

# **ARTS2061**

7 cbh/a dcfUfm5ddfcUWXYg hc 7]bYa U

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

## 7ci fgY'Cj Yfj ]Yk

#### GhJZZ7cbhJWh8YhJ]`g`

#### 7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`] <b>m</b>	@cWUh]cb	D\cbY
8f'>cX]'6fcc_g		0 0 1	&' % 'K YVghYf 6i]`X]b[	-',))*')

#### 'Hi hcfg'

B Ua Y	9a U]`	5j U]`UV]`] <b>m</b>	@cWUhjcb	D\cbY
8fFcXbYmK U``]g	f"k U``]g4 i bgk "YXi "Ui	hc:'VY:'WcbZjfa YX		

#### GWkcc~7cbhJWh~abZcfa Uhlcb

Fcca " %&ž~Yj Y~" FcVYfhK YVghYf~6i ]`X]b[

D\cbY. f\$&Ł'-',) '(,) \*

9a U]`. 'gUa 4 i bgk "YXi "Ui

K YVq]hY. '\hda.##qUa "Ufhq"i bak "YXi "Ui

H\Y'GW\cc``cZh\Y'5fhg'UbX'A YX]U'k ci `X``]\_Y'hc'F YgdYWM ``m5W\_bck `YX[Y'h\Y'HfUX]hjcbU``7 i ghcX]Ubgž h\Y'6YXY[U``fP Ybg]b[hcb'WJa di głž; UX][U``fP]hmUbX'5fhZ '8Yg][b'7 Ua di gYgŁ'UbX'h\Y'B[i bbUk U` dYcd`Y'fb i ghfU`]Ub'8YZYbW': cfW'5WJXYa m]b'7 UbVYffUŁ'cZh\Y'`UbXg'k \YfY'YUW\'WJa di g'cZl BGK ']g `cWJhYX"

#### 5 hyb XUb WY F Yei ]fYa Ybhg

5 'ghi XYbhi]g'Yl dYWYX'hc'UhhYbX'U```WUgg'WebhUWi\ci fg'Zcf'U'ZUWY!hc!ZUWY'fl &: Ł'cf'V`YbXYX'Wei fgY'UbX Wea d`YhY'U```UW¶j ]hjYg'Zcf'U'V`YbXYX'cf'Z ``micb`]bY'Wei fgY"

5 'ghi XYbhik \c'Uff]j Ygʻa cfYʻh\Ubʻ%) 'a ]bi hYgʻ`UhYʻa UmiVYʻdYbU`]gYXʻZcfʻbcb! UhhYbXUbWY"ʻ⊋gi W\`UʻdYbUʻhm ]gʻ]a dcgYXžʻh\Yʻghi XYbha i ghiVYʻ]bZcfa YXʻj YfVUʻ`mʻUhih\YʻYbXʻcZWUggʻUbXʻUXj ]gYXʻ]bʻk f]h]b[ 'k ]h\]bʻ&(\ci fq"

⊋Uʻghi XYbhYl dYf]YbWgʻ]``bYggža ]gUXj Ybhi fYʻcfʻch\YfʻcVW ffYbW h\Una U\_YgʻUVgYbWʻZfca ʻU WUgg#UWlj ]hmi bUj c]XUV`YžʻcfʻYl dYWgʻhcʻVY`UVgYbhZfca ʻUʻZcfh\Wca ]b[ˈWUgg#UWlj ]hmž'h\Ymg\ci `XʻgYY\_dYfa ]gg]cbʻZfca ʻh\Yʻ7 ci fgYʻ5i h\cf]hmžʻUbX`k\YfY`Udd`]WUV`Yž'h\Y]fʻfYei Yghg\ci `XʻVY`UWWca dUb]YX`VmUb cf[[]bU``cf`WffhZ]XX`WcdmcZU`a YX]WU``WYfhZ]WUhY`cf`ch\Yf`Zcfa `cZUddfcdf]UhY`Yj ]XYbWY"

5.7 ci fgY '5 i h\cf]hma UmYI W gY 'U'ghi XYbhZfca 'WUggYg'cf'UWjj ]hjYg'Zcf'i d'hc'cbY 'a cbh\"'<ck Yj Yfž'h\Ym a UmUgg][ b'UXX]hjcbU``UbX#cf'U'hYfbUhjj Y'HUg\_g'hc'Ybgi fY'Wca d`]UbW"'' 5.7 ci fgY '5 i h\cf]hmWcbg]XYf]b[ 'h\Y [fUbh]b[ 'cZUVgYbW' a i ghVY'gUhjgZ]YX'U'ghi XYbhk ]```gh]```VY'UV'Y'hc'a YYhh\Y'Wci fgY'g'`YUfb]b[ 'ci hWca Yg UbX#cf'j c'i a Y'cZ'YUfb]b[ "'5'ghi XYbhgYY\_]b[ 'Uddfcj U`'hc'VY'UVgYbh'Zcf'a cfY'h\Ub'cbY'a cbh\'a i gh'Udd'm ]b'k f]hjb[ 'hc'h\Y'8YUb'UbX'dfcj ]XY'U``cf][]bU``cf'WYfhZYX'gi ddcfh]b[ 'XcW a YbhUh]cb"

 $: cf'a\ cfY']bZcfa\ UfJcb'UVci\ hih\Y'UffYbXUbWY'dfchcWc`g']b'h\Y':\ UWV`hmicZ5fhg'UbX'GcWJU`\\ GWJYbWYg.'\underline{htdg.} \#k\ k\ k''\underline{Uffg''i\ bgk''YXi''Ui\ \#W\ ffYbHghi\ XYbhg\#\underline{UWJXYa}]W]bZcfa\ UfJcb\#\underline{dfchcWc`g![i\ ]XY`]bYg\#\underline{UWJXYa}$ 

## 5WUXYa]W±bZcfaUh]cb

: cf`YggYbh]U``ghi XYbh`]bZcfa Uh]cb`fY`Uh]b[ `hc.`fYei Yghg`Zcf`Yl hYbg]cb/fYj ]Yk `cZa Uf\_g/cWW dUh]cbU``\YU`h\UbX`gUZYhm'Yl Ua ]bUh]cb`dfcWXi fYg/gdYV]U``Wcbg]XYfUh]cb`]b`h\Y`Yj YbhcZ]``bYgg`cf`a ]gUXj Ybhi fY/ghi XYbhYei ]hmUbX`X]gUV]`]hm'UbX`ch\Yf`YggYbh]U``UWUXYa ]W]bZcfa Uh]cbž gYY`\hdg.#k k k "Ufhg"i bgk "YXi "Ui #W ffYbhghi XYbhg#JWUXYa ]W]bZcfa Uh]cb#dfchcWc`g![i ]XY`]bYg#

## 7ci fgY 8YHJ] g

7 fYX]hDc]bhg\*\*

### Gi a a UfmcZh\Y 7ci fgY

Gi VYWn5fYU. 8[\_\_ EfgV[We

H\]g`Wci fgY`]blfcXi Wg`ghi XYbhg`hc`gca Y`cZh\Y`\_YmXYVUhYg`]b`WcbhYa dcfUfmZ]`a 'h\YcfmZfca 'h\Y`% +\$g hc'h\Y`dfYgYbh'`\=fYbUV`Yg`ghi XYbhg`hc`j ]Yk 'UbX`ghi XmU'j Uf]YhmcZZ]`a a U\_]b[ 'dfUWf]W\g'!`]bWi X]b[ 'dc`]h]W\UbX`ghi XmU'j Uf]YhmcZZ]`a a U\_]b[ 'dfUWf]W\g'!`]bWi X]b[ 'dc`]h]W\UbX`ghi XmU'j Uf]YhmcZZ]`a a U\_]b[ 'dfUWf]W\g'!`]bWi X]b[ 'dc`]h]W\UbX`ghi XmU'j JXYcž'Ug'k Y``'Ug'a U]bghfYUa 'W]bYa Ug'!'UbX``cc\_g'Uhgca Y`cZh\Y`X]j YfgY`k Umg'h\Uh'Z]`a '\Ug'VYYb`i bXYfghccX`UbX`XYVUhYX`VmVch\'Z]`a a U\_Yfg'UbX`Z]`a 'h\Ycf]ghg'' Dfcj ]XYg'U'Zci bXUh]cb'Zcf'i ddYf`Yj Y``ghi Xm]b`: ]`a 'Ghi X]Yg''

#### 5 hh Y WcbWi g]cb cZh ]g Wci fgY h Y gh XYbhk ] ``VY UV Y hc

- %" HYghiUbX`Udd`migca Y`cZh\Y`\_YmWcbWfdhg`UbX`XYVUhYg`]b`h\Y`X]gW]d`]bY`hc`j Uf]ci g`Z]`a `UbX`a YX]U hYI hg`UbX`WcbhYI hg"
- &" ⇒XYbhjZmUbX`YId`U]b`gca Y`cZh\Y`g]a]`Uf]hjYg`UbX`X]ZZYfYbWYg`VYhk YYb`X]ZZYfYbhiZcfa g`cZWJbYa UUbX`h\Y`k Umg`h\Uhih\YmUfY`W\`hifU``mijU`iYX"
- ' "8YacbglfUlY:VUg]Wg\_]``g`fYei]fYX`Zcf`Wc``UVcfUl]jY'dfcYWiXYg][b'UbX'fYgYUfWX"
- ("FYWc[b]gY`gcaY`cZh\Y`hYW\b]WU`žUYgh\Yh]Wž`UbX`]bXi ghf]U``fY`Uh]cbg`VYhkYYb`W]bYaU`UbX`fY`UhYXaYX]u"
- ) "8 Ya cbglfUhY 'h\Y 'UV]`]mihc 'Zcfa i `UhY 'Ub 'YZYW]j Y 'Z]`a 'ghi X]Yg 'Uf[ i a Ybhi]b 'k f]hhYb 'Ub X 'gdc\_Yb Zcfa "

## HYUWX]b[ GhfUhY[]Yg

HYghjb[ 'UbX'Udd`mjb[ 'WebWidng'UfY'dUfhjW `UfmdfcXi Whj Y'k Umg'hc'XYj Y`cd'Vch\ 'mci f'i bXYfghUbX]b[ 'cZh\Y']Y`X'UbX'mci f'UbU`mhjWg\_]`g'UbX'Zcf'h\]g'fYUgcb'WfjhjWU`X]gW gg]cb'UbX'XYVUhY'Ufci bX'WebWidng'UbXhYfa g'k]``d`UmU'\_Ymfc`Y']b'h\]g'Wei fgY"'K\]Y'h hcf]U`g'dfcj ]XY'h\Y'df]a Ufm'Zcfi a 'Zcf'XYVUhY'UbXXX]gW gg]cb']b'h\]g'Wei fgYž'mci 'UfY'U`gc'YbWei fU[YX'hc'Ug\_'ei Ygh]cbg'Uhh\Y'YWhi fYg'UbX'h\YfY'k]``VY'h]a YgYhUg|XY'Zcf'ei Ygh]cbg']b'YUW\'YWhi fY"

HU\_]b[ 'fYgdcbg]V]`]mmZcf'mci f'`YUfb]b[ ž'Vch\ 'h\fci [ \ 'WUgg'dUff]W]dUh]cb''UbX'h\fci [ \ 'mci f'ck b'Wti fgY fYgYUfW\ 'UbX'WUgg'dfYdUfUh]cbž']g']a dcffUbhZcf'XYj Y`cd]b[ 'mci f'k cf\_'g\_]``g'UbX'mci f'UV]`]hmhc'a UbU[ Y dfc'YWg"'8i f]b[ 'h\]g'Wti fgY'k Y'k ]```X]gW gg'YZZYWf]j Y'k Umg'cZcf[ Ub]g]b[ 'mci f'gh Xmhc'YbUV'Y'mci 'hc'[ Yh h\Y'a cghici hcZh\]g'Wti fgY'UbX'gc'h\Uhmci 'WUb'U`gc']XYbh]Zmh\Y'UbU`mh]WUbX'fYgYUfW\'g\_]``g'h\Uhmci 'fY XYj Y`cd]b[ "

±0XYdYbXYbh`YUfb]b[ 'k ]``d`Um'Ub`]bj U`i UV`Y`fc`Y`]b`mci f`gh Xm''5g`k Y```Ug`h\Y`YggYbh]U``fYUX]b[ 'Zcf`h\Y Wći fgYžmci 'g\ci `X`U`gc'i bXYfhU\_Y`mci f`ck bž]bXYdYbXYbhžfYgYUfW\`Ufci bX`hcd]Wg`UbX`Z]`a 'dfUWf]Wfg Wćj YfYX`]b`h\Y`Wći fgY"'9UW\`hcd]WWca Yg`k ]h\`gi [[YghYX`YI hfU`fYUX]b[g`UbX`]Zh\YfY`UfY`dUfh]Wi`Uf`UfYUg cf`hcd]Wg`h\Uhmci `k ci `X``]\_Y`hc'di fgi Y`Z fh\Yfž'd`YUgY`gYY`a Y`Zcf`gi [[YghYX`fYgci fWfg"

 $A \ mUddfcUVX \ 'hc' 'hY UVX \ ]b['']b''h\ ]g''Wci \ fgY']g''VUgYX'cb'a \ m'VY`]YZh\ Uh'ghi \ XYbhg''YUfb''VYghik \ Yb''h\ Ym'UfY UVMjj \ Y`mYb[ U[ YX']b''h\ Y''Wci \ fgY'a Uh'Yf]U'g''' <math>\Rightarrow$  'a m'Yl  $\ dYf]YbWY'U'gi \ WW'ggZ ``'Yj Y'`&'Wci \ fgY']g'cbY'k \ YfY.$ 

 Ghi XYbhg ZYY``h\Uhih\Ym\Wb`XfUk `cb`h\Y]f`ck b`]bX]j ]Xi U``]bhYfYghg UbX`UfYUg`cZYI dYfh]gY`UbX Vf]b[ `h\]g`]bhc`h\Y`WUggfcca `hc`YI d`cfY`UbX`hYghci hbYk `]XYUg`UbX`k Umg`cZh\]b\_]b[ /



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

Gh XYbhgʻUfYʻYl dYWYX`hcʻdi hh\Y]fʻbUa YgʻUbXʻgh XYbhibi a VYfgʻcbʻYj YfmdU[YʻcZh\Y]fʻUgg][ ba Ybhgʻ

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

#mci 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]''h\Ya '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\!''=\maintent{Image} mci
UfY'i bUV'Y'hc'gi Va ]hmci f'Ugg][ ba YbhXi Y'hc'U'ZJi 'hk ]h\'Hi fb]h]b'mci 'a Um'Udd'm\!Zcf'Ub'YI hYbg]cb\!Vi hmci
a i ghfYhJ]b'mci f'h]\!\Yhbi a VYf'\!\Ica '9I hYfbU''Gi ddcfhfU'cb[ 'k ]h\'Ubmch\Yf'fY'Yj UbhXcW a Ybhgt'hc
]bWi XY'Ug'Yj ]XYbW'hc'gi ddcfhmci f'Yl hYbg]cb'Udd']\!\Uh\]cb'''=\maintent{Image} mci 'Ya U]''9I hYfbU''Gi ddcfhmci 'k ]'`
Ui hca Uh\!\WJ'`mfY\W']j Y'U'h\!\\Yhbi a VYf\!\Ica 'Vi h\]Zmci 'hY'Yd\cbY'mci 'k ]'''bYYX'hc'gdY\!\\\Z\\WJ'`mUg\_'Zcf'cbY''
Hi fb]h\!b'U'gc'dfcj ]XYg'i dXUhYg'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk]h\'f''

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

#### @UhY 5ggYgga YbhDYbU`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 Wti fgY'@YUfb]b['A UbU[Ya YbhGmghYa 'f@A GŁ"

 $\label{thm:condition} $$HY^UHY^dYbU^m]g^hY^cgg^cZ)_L^cZ^hY^hcHU^dcgg]VY^aUf_g^Zcf^hYY^HUg_Z^cf^YUW^XUmcf^dUfhhYfYcZhY^kcf_]g^UHY^@UhYbYgg^k]^*]bW^XY^kYY_YbXg^UbX^di_V^]WYc^]XUmg^"HY]g^XcYg^bchUdd^mhc^U'HUg_'hWh]g^UqqYqqYX^Vi_hbc^aUf_]g^Uk_UfXYX"$$$ 

K cf\_'gi Va ]hhYX'Zci fhYYb'fl%( Ł'XUmg'UZhYf'h\Y'Xi Y'XUhY'k ]``VY'a Uf\_YX'UbX'ZYYXVUW\_'dfcj ]XYX'Vi hbc'a Uf\_ k ]``VY'fYWcfXYX"' ₹h\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 h'bc'a Uf\_']g'Uk UfXYX"

K cf\_'gi Va ]hh/X'hk YbhnlcbY'f&&:XUmg'UZhYf'h\Y'Xi Y'XUhY'k ]```bchVY'UWW'dh/X'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]\W'`mZJ]`'h\Y'Wci fgY"

#### GdYWJU`7cbg]XYfUhJcb5dd`JWUhJcbg

Mci 'WUb'Udd`m'Zcf'gdYWJU``Wcbg]XYfUhJcb'k \Yb']``bYgg'cf'ch\Yf'WJfW a ghUbWrg']bhYfZYfY'k ]h\'mci f UggYgga Ybh'dYfZcfa UbWr"

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

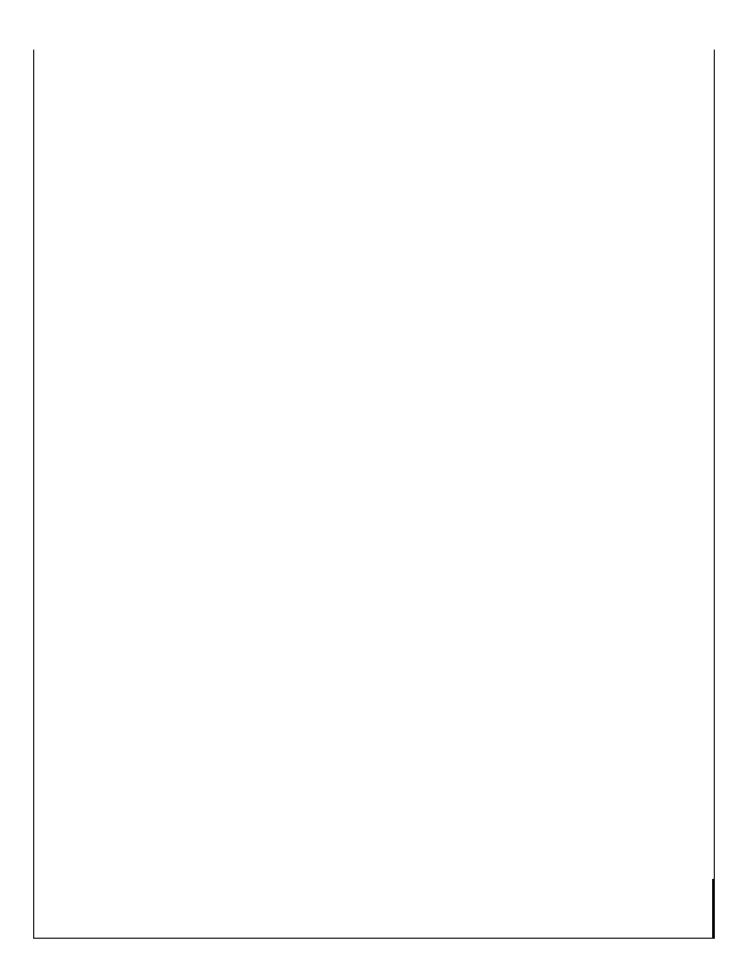
# 7ci fgY GW

J]Yk 'WUgg'h]a YhU

8 UhY	bh
K YY_`%`&*`: YVfi ( A UfWX	:XiWh]cbhch\YWcifgY.gWcdY fUh]cbU`Yfcfh\Yfk\Uhžk\m \ckficZh\]gWcifgYŁ
	Yg`K_Y`HY```fGUfU\`Dc``Ymž'&\$%&Ł
	ŊŪ`fYUX]b[.
	7 cff][ Ubž'H]a ch\m'UbX'K \ ]h\z'DUhf]\\JU f&\$\&\z'''F YUX]b[ 'UVci h: ]`a . 7 f]h\VU` A Yh\cXg'UbX'H\Ycf]\Ygž''7\Udh\Yf'\%cZH\\ : ]`a '9  d\Yf]\Yb\\Y. 5b'\bhfcXi \W]cb\ 6cghcbz A Ugg. 6\YXZcfX#GhA Ufh]bgz''!(')"
	/f <sup>-</sup> fYUX]b[.
'5 ' ggYfi Ugh	\$ 5bXYfghž@YU\`f&\$% Ł"A Ya cfmfg`7\cfi g. Ghcf]Yg'K Y'HY```UbX'GUfU\`Dc``Ymfg`H\Ycfn cZ5i hcV]c[fUd\mž"GYbgYg'cZ7]bYa U *-"

K YY_'*.'-'5df]`'!'%) '5df]`	@YWhifY_	H\Y`BYk `8cW a YbHJfm
	GWYYb]b[	H\Y`H\]b`6`i Y`@]bY`f9ffc``A cff]gž%,, Ł
	F YUX]b[	9ggYbhJU`fYUX]b[.
1	l	

	ŀ
	H\YfY'k]``VY'bc'h hcf]U`h\]g'kYY_Zcf'h\Y K YXbYgXUmWUggYg'XiY'hc'h\Y'5bnUW8UmdiV`]W \c`]XUm''=Zmci 'UfY']b'cbY'cZh\YgY'WUggYg'd'YUgY W\YW_'A ccX'Y'Zcf'UXX]h]cbU`fYgci fWfg'Zcf'mci " Gh XYbhg']b'h\Y'K YXbYgXUmWUggYg'UfY'k Y'Wca Y'!! Vi hbchfYei ]fYX'!!'hc'UhhYbX'U'Hi YgXUmWUgg'h\]g k YY_"  5```gh XYbhg'UfY'fYei ]fYX'hc'fYUX'h\Y'YggYbh]U` fYUX]b['UbX'Uh'YUghcbY'cZ'h\Y'UXX]h]cbU`
	fYUX]b[g:f7\]cbž?UggUV]Ub:YhW£UbX:dcghU WcaaaYkbhcb4Acc&X~Y"



## FYgci fWfg

DfYgWf]VYX F Ygci fWYg

 $9ggYbh]U^{f}YUX]b[$  .

 $\label{thm:converse} $$HY'gYhk YY_mfYUX]b[g'Zcf'h\]g'Wci fgY'UfY'Uj U]'UV'Y'h\fci [\'@Y[Ubhc'j]U'A ccX'Y'!!'d'YUgY'a U_Y'gi fY mci 'Vf]b['Y'YWfcb]Wcf'\UfX'Wcd]Yg'cZh\Y'fY'Yj UbhfYUX]b[g'hc'WUgg'YUW\'k YY_'gc'h\Uhh\Ym'WUb'VY dfcdYf'mX]gW ggYX'UbX'XYVUhYX''$ 

Cb`]bY`WcifgY`fYgcifWY.'5FHG&\$\*%]g`cb`AccX`Y—d`YUgY`Wcbgi`h]hfY[i`Uf`miZcf`]adcftUbh]bZcfaUt]cbUVcihihY`WcifgY"