]h

GmbYf[]Yg']b'GcibX'&\$%*

7F = 7CG

7F = 7CG Dfcj]XYf 7cXY. \$\$\$-,;

5W_bck `YX[Ya YbhcZ7ci bhfm

 $K Y : UW\underline{b} ck `YX[Y : h, Y : 6YXY[U : dY cd `Y : k \ c : UfY : h, Y : hfUX]h\underline{b} cb : `W : ghcX]Ubg : cZh, Y ``UbXg : cb : k \]WX : I BGK ? Ybg]b[hcb : WUa di g :]g ``cWUhYX"$