

# **ARTS2212**

Gci h\YUgh'5g]U

GYa YghYf'C bY''##'&\$%

# 5WUXYa]W±bZcfaUh]cb

: cf`YggYbhJU``ghi XYbh`]bZcfa UhJcb`fY`UhJb[ 'hc. 'fYei Yghg`Zcf`Yl hYbg]cb/fYj ]Yk 'cZa Uf\_g/cWW dUhJcbU``\YU`h\UbX`gUZYhm'Yl Ua ]bUhJcb'dfcWYxi fYg/gdYWJU``Wcbg]XYfUhJcb`]b'h\Y'Yj YbhcZ]``bYgg`cf`a ]gUXj Ybhi fY/ghi XYbhYei ]hmUbX`X]gUV]`]hm'UbX`ch\Yf`YggYbhJU``UWUXYa ]W]bZcfa UhJcbž gYY`\hdg.#k k k "Ufhg"i bgk "YXi "Ui #W ffYbhghi XYbhg#JWUXYa ]W]bZcfa UhJcb#dfchcWc`g![i ]XY`]bYg#

# 7ci fgY 8YW] g

7 fYX]hDc]bhg \*\*

Gi a a UfmcZh\Y 7ci fgY

H\Y`Wci fgY`ZcW gYg`cb`a cXYfb`Gci h\YUgh5g]U`g]bWY`h\Y`YbX`cZh\Y`Wc`cb]U``dYf]cX`i bhj``h\Y`dfYgYbhXUm' ±ghYUX`cZh\Y`lfUX]hjcbU``]bhYfdfYhUhjcbžk \]W\`gYYg`U`lfYbX`hck UfXg`Ui h\cf]hUf]Ub]ga žk Y`g\U```fYUX \]ghcfmUbX`dc`]hjWg`]b`WcbhYa dcfUfmGci h\YUgh5g]U`Ug`Ub`i bfYgc`j YX`WcbZ]WiVYlk YYb`lk c Wca dYhjb[`

# 5ggYgga Ybh

#### 5ggYgga Ybh'HUg\_g'

5ggYgga Ybh'hUg_	K Y][\h	8i Y'8UHY	Gh XYbh@YUfb]b[ Ci hWca Yg 5ggYggYX
FYgYUfV% '9ggUm'	(\$1	\$(#\$)#&\$% `\$(.\$\$`DA	&Ž Ž(
F YgdcbgYg'hc'fYUX]b[g'	&\$ı	Hi hcf]U`g`]b`k YY_g'' ž'(ž*`UbX +	(
7`UggʻhYghi	&\$ı	&) #\$) #&\$% `\$\$\$`5A	% <u>ž</u> ( <u>ž</u> )
±bX]j]XiU`'9IYfWjgY. Gcih\YUgh5g]Ub'±ggiYg'	&\$ı	Bch5dd`]WUV`Y	&Ž

#### 5ggYgga Ybh'8YHJ]`g

5ggYgga Ybh'% F YgYUfVX '9ggUm

GhUfhXUhY. Bch5dd`]WUV`Y

**8YhJ]`g.** F YgYUfW. '9ggUmVfc\_Yb`Xck b`]bhc—V]V`]c[fUd\mž`UVghfUWhUbX`Z]bU``YggUmGh XYbhg`k f]hY`Ub YggUmfWJ"' \$\$\$`k cfXgŁ`]b`fYgdcbgY`hc`cbY`cZh\Y`ei Ygh]cbg`i g]b[`gWkc`Ufg\]d`]b`Gci h\YUgh5g]Ub ghi X]Yg": YYXVUW\_`]g`h\fci [\`]bX]j ]Xi U``Wca a Ybhg`UbX`fi Vf]W"H\]g`]g`h\Y`Z]bU``UggYgga YbhZcf`UhhYbXUbW di fdcgYg"

#### 5XX]h]cbU`'XYhU]`g.

 $D^YUgY^c[\ cb'hc'h,Y'A\ ccX'Y'G]hY'Zcf'h,Y'Wc'i\ fgY'i\ bXYf'''7\ cbhYbhUbX'F Ygci\ fWYg'''hc'UVWYgg'h,Y'Z]Y'Ybh]hYX'''9ggUmHcd]Wg'UbX'6]V`]c[\ fUd\]Yg'''$ 

 $\label{thm:limit} \begin{tabular}{ll} Hi & fb \end{tabular} $$ $H' \end{tabular} $$ $ fb \end{tabular} $$ fb \end{tabular} $$ $ fb \end{tabular} $$ 

5ggYgga Ybh& FYgdcbgYg hc fYUX]b[g

GhUfhXUhY. Bch5dd`]WUV`Y

**8YHJ]`g.** `Gh XYbhgʻgi Va ]hUʻfYgdcbgYʻfWU"`) \$\$!\*\$\$`k cfXgŁhcʻgYhei Ygh]cbgʻcb`k YY\_`mfYUX]b[ gʻVYZcfY Zci f`h hcf]U`g"`: YYXVUW\_`]gʻVm]bX]j ]Xi U``Wca a Ybhgžfi Vf]WžUbX`]b!WUggʻX]gW gg]cb"

#### 5XX]h]cbU`XYhU]`g.

H\Y``ci fbU``]g`Ub`YI ffYa Y`m]a dcffUbhWca dcbYbhcZh\Y`UggYgga Ybh'``Hi fcf]U`g`k ]```cb`mk cf\_`]Zgh XYbhg Wca Y`fc'h\Y`WUgg'dfYdUfYX`Zcf'X]gW gg]cb''`Gh XYbhg`g\ci `X`Xc'h\Y`fYei ]fYX`fYUX]b[ `Zcf'h\Y`k YY\_`UbX Wcbff]Vi hY`fc'h\Y`WUgg'X]gW gg]cb']b`Ub']bZcfa YX`a UbbYf''``H\Y`gi Va ]gg]cb`cZh\Y``ci fbU``Ugg][ ba Ybh Ybgi fYg'h\Uhgh XYbhg'k ]```Wca Y`fc'WUgg'dfYdUfYX''`D`YUgY``c[ `]bfc'h\Y`A ccXY`g]hY`fc'Xck `cUX

 $\label{thm:continuous} $$ h_Y ''_Y ''_Y bh_h Y '''_Y bh_h Y '''' for the following of the$ 

#### 5XX]h]cbU`'XYhU]`g.

#### ±0X]j ]Xi U``9I YfW]gY`

Ghi XYbhgʻg\ci `X`WkccgY`Ub`]ggi Y`h\Ymh\]b\_`]gʻ]a dcfhUbhcbY`]bʻGci h\YUgh5g]UʻUbX`X]gWʻggʻfl⁄£`k\m]h`]g ]a dcfhUbhžʻfl⁄£`k\Uh]gʻdYW`]Uf`mGci h\YUgh5g]UbʻUVci h`]hžʻUbX`fl Ł\ck `\Ugʻ]hUZYWYX`Gci h\YUgh5g]UbgcW]Ymž\]ghcfmždc`]h]WgžYWcbca mž`W`hi fY`YhW`ʻ=b`cfXYf`hc`]`i ghfUhY`mci f`]ggi Y`k]h\`Ub`YI Uad`Y`mci ʻa Um Xc`U`WJgY`ghi XmcZcbY`Gci h\YUgh5g]Ub`Wci bhfm'``Ghi XYbhgʻg\ci `X`Xc`h\Y]f`ck b`fYgYUfW\`cb`h\Y]f`WJgYghi Xm'

Gca Y ]ggi Yg Wci `X VY. ``Wcffi dhjcbžbYdchjga ž'Ui h\cf]hUf]Ub]ga ž\_]bg\]d 'dc`]hj\\gžYbj ]fcba YbhU``dfcV`Ya g flzfYl Ua d`Y `XYzcfYghUhjcbž'dc``i hjcb YhWłżk ca Yb'g UbX [ YbXYf`]ggi YgžfY`][ ]ci g VY`]YZgžYXi WUhjcbU` gmghYa gžW `hi fU``Uhjhi XYg fl\\cgy'cbY cf'k cłž`\Ub[ i U[ YžYh\b]WjhjYgž]bhYfbUhjcbU``fY`Uhjcbg\]dg cf X]d`ca Uhj\WfY`Uhjcbgž'h\Y`\Wf]g]g`]b h\Y`gci h\`7\]bU`gYU#K YghD\]`]dd]bY`gYUža YX]\W\`hci f]ga ž'DfYg]XYbh 8i hYfhYfg'k Uf`cb`Xfi [ gž Xca Ygh]W\Y`dYfgž``UVci f`]ggi Yg`]b`Yl dcfhidfc\Wgg]b[ `ncbYgža ]`]hUf]ga žYh\b]\W a ]bcf]hjYgž'\Jj ]``k UfgžfYg]ghUb\W hc`X]\WUhcfg\]dgž bUhi fU``X]gUghYfg`fhmd\ccbgžZccXgžhgi bUa ]gžj c`\WJb]\W Yfi dhjcbgłžYhW

Ghi XYbhgʻUfYʻYbWci fU[YXʻhcʻVYʻWfYUhjjYʻ]bʻ]XYbhjZmjb[ʻUbʻ]a dcfhUbhi]ggi YʻʻGhi XYbhgʻk]``dfYgYbhh\Y]f ]ggi YʻcfU``m`]bʻWUggʻZcfʻUVci h'&!' `a ]bi hYgʻcb`m''

 $H\[g']g'mci\ f']bX]j\ ]Xi\ U'\#f][\ ]bU''fYgYUfW\'dfc YWf''Ghi\ XYbhg'g\ci `X'gi\ Va\ ]h'U'CB9'dU[\ Y'UbbchUhYXV]V']c[\ fUd\mhc'h\Y'hi\ hcf'cb'h\Y'XUmcZh\Y]f'dfYgYbhUh]cb''$ 

Hi fb]hjb gYhjb[. H\]g ]g bchU Hi fb]hjb Ugg][ ba Ybh

## Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g

Gh XYbhg UfY Yl dYWYX hc di hh\Y]f bUa Yg UbX gh XYbhbi a VYfg cb Yj YfmdU[Y cZh\Y]f Ugg][ ba Ybhg"

#### Hi fb]h]b Gi Va ]gg]cb

Imagi YbWci bhYf'U'dfcV'Ya 'k \Yb'UthYa dr]b[ 'rc'gi Va ]hmci f'Ugg][ ba Ybht\fci [ \'Hi fb]r]bž'd'YUgY hY'Yd\cbY'9I hYfbU'Gi ddcfhcb'-', ) "''' %cf'Ya U] hYa 'cb'<u>Yl hYfbU'hY'hgi ddcfh4 i bgk "YXi "Ui"</u> "Gi ddcfh \ci fg'UfY', .\$\$Ua '-'%\$.\$\$da 'cb'k YY\_XUmg'UbX'-.\$\$Ua '-') .\$\$da 'cb'k YY\_YbXg'fl \*) 'XUmg'U'mYUft'" Imai UfY'i bUV'Y 'rc'gi Va ]hmci f'Ugg][ ba YbhXi Y'rc'U'ZJi 'hk ]h\ 'Hi fb]h]b'mci 'a UmUdd'mZcf'Ub'YI hYbg]cbž'Vi hmci a i ghfYhJ]b'mci f'h]\W\_Yhbi a VYf'Zfca '9I hYfbU''Gi ddcfhfU'cb[ 'k ]h\ 'Ubmch\Yf'YYj UbhXcW a Ybhgt'rc ]bWi XY'Ug'Yj ]XYbW' 'rc'gi ddcfhmci f'Yl hYbg]cb'Udd']\WJhjcb"'Imai 'Ya U]''9I hYfbU''Gi ddcfhmci 'k ]'`Ui hca Uh]\WJ'`mfYWf'] Y'U'h]\W\_Yhbi a VYfž'Vi h]Zmci 'hY'Yd\cbY'mci 'k ]'``bYYX'rc'gdYW]ZJ\WJ'`mUg\_'Zcf'cbY'' Hi fb]h]b'U'gc'dfcj ]XYg'i dXUhYg'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk ]hYf''

; YbYfU`mž'UggYgga YbhitUg\_g'a i ghVY'gi Va ]hhYX'Y`YWfcb]WU``mj ]U'Y]h\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ ba Ybh''=b']bghUbWfg'k \YfY'h\]g']g'bchdcgg]V`Yž']hk ]```VY'ghUhYX'cb'mci f'Wci fgY'g'A ccX`Y'g]hY'k ]h\U`hYfbUh]j Y'gi Va ]gg]cb'XYhU]`g"

#### @UhY 5ggYgga Ybh'DYbU`h]Yg

5b'UggYggYX'HUg\_']g'XYYa YX``UhY']Z]h']g'gi Va ]hhYX'UZhYf'h\Y'gdYW]Z[YX'h]a Y'UbX'XUhY'Ug'gYhci h']b'h\Y Wci fqY'@YUfb]b['A UbU[Ya YbhGmqhYa 'f@A GŁ"

$$\label{thm:condition} \begin{split} &\text{H}^{\text{U}$$

K cf\_'gi Va ]hhyx'zci fhyyb'fl%( EXUmg'Uzhyf'h\y'Xi Y'XUhy'k ]``VY'a Uf\_YX'UbX'zYYXVUW\_'dfcj ]XYX'Vi hbc'a Uf\_ k ]``VY'fYWcfXYX"'=Zh\Y'k cf\_'k ci `X'\Uj Y'fYWr]j YX'U'dUgg'a Uf\_'Vi hzcf'h\Y'`UhybYgg'UbX'h\Y'k cf\_']g'U Wca di `gcfm'Wci fgY'Wca dcbYbhz'U'gh XYbh'k ]``VY'XYYa YX'hc'\Uj Y'a Yhih\UhfYei ]fYa Ybh''H\]g'XcYg'bch Udd`mhc'U'hUg\_'h\Uh']g'UggYggYX'Vi hbc'a Uf\_']g'Uk UfXYX"

K cf\_'gi Va ]hh/X'hk YbhnlcbY'f&&XUmg'UZhYf'h\Y'Xi Y'XUhY'k ]```bchVY'UWWdhYX'Zcf'a Uf\_]b[ 'cf'ZYYXVUW\_UbX'k ]```fYWY]j Y'bc'a Uf\_'cf'[ fUXY"'=Zh\Y'UggYgga YbhHUg\_']g'U'Wca di `gcfmWca dcbYbhcZh\Y'Wci fgY'Ugh XYbhk ]```Ui hca Uh]WU``mZU]`'h\Y'Wci fgY"

## GdYWJU`7cbg]XYfUhJcb55dd`]WUhJcbg

 $\label{eq:linear_continuity} $$Mc_i = W_0 - W_$ 

G]W\_bYggža ]gUXj Ybhi fY'cf'ch\Yf'W]fW a ghUbWrg'VYmcbX'mci f'Wcbhfc``a Um

ł DfYj Ybhimci Zfca Wca d`Yhlb[ U.Wci fqY fYei ]fYa Ybhž

ł? YYd mci Zfca 'UthYbX]b[ 'Ub 'UggYggUV'Y 'UWnji ]tmž

ł Ghod moi gi Va ]hh]b[ 'UggYggUV'Y k cf\_ Zcf'U Wci fgYž

ł `G][ b]Z]\WbhmUZZY\Wimci f`dYfZcfa Ub\Wr`]b`UggYggUV`Y`k cf\_ž`VY`]h'U`Zcfa U``YbX!cZgYa YghYf`Yl Ua ]bUh]cbž`U \WUgg`hYghž`U``UVcfUhcfmhYghž`U`gYa ]bUf`dfYgYbhUh]cb`cf`Ubmch\Yf`Zcfa 'cZUggYgga Ybh'

#### 5 WUXYa ]W<cbYghmUbX D`U[ ]Uf]ga

D`U[]Uf]ga `]g`i g]b[ 'h\Y`k cfXg`cf`]XYUg`cZch\Yfg`UbX`dfYgYbh]b[ 'h\Ya `Ug`mci f`ck b"'\lefi\Wb'hU\_Y`a Ubm Zcfa gžZfca `XY`]VYfUhY`W\YUh]b[ 'hc`UVW]XYbhU`mWcdm]b[ 'Zfca `U`gci f\W' k ]h\ci hUW\_bck `YX[ Ya Ybh'

IBGK [fcidgdu[]uf]ga ]bhch\YZc``ck]b[ WuhY[cf]Yg.

7 cdm]b[.'i g]b['h\Y'gUa Y'cf'j Yfmg]a ]`Uf'k cfXg'hc'h\Y'cf][]bU`hYl h'cf']XYU'k ]h\ci h'UW\_bck `YX[]b['h\Y gci fW'cf'i g]b['ei chUh]cb'a Uf\_g"'H\]g'U`gc'Udd`]Yg'hc']a U[Ygž'Ufh'UbX'XYg][b'dfcYWhgž'Ug'k Y``'Ug dfYgYbhUh]cbg'k \YfY'gca YcbY'dfYgYbhg'Ubch\Yf'g']XYUg'cf'k cfXg'k ]h\ci h'WfYX]h'

±DUddfcdf]UhY`dUfUd\fUg]b[.'W\Ub[]b['U'ZYk'kcfXg'UbX'd\fUgYg'k\]`Y`acghmfYhJ]b]b['h\Y`cf][]bU`ghfi WhifY`UbX`]bZcfaUh]cb`k]h\ci hUW\_bck`YX[YaYbh'H\]g'U`gc'Udd`]Yg`]b'dfYgYbhUh]cbg'k\YfY`gcaYcbYdUfUd\fUgYg`Ubch\Yf'g`]XYUg`cf'kcfXg'k]h\ci hWfYX]h''±iU`gc'Udd`]Yg`hc'd]YW]b['hc[Yh\Yf'ei chYg'UbXdUfUd\fUgYg`]bhc'U'bYk'k\c`Yžk]h\ci hfYZ/fYbW]b['UbX'U'ghi XYbh'g`ck b'UbU`mg]g`hc'Vf]b['h\Y`aUhYf]U`hc[Yh\Yf''

7 c``i g]cb. 'k cf\_]b[ 'k ]h\ 'ch\ Yfg'Vi h'dUgg]b[ 'c\Z'h\ Y 'k cf\_'Ug'U'dYfgcb'g']b\X]j ]\Xi U``k cf\_"'7 c``i g]cb'U`gc ]b\Wi XYg'dfcj ]\X]b[ 'mci f'k cf\_'hc'Ubch\ Yf'ghi XYbh\ VYZcfY'h\ Y 'Xi Y 'XUhYzcf'Zcf'h\ Y' di fdcgY'cZh\ Ya d`U[ ]\Uf]g]b[ 'Uh\Ubmh]a Yz'dUm]b[ 'Ubch\ Yf'dYfgcb'hc'dYfZcfa 'Ub'U\WUXYa ]\Wh\Ug\_z'ghYU']b[ 'cf'U\\ello i ]f]b[ Ubch\ Yf'dYfgcb'g' U\WUXYa ]\Wk cf\_'Ub\X'\\ello dm]b[ ']hz'c\ZYf]b[ 'hc'\\ello a d`YhY'Ubch\ Yf'dYfgcb'g' k cf\_'cf'gYY\_]b[ d\una Ybh\Zcf'\\ello a d`Yh\beta d`

±bUddfcdf]UhY`W]hUh]cb.`7]h]b[ˈgci fW/gˈk \]WX`\Uj Y`bchVYYb`fYUXžk]h\ci hUW\_bck`YX[]b[ˈh\Y`″gYWcbXUfm″gci fW/Zfca k \]WX`\_bck`YX[Y`cZh\Ya`\Ug'VYYb`cVhU]bYX"

8 i d`]\WUh]cb`ff`gY`Zld`U[]\Uf]ga "Ł`gi Va]\h]b[`mci f`ck b`k cf\_ž]b`k \c`Y`cf`]b`dUfhžk \YfY`]h`\Ug`dfYj]ci g`m VYYb`dfYdUfYX`cf`gi Va]\hYX`Zcf`Ubch\Yf`UqqYqqa Ybhcf\Wci fgY`UhI\_BGK\_`cf`Ubch\Yf`i b]\Yfq]\m"

7 cffYWhfYZYfYbWb[dfUWhWyg.

• VYHYfa UbU[Ymcifh]a Y

# 7ci fgY GWXYXi `Y

# J]Yk 'WUgg'ha YHUV'Y

# H]a YtUV`Y

8 UhY	HmdY	7 cbhYbh	
K YY_'%'&*': YVfi Ufm!'( A UfVX	@YWnifY	H\Y`8 mbUa ]Wg`cZ8 ]WfUhcfg\]dg`]b`h\Y`D\]`]dd]bYg UbX`&XcbYg]U`]bWi X]b[`U`XcW a YbhUfmZ]`a`~7 ci d XfYhUh	
	Hi hcf]U`	Be'hi hef]U`g'	
K YY_'&.') 'A UfW\'!'%% A UfW\	@YWhi fY	H\Y'?\a Yf'F ci [Y']bWi X]b['YI WYfdhg'Zfca 'h\Y'Z]`a FZW=[^{\circ} Y 8[WVe UbX'WUgg'X]gW gg]cb'	
	Hi hcf]U`	-bHfcXi Whjcbž\ck 'hc'k f]hY'U' 'ci fbU'ž'UbX'Hf]j ]U` Di fgi ]h∵"BUa Y'h\Un'8]WhUhcf"'	
K YY_'' .'‰'A UfWX'!'% A UfWX	@YWn fY	A ][ fUh]cb	
	Hi hcf]U`	H\Y`±bhYfbYh'UbX`Dc`]h]Wg`]b`h\Y`D\]`]dd]bYg`UbX ±bXcbYg]U	
K YY_'(.'%'A UfWX'!'&) A UfWX	@YWnifY	J ]YhbUa	
	Hi hcf]U`	H\Y'?\a Yf'F ci [Y	
K_YY_').'&*'A_UfWX'!'% 5df]`	@YWifY	Bc``YWnfYg.'; ccX': f]XUm'\c`]XUm	
	Hi hcf]U`	Beih hef]Uig.ii; ccXi: f]XUmi\ci]XUm	
6fYU`&`5df]`!`, `5df]`			
	@YWnifY	G]b[UdcfY	
	Hi hcf]U`	A ][ fUh]cb ·	
K_YY_`+.`%*`5df]``!`&& 5df]`	@YWi fY	K ca Ybʻ]bʻ7cbhYa dcfUfmGci h\YUgh5g]U	
	Hi hcf]U`	J ]YIbUa	
K YY_', .'&' '5df]`'!'&- 5df]`	@YWi fY	6i fa U#A mUba Uf`]bWi X]b[ 'h\Y'F c\]b[ mUg	
	Hi hcf]U`	G]b[ UdcfY	
K YY_''' \$'5df]`'!'*'A Um		H\U]`UbX.``A cbUfW\m'UbX`A ]`]HUfm	

	Hi lcf]U`	8 cW a YbfUfmZja 'g\ck ]b[ 'fG]ffk YŁ'UbX'X]W gg]cb cb'f\Y'F c\]b[ mUg	
K YY_`%\$.`+`A Um!`% A Um	@YWhi fY	A U`Umg]U`UbX`h\Y`F]gY`cZh\Y`A]XX`Y`7`UggYg`]b Gcih\YUgh5g]U	
	Hi hcf]U`	H\U]`UbX	
K YY_'%%' %( 'A Um! '&\$ A Um	@YWhi fY	DUffn% "H\Y"A Ubm: UWYg"cZHci f]ga "]b"Gci h\YUgh 5g]U	
		DUfn&: 8Ya cWfUWmGci h\YUgh5g]Ub GhmY	
	Hi hcf]U`	±bX]j ]Xi U``9I YfW]gY	
K YY_'%&.'&%'A Um!'&+ @YWhifY A Um		7 `Ugg`HYgh	
	Hi hcf]U`	±oX]j ]Xi U``9I YfW]gY`Wcbh]bi YX`	
K YY_'%' .'&, 'A Um'!''	@YWh fY	Bc "YWh fY	
>i bY	Hi hcf]U`	±bX]j ]Xi U``9I YfW]gY`W¢bh]bi YX	
		9ggUmgʻfYhi fbYXʻUbXʻZYYXVUW_ʻ[]j Yb"	

# FYgci fWyg

### DfYgWf]VYX F Ygci fWfg

H\YfY UfY bc hYl Wcc\_g fYei ]fYX Zcf h\]g Wci fgY"

D`YUgY``c[`]bhc'h\Y'A ccX`Y'G]hY'Zcf'h\Y'7 ci fgY'UbX'W]\\\_'cb'h\Y'Z]`Y'''Hi hcf]U``E i Ygh]cbg'UbX'F YUX]b[g''' 5```h\Y'ei Ygh]cbg'Zcf'h\Y'ci fbU``Ugg][ba Ybhg'UbX'hi hcf]U``X]gW gg]cb'hcd]\\g'UfY'h\YfY'Ug'k Y```Ug'h\Y fYUX]b[g'\Wb'VY'UW\\ggYX'h\fci [\'h\Y'@]\VfUfm@Y[Ubhc'gmghYa 'Ya VYXXYX']b'h\Y A ccX'Y'g]hY'Zcf'h\Y'Wci fgY"''@cc\_'i bXYf'''7 cbhYbhg'UbX'F Ygci f\\g'''UbX'h\Yb'\W]\\\_'cb'h\Y'[fYYb']\\cb'\Ybh]hYX''F Yei ]fYX'F YUX]b[g'\ZgY'Y\\h\Y'k YY\_'UbX'h\Y'fYUX]b[g'\UfY'h\YfY''

#### FYWca a YbXYX FYgci fWyg

 $\label{eq:continuous} D`YUgY``c[``]bhc`th\Y`A ccX`Y`G]th'`Zcf`th\Y`Wci fgY`UbX`W]W\_`cb`th\Y`Z]`Y```^9ggUmE i Ygt]cbg`UbX`6]V`]c[fUd\]Yg``k\]W\`Ug`th\Y``]ghcZYggUmei Ygt]cbg`UbX`fYWca a YbXYX`fYUX]b[g`Zcf`YUW\`hcd]W'$ 

.

## 7ci fgY 9j U`i Uh]cb UbX 8Yj Y`cda Ybh

Ghi XYbhYj U'i Uh]cb']g'[ Uh\YfYX'h\fci [ \ `A m9I dYf]YbW' WcgY'hc'h\Y'YbX'cZh\Y'gYYa ghYf"'H\Y'ZYYXVUW\_
'UghmYUf'k Ug'j Yfmdcg]hj Y'UbX'h\Y'cb'ma U'cf'WcbWfb'k Ug'h\Y'bi a VYf'cZUggYgga Ybhg"'=b'fYgdcbgY'hc
h\]g'=\Uj Y'fYXi W'X'h\Y'bi a VYf'cZUggYgga Ybhg'Zcf'h\]g'Wci fgY"'=fYa cj YX'h\Y'"9h\bc[ fUd\]W9I YfW]gY"
k\]W\'fYei ]fYX'ghi XYbhg'hc'[ c'hc'7 UVffUa UhtU'cb'h\Y]f'ck b'UbX'X]gW gg'h\Y'k Umh\]g'gi Vi fV']g
J ]YhbUa YgY'fUbX'?\a YfŁ"''5 "YWh fY'k Ug'[]j Yb'cb'\ck 'hc'Xc'h\]g'HUg\_'Vi hh\]g'\Ug'U'gc'VYYb'fYa cj YX
Zca 'h\Y'Wci fgY'XYg][ b']b'&\$% "''=U'gc'fYa cj YX'h\Y'a ]X!h\Yfa 'h\Yghgc'h\Uhighi XYbhg'bck 'cb`mXc'%h\Ygh'Uh
h\Y'YbX'cZgYa YghYf"''=b'ch\Yf'k cfXg'hk c'UggYgga Ybh]h\Ya g'k YfY'fYa cj YX'Zfca 'h\Y'Wci fgY"''H\]g'cZ
Wci fgY'a YUbhh\Uh=\UX'hc']bWfYgUY'h\Y'j U'i Y'cZh\Y'YggUmfYei ]fYa Ybh'

## = a U[Y'7fYX]h

 $GlfYYhGVWbY]b < c.7 \]A]b \7]mf&$\% E"D \chc[fUd \VmA Uflmb@mcbg]$ 

#### 7F = 7CG

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