

# **ARTS2871**

Dck Yf'UbX'Dck YfYggbYgg

HYfa 'H\fYY''##'&\$%-

# 7ci fgY<sup>-</sup>Cj Yfj ]Yk

# GHUZZ:7cbHUWh8YHJ]`g`

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`] <b>m</b>	@cWUhjcb	D\cbY
A Y`Ub]Y`K \]HY		K YXbYgXUmg '\$!%\$.'\$Uaž %'\$!&.'\$dažUbX VmUddc]bhaYbh	A 6%* &	\$&'-',) &'\$(

# GWXcc`7cbHJWhi±bZcfa Uhjcb

GWXcc``cZGcWJU``GWJYbWYg

Fcca '%) -

A cfj Yb 6fck b 7 &\$

Ya U]`. 'gcgg4 i bgk "YXi "Ui

d\cbY. '\$&'-',) '% \$+

# 7ci fgY 8YW] g

7 fYX]hDc]bhg \* \*

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

Gi VYWn5fYU. EaU[a'aYk S`V3`fZdaba'aYk

K \Uhi]g'dck Yf3''K \UhiUfY']rg'YZZYWrg3''K \Uhi]g'dck Yffig'fY`Uh]cb'rc'dck YfYggbYgg3'Dck Yf']g'U Z bXUa YbrU''WcbW'dh]b'rh\Y'gcW]U''gW]YbWYg'''=i]g'U'gc'cbY'cZh\Y'a cghWcbhYghYX'''=b'rh\]g'Wci fgYž'mci 'k]'' Wcbg]XYf'X]ZZYfYbhUddfcUWXYg'rc'dck Yf'Zfca 'rh\Y'dYfgdYWf] Y'cZdck Yffig'fY`Uh]cb'rc'dck Yf'YggbYgg''K Y k]'''Wcbg]XYf'\ck 'dck Yf'UbX'dck Yf'YggbYgg'UfY'i bXYfgrcx'UbX'YI dYf]YbWYX']b'fY`Uh]cb'rc'Wca dUb]cb WcbWfdrg'gi WX'Ug'j ]c'YbWYž'ZfYYXca ž\_bck 'YX[Yžgcj YfY][brmž'VcX]Ygž'WfYUh]j ]hmž'UbX'f][\rangle hg'''

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

%" FYWc[b]gY'\_Ym]ggi Yg']b'h\Ycf]n]b['h\Y']bhYfgYWf]cb'cZdck Yf'k]h\'dck YfYggbYgg

- &" 8 ]qh]b[i]q\ 'VYhk YYb 'X]ZZYfYbhdYfqdYWIj Yq cb 'dck Yf
- ' "DfuWiW fYUX]b[ 'Ug'U'a cXY cZUWij Y 'UbU'miWu`Yb[ U[ Ya Ybi'
- $(\ "5dd`mig\_]`g`UggcV]UhYX`k\ ]h\ `gWkc`Ufmi]bei\ ]fmi]bWi\ X]b[\ 'h\ cgY`fY`UhYX`hc`Wf]h]WU``UbU`mg]gž`Uf[\ i\ a\ YbhUbX`k\ f]hHYb`Yl\ dfYgg]cb$

#### HYUWX]b[ 'GhfUhY[]Yq'

 $H^{g'}WcifqY']g'VUgYX'cb'hY'Zc``ck]b['df]bW]d`Yg.$ 

%"```Hc`WfYUhY``Ub`]bhY``YWhiU``migh]a i``Uh]b[`gdUWY`Zcf`ghiXYbhg`h\UhifYkUfXg`UWh]jY`Yb[U[YaYbhk]h\W\U``Yb[]b[`WcbWYdhg

&"····HcfYUXdf]a UfmiYI hq'k ]h\ci hi\Y'i qY'cZqYWbXUfmgci fWgž'Wba a YblUf]Yg'cf'X][ YglYX'qi a a Uf]Yg"

'"```Hc`ZcghYf`X]U`c[iY`]b`UbX`cihcZWUgg`VYlkYYb`ghiXYbhgž`UbX`k]h\`h\Y]f`hYUW\Yfg`]b`cfXYf`hc`WfYUhY`U Wcaaib]micZ`YUfbYfg

(""Hc fYUX [YbYfci g`m

) "·····Hc·WfYUhY·U·WccdYfUh]; Y··YUfb]b[ ·Ybj ]fcba Ybh

\*"····Hc:YbWci fU[Y:ghi XYbhifYgdcbg]V]`]lmihc:h\Y:VfcUXYf:UWJXYa ]WWca a i b]lm

 $H\setminus g'WcifgY'k]``VY'U'fkc!\cif``YWfifY'UbX'cbY!\cif`fifncf]U`''$ 

#### @YWhifYq

H\Y``YWi fYg`k]```WcaV]bY`h\Y`hYW\b]eiYg`cZU`hfUX]h]cbU```YWi fY`k]h\`h\Y`]bhYfUWjcb`UbX`X]U`c[iY`hmd]WU``m UggcWJUhYX`k]h\`hincf]U`g"``Ghi XYbhg`UfY`YbWci fU[YX`hc`dUfh]WJdUhY`UWhj Y`m]b``YWhi fYg`VmeiYgh]cb]b[`UbX WcaaYbh]b[`cb`h\Y`Wci fgY`aUhYf]U`"``@YWhi fYg`k]```fY`mcb`hYIhiU``WcaaYbhUfmž`Zj`a`UbX`j]giU``]aU[YfmhcYId`]WUhY`h\Y`WcbWYdhq`Zci bX`]b`h\Y`fYUX]b[g"

## Hi hcf]U`g

 $\label{thm:continuity} Hi hcf]U`g`k\ ]```VY`i gYX`hc`cf[\ Ub]nY`ga \ U```[\ fci\ dg`hc`YghUV`]g\ `U`Wc```UVcfUh]j\ Y`k\ cf\_]b[\ `Ybj\ ]fcba\ Ybhk\ \YfY\ ghi\ XYbhg`WUb``YUfb`Zfca \ `cbY`Ubch\Yf''$ 

## •

#### FYUX]b[ Ei Ygh]cbg

#### .

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# 5ggYgga Ybh

#### 5 hmYbXUbWY Dc`]Wm

#5 'fk ]g'Wci fgY'mci 'UfY'Yl dYWYX'lc 'UfHY'bX'Uh'YUgh', \$1 'cZWUggYg'"H\]g'a YUbg'h Uhmci 'a i gh'UfHY'bX '%\$#\&'cZhi hcf]U'g"'=Zmci 'UfHY'bX''Ygg'h\Ub', \$1 'cZmci f'WUggYg'mci 'a UmVY'fYZ gYX'Z]bU`'UggYgga Ybh''H\]g a YUbg'h\Uh'YUgh', \$1 'cZdcgg]V'Y'WUggYg'mci f'Z]bU`'UggY[ba Ybha UmfYWY]j Y'U a Uf\_'cZnYfc": cf'h\Y'di fdcgY'cZUfHY'bXUbW'a cb]hcf]b[ ž'h\Y'Z]bU`'UggYgga Ybh'Zcf'h\]g'Wci fgY']g'h\Y K cf\_Vcc\_'k cff\\') \$1 'cZmci f'cj YfU`''[ fUXY'Zcf'h\]g'Wci fgY"'H\]g']g'h\Y'UggYgga Ybh']hYa 'h\Uhk]`'VY [ fUXYX'UhnYfc']Zmci 'Xc'bcha YYhf\Y'UfHYbXUbW'fYei ]fYa Ybh'Zcf'h\]g'Wci fgY"

#### 5ggYgga YbhHUg\_g

5ggYgga Ybh'hUg_	K Y][\h	8i Y'8UHY	Gh XYbh@YUfb]b[ Ci hWca Ygʻ5ggYggYX
K cf_Vcc_	) \$1	K YY_'* 'UbX'K YY_'%\$	&Ž Ž(
; fci d': UVJ]HUH]cb'	&\$ı	K YY_g") "hc"-	%ž&
9ggUmi	' \$ı	&) #%#&\$% `%%) - `DA	% <u>ž&amp;</u> ž(

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

5ggYgga Ybh% K cf\_Vcc\_

GhUfh XUhY.

@Yb[h\.)\$\$ k cfXg dYf k YY\_

**8YHJ**]`g. `Ghi XYbhg`k ]```dfYdUfY`k f]hhYb`Ybhf]Yg`cZ%l&`dU[ Yg`cb`h\Y`Ugg][ bYX`fYUX]b[ g`YUW\`k YY\_"`H\Y k cf\_`k ]```VY`gi Va ]hhYX`UbX`UggYggYX`dYf]cX]\WJ``mh\fci [ \`h\Y`hYfa ": YYXVU\W\_.`K f]hhYb`\\cappaca a Ybhg`UbX [ fUXYX`U[ U]bghU`\Wf]hYf]U`g\YYh'

5XX]hcbU`XYhJ]`q.

K cf\_Vcc\_5ggYgga Ybh

H\YfY UfY k c gi Va ]gg]cbg Zcf h\Y k cf\_Vcc\_.

% K YY\_'\* 'f**A cbXUmž**'& C WcVYf'& \$\% L ''D \YUgY'gi Va ]hmci f'k cf\_Vcc\_'Ybhf] Yg'Zcf'K YY\_g'& z'' z'( 'UbX') Zcf'[ fUXYX'ZYYXVUW "

&ŁK YY\_'%\$`f**A cbXUmž**'% 'Bcj Ya VYf'&\$% Ł'D`YUgY'gi Va ]hmci f'k cf\_Vcc\_'Ybhf]Yg'Zcf'K YY\_g'\*z'+z', 'UbX - 'Zcf'[fUXYX'ZYYXVUW\_

Mci 'UfY'fYei ]fYX'hc'dfYdUfY'U'k cf\_Vcc\_'YblfmYUW\'k YY\_"'''Mci f'k cf\_Vcc\_g'k ]```fYWcfX'mci f'fYUW]cbg'hc h\Y'fYUX]b[ gž'UbX'dcgg]V'mž'mci f'fYgdcbgYg'hc'X]gW gg]cbg']b'`YWhi fYg'UbX'hi hcf]U'"''H\Y'k cf\_Vcc\_']g ]bhYbXYX'Ug'U'hcc''h\Uhk ]``'U'`ck 'mci 'hc'fYZYWhcb'mci f'h\ci [\hg'Ug'h\YmW\Ub[Y'UbX'XY] Y'cd'cj Yf'h\Y gYa YghYf"''K Y'UfY'dUfh]W'`Uf'm]bhYfYghYX']b'\ck 'h\Y'fYUX]b[ g'W\U``Yb[Y'mci f'dfYj ]ci g'Uggi a dh]cbgž'k \Uh h\YmYbWci fU[YX'mci 'hc'h\]b\_'UVci h]b'bYk 'k Umgž'UbX'k \Uhmci 'dYfWY]j Y'h\Y]f'`]a ]hg'hc'VY"'F YUX]b[']gb'h

Gi Va ]gg]cb bchYg.H\]g gi Va ]gg]cb k ]```]bWi XY

 $\label{thm:continuous} \begin{tabular}{ll} Hi & fb & fb & gYM &$ 

5ggYgga Ybh&; fci d: UWj ]hUhjcb

GhUfh'XUhY.

@Yb[h\. &\$ a ]bi hYg fa Ul ]a i a Ł

8 YHU]`g. `Ghi XYbhg`k]```XYg][ b`Ub`]b!WUgg`UWhjj ]hmf&\$`a ]b\LinkUhVf]b[ g`]bhc`fY`]YZUb`]a dcfHubhUgdYWhcZh\YhYl hi bXYf`Wcbg]XYfUhjcb"`H\Ymk]```VY`UggYggYX`cb`h\Y]f`UV]`]hmhc`k cf\_`Wc```UVcfUhjj Y`mUbX`hc`Yl Ua ]bY`h\Y dfUWhjWU``]a d`]WUhjcbg`cZh\Y`fYUX]b[ `Zcf`Yj YfmXUm`]ZY"`Ghi XYbhg`k]```VY`fYei ]fYX`hc`dUfhjWjdUhY`]b`cbY

.

**BGHFI7H€BG**.

 $=XYbh]Zm\&cf''X]gh]bWhYUfb]b[YIdYf]YbWYg'mci'\UX']b'h\Y'WcifgY''$ 

: cf'YUWX'cbY.

%"8YgWf]dh]cb. ``9ghU^`]g\ 'h\Y`WcbhYI hZcf`h\]g``YUfb]b[`YI dYf]YbWY`fkY"["žk\Uhk Ug`h\Y`hcd]WcZghi Xmžk Ug ]hUb`UggYgga YbhHUg\_`cf`Ub`YI dYf]YbWY`h\Uhmci `\UX`]b`WUggžYhW\!"`=b`g\cfhžVf]YZmhY```i g`k\Uh \UddYbYXžVi h\_YYd`]hg\cfh

&"5bU`mg]g#5dd`]WUh]cb. "Bck žhY``i g'k \mih\]g'Yl dYf]YbW'k Ug']a dcftUbh'Zcf'mci "''l g]b[ 'h\Y'Ug][ bYX fYUX]b[ žhY``i g'\ck ']h\\Ug'XYYdYbYX'mci f'i bXYfghUbX]b[ 'cZdck Yf']b'mci f'X]gW]d`]bUfm'WcbhYl h''< YfY'UfY gca Y'dfca dhg.

- HY```i g`k \Uh'mci f`dfYj ]ci g`dYfgdYWhjj Yg#bg][\hg#Uggi a dhjcbg`k YfY"\``H\]g`]g`Ub`cddcfhi b]hmhc YghUV`]g\`mci f`df]cf`\_bck `YX[ Y`UbX`YI dYf]YbWY"
- HY``i g'k \UnbYk ']XYUg'cf']bg][\hg'W\U``Yb[YX'mci f'dYfgdYWh]j Y'cf'Uggi a dh]cbg"''Hfmhc
  Y'UVcfUhY'cb'h\Y'bUhi fY'cZh\YgY'YI dYf]YbWrgž']XYUg'UbX'cVgYfj Uh]cbg'UbX'hfmhc'Ufh]W'`UhY'k\Uh
  mci 'Zci bX'WcbZ g]b[ž]bgd]f]b[žX]ZZ]W'`hcf']bhYfYgh]b[žUbX'k\m'

dfcWrgg'Ug'h\Y'Wci fgY'\Ug'dfc[fYggYX'Vm]bhYffc[Uh]b['mci f'dfYj]ci g'Uggi a dh]cbg"

8Yj Y`cda YbhcZ'⇒XYUg"'H\]g'UXXfYggYg'k\Yh\Yf'mci '\Uj Y'Wcbg]XYfYX'\ck 'mci f']XYUg'UVci hdck Yf'\Uj Y W\Ub[YX'gdYW]Z]WU``m]b'fY`Uh]cb'hc'mci f'X]gW]d`]bY"''\Vci 'k]```VY'UggYggYX'cb'\ck 'mci f'i bXYfghUbX]b['cZ dck Yf'UbX'dck Yf'YggbYgg'\Ug'XYj Y`cdYXž'WUf]Z]YX'cf'dfc[fYggYX"

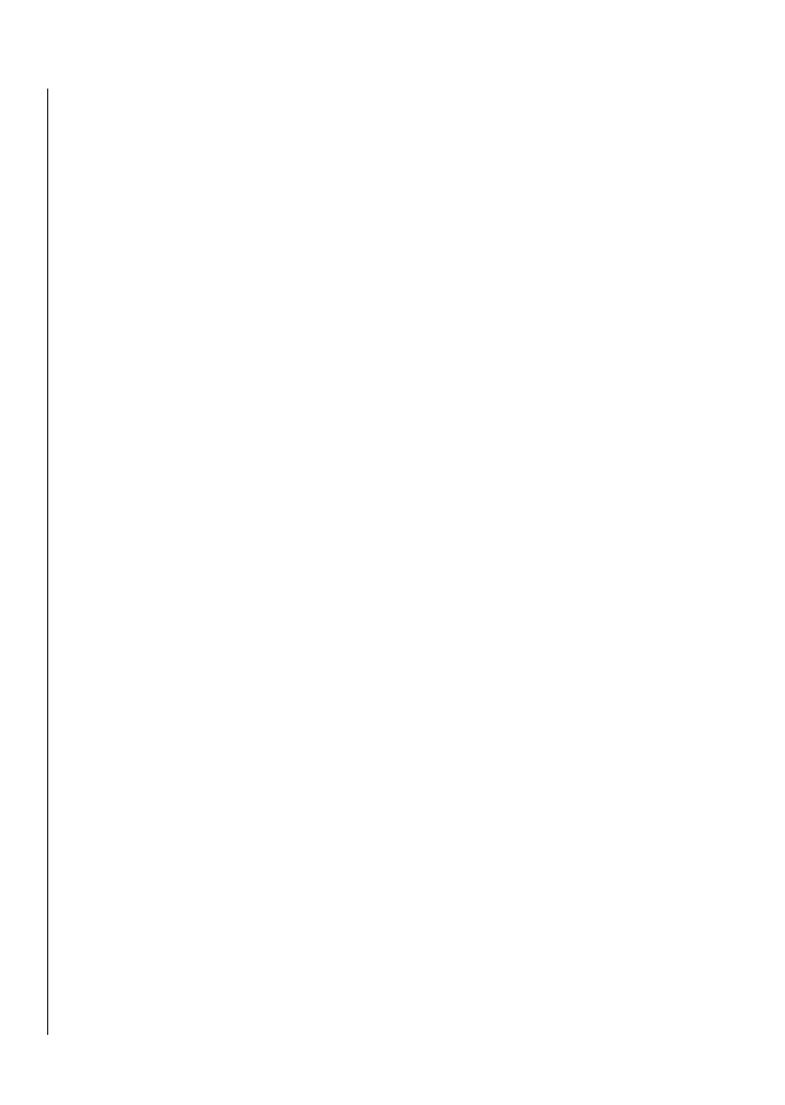
 $\label{eq:family} FYZYfYbW] b[""H\] g"fYei"] fYg"mci "hc"fYZYfYbW" dUggU[Ygž'h\Ya Yg"UbX"] XYUg"UWW fUhY`m" \\$ 

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	Hi hcf]U`	G\cdYž>UbYh< ]bgcb":"GYdUfUhY'Vi h'9ei U`. 8 i f_\Y]a fig'F YgdcbgY'hc'h\Y'K ca Ub'E i Ygh]cb"" GcW]c`c[]\WJ`=bei]fm*("%f\%-(\L'&' -' *"  Ga ]\h\z'D\]`]d":"8 i f_\Y]a 'UbX'7f]a ]bc`c[m F Y\\cbght bghfi \W]b['h\Y'@Y[U\\m'":5i ghfU`]\Ub\' BYk NYU`UbX'>ci fbU`cZ7f]a ]bc`c[m(\%" 'f&\\$, \L '''-'(("  J Y]\\X\z'? YbbYh\":"Gc\\J\'Gc`]XUf]\m'UbX'h\Y'Dck Yf'cZ 7 cbhfU\\"">ci fbU`cZ@Uk 'UbX'Gc\\J\'m\', "&'f\\\$\\\L \"-\&\(")
K YY_'(.'+'C WcVYf'!'%%C WcVYf	@YWhifY Hihcf]U` FYUX]b[	K YY(.; "K ": ' <y[y`.'a "'f%="" ":="" "k="" \$+@'+\xydybxybw''ubx="" ''ci="" '@cfxg\]d'ubx="" 'yx"="" **********************************<="" ++'0%="" 5g'gwxyxi="" 6cbxu[y']b'bzw="" 7="" 8ydybxybw'czgy'z="" <y[y'z;="" ]'yf2"'ci="" ]fyx'f="" a="" a'ayk="" a_="" axe="" b[df="" b]j="" cbgw]ci="" f="" fffubg":5"j"="" gbygg.="" td="" ughyf'ubx'g'uj="" w="" y="" yei="" yfg]lmdfyggz'dd"="" yux]b[="" zcfx'i="" zcfx.=""></y[y`.'a>

c.7



	D]b_UfXžHYffm":" <y[y``ubx`aufi"":h\y`cizcfx <ubxvcc_'czh\y`<]ghcfmcz9h\]wg":cizcfx Ib]jYfg]lmiDfYggž&amp;\$%":</ubxvcc_'czh\y`<]ghcfmcz9h\]wg":cizcfx </y[y``ubx`aufi"":h\y`cizcfx 

	Hi hcf]U` 5ggYgga Ybh <ca cf_<="" th="" yk=""><th>K \]a ghYfžGUa ž'UbX'GWchi@Ug\"'A Ul 'K YVYfž F UhJcbU']hm'UbX'A cXYfb]hm'' &lt; cVc_Yb. F ci hYX[ Yž HUmcf'UbX': fUbWjgž&amp;\$%( " ; fci d': UWj]hUhJcbg'WcbhJbi Y" : ]fghik cf_Vcc_'gi Va ]gg]cb. "K YY_g'&amp;ž' ž'(ž'UbX')  8 i Y'8 UhY. "A cbXUmž'C WcVYf'&amp;%ghž'- Ua 'fHi fb]hJbŁ 5 ZhYf'hi hcf]U'h\]g'k YY_ž'Wca d'YhY mci f'UZhYf!WUgg'k cf_Vcc_'Ybhfmhc'WcbWi XY'K YY_ * 'fK YVYfŁ"</th></ca>	K \]a ghYfžGUa ž'UbX'GWchi@Ug\"'A Ul 'K YVYfž F UhJcbU']hm'UbX'A cXYfb]hm'' < cVc_Yb. F ci hYX[ Yž HUmcf'UbX': fUbWjgž&\$%( " ; fci d': UWj]hUhJcbg'WcbhJbi Y" : ]fghik cf_Vcc_'gi Va ]gg]cb. "K YY_g'&ž' ž'(ž'UbX')  8 i Y'8 UhY. "A cbXUmž'C WcVYf'&%ghž'- Ua 'fHi fb]hJbŁ 5 ZhYf'hi hcf]U'h\]g'k YY_ž'Wca d'YhY mci f'UZhYf!WUgg'k cf_Vcc_'Ybhfmhc'WcbWi XY'K YY_ * 'fK YVYfŁ"
		6YZcfY``YWifYz`dfYdUfY mcif`VYZcfY!WUgg`kcf_Vcc_`YbHmiZcf`KYY_`+ fGW.a]Ht!"
K YY_'+.'&, 'C WcVYf'!'% Bcj Ya VYf	@YWhifY FYUX]b[	K YY_`+.`7 Uf``GW\a ]th`9bYa ]Yg`UbX`GtUhYg F Yei ]fYX`F YUX]b[
		GVW.a ]hhž7Uf`f&\$\$+'O%&+OEFZW5a`UWbfaXfZW Ba{f[US^z 7\]WU[c.``Ib]jYfg]hmcZ7\]WU[c`DfYggž dd"`%!*\$"
		Gi dd`Ya YbhJfmF YUX]b[ fF YWca a YbXYXŁ! 5j U]`UV`Y'j ]U'@Y[ Ubhc
		6YbXYfg_mz~cgYd\`K "`K "`"7 Uf`GVXa ]thUbX`t\Y K Y]a Uf`F ][ \th"`H\Y; Yfa Ub`F ][ \th]b`t\Y`K Y]a Uf F Ydi V`]W`Gti X]Yg`]b`t\Y`< ]gtcfmcZ; Yfa Ub 7 cbgYfj Ut]ga z`B Ut]cbU`]ga z`UbX`5bt]gYa ]t]ga " 6Yf[ \U\b`6cc_gz`&\$%( "`&*, -&-\$"`
		; i``]ž'6fi bc"' <iaub]hm'ubx'h\y'9bya m'<ck'9h\]wg<br="">7Ub'F]X'Dc`]h]Wg'cZJ]c`YbWY"'BYk'Mcf'DU`[fUj Y AUWa]``Ub'I Gž'&amp;\$%("'</iaub]hm'ubx'h\y'9bya>
		?Y``mž8ibWUb"'H\Y'GKURY'cZK\Y'Dc`]r]WU`. 7cbWYdr]cbg'cZDc`]r]Wg'UbX'K\Y'GKURY']b'K\Y H\ci[\hcZAUI'KYVYfž'7Uf`'GW\a]Hrž'UbX':fUbn BYiaUbb"'CIZcfX/BYk'Wcf'CIZcfX'Ib]jYfg]hm DfYggž'&\$\$'"''
		A ci ZYž7\UbHU`"`H\Y`FYhifb`cZh\Y`Dc`]h]WU`" @cbXcb/BYk `Mcf`JYfgcž'%-' "'
		G`ca dž; UVf]Y``U"'7 Uf`'GW\a ]lhiUbX'lh\Y'Dc`]ljWg'cZ <cglj`]lmžj]c`ybwy'ubx'hyffcf"'@cbxcb.'du`[ fuj="" y<br="">A UWa ]``Ub'l ?ž'&amp;\$\$-"'</cglj`]lmžj]c`ybwy'ubx'hyffcf"'@cbxcb.'du`[>
		HUi VYgž'>UWcV"'Hc'7Uf'GWXa]hr@YhhYfg'UbX

	Hi hcf]U` C b`]bY'5Whj ]hm < ca Yk cf_	FYZYWIJcbg" BYk "Mcf "7 c`i a V]U'I b]j Yfg]lmiDfYggž&\$%"  K ]'XYžA UfWXY" "A YYIJb[ 'C ddcg]hYg. 'H\Y'Dc`]hJWU`H\Yc`c[]Yg'cZK U'hYf'6Yb'Ua]b'UbX'7 Uf'GWXa]hti" D\]'cgcd\mUbX'F\Yhcf]W(("("f&\$%\L" *' -' , %" ; fci d: UWJ'hUrJcbg WcbhJbi Y" GYY'A ccX'Y'Zcf'8YhU]`g"  5ZYf'h hcf]U''h\]g'k YY_ž'Wca d`YhY mci f'UZhYf!WUgg'k cf_Vcc_'Ybhfmhc'WcbWi XY'K YY_+'fGWXa]ht!"  6YZcfY''YWi fYž'dfYdUfY mci f'VYZcfY!WUgg'k cf_Vcc_'YbhfmZcf'K YY_', f5fYbXht"
K YY_', .'( 'Bcj Ya VYf'!', Bcj Ya VYf	@YVVni fY	K YY_', .' <ubbu\'5fybxh'f [="" yyg'ubx<br="" yz="">F ][ \hg'fBc  Ya VYf'*Ł</ubbu\'5fybxh'f>
	F YUX]b[	F Yei ]fYX'F YUX]b[ <ubbul\'5fybxhff% "''="" %@'h\y'8yw]by'czh\y="" &*"&f&\$\mathbb{\text{n}}\text{y}'''-\mathbb{\text{y}}\text{y}''''="" '5bx'h\y'hfux]h]cb'cz="" 'mcf="" ('0%)="" (+"&f&\$\$&&&&+'!'%"'="" (b)="" -="" .="" 5fybxhz'<="" 5j="" 6fubb][="" 6yb\uv]vz'gymu"'h\y'f][\hg'czc="" 7="" <cb][="" <ufwci="" [\h'eau[s^d="" [e_z'byk="" [i="" \text{y}''''''''''''''''''''''''''''''''''''<="" ]'.="" ]bc'c[mubx';="" ]c'ybw'''''<agd="" ]u'@y[ubhc="" a="" axfafs\ffsds`="" b]]="" b]j="" buhcb ghuh'ubx'h\y'9bx'czh\y'f][\hg'cza="" byk="" c="" ci="" dd'ya="" dy['e="" f]a="" fhz'dd"'&*+!'\$&"="" gh]by"'6ymcbx'h\y'6ubu']mcz9j="" gi="" h\yfg.'5']ybgz'f="" k="" s^ax;`fwd="" sf[a`s^3="" td="" u]'uv'y'j="" ua="" ub']b'fzwa="" ubbu\"''f="" ubbu\"'?="" ubz'5i="" uf'a="" ufl="" vf[x[y="" vf[x[y'i="" w\""'8]zyfybwyg="" wewsdjzł="" xs[db'&'"%'f%-*-ł'%']')"="" ybcw]xy'''%ghyx"'c="" ybhufmf="" ybxyxł'!="" yfg]mdfyggz'&\$\$(="" yfg]mdfyggz'&\$%="" yg]xybhg'ubx'7]h]nybg"'7="" yghyfb'dc']h]wu'h\ci="" yux]b['ff="" ywca="" yzyw]cbg'cb'j="" z'6cbb]y"'"5fybxhcb'h\y'7="" zcfx="" zcfx.=""  =""></ubbul\'5fybxhff%>

K YY_``%%Bcj Ya VYf'! %) Bcj Ya VYf	Hi hcf]U` C b`]bY`5Wfj ]hm <ca @ywi="" cf_="" f="" fy="" th="" yk="" yux]b[<=""><th>A Ugʻjbzʻʻ ja VYFmʻʻʻH\Yʻʻ YbXYf BYİ HÜʻʻ Ya jbjgaʻcz &lt; UbbU\ 5fYbXhʻʻ &lt; mdUhjU &amp; ʻʻ f&amp;\$% Łʻ), ) = *\$%′  A cfi nnjžBcfa Uʻʻ 'UjfYʻʻGdYU_jb[ 'thfci [\'thY A Ug_ ' &lt; UbbU\ 5fYbXhUbX 'thY`Dcʻjh\vgʻczGcv\lu` = XYbhjmfʻ=h UvUžB 'M. '7 cfbY`ʻl bjj YfgjmiDfYggž &amp;\$\$\$*′  Ga YYlcbž &gt; cY'ʻʻ fca '5f]grchY rcʻ5fYbXhʻ5 D\Ybca Ybcʻc[ ]wUʻʻ9l dʻcfUhjcb cz; cfa gʻcz ? bck 'YX[ YʻUbX DfUvijWi' jb thY' 7 cbYl hcz 7\]X DfchYwijcb 'GcWluʻ K cf_jbʻthYʻl ? ''' Ei UʻjhUhj Y GcWluʻ K cf_š*Y6f8\$%+Ł 'W( = &amp;, ''' fci dʻ; UWjjhUhjcbg Webhjbi Y'' GYYʻA ccXYʻZcf8YhUjʻgʻ′ 5ZYfth tcfjUʻth\jgʻk YY_ZWca dʻYhY mci fʻUZhYf!WUggʻk cf_Vcc_Ybhfmhc WebWi XYʻK YY_, 'fbfybXht²</th></ca>	A Ugʻjbzʻʻ ja VYFmʻʻʻH\Yʻʻ YbXYf BYİ HÜʻʻ Ya jbjgaʻcz < UbbU\ 5fYbXhʻʻ < mdUhjU & ʻʻ f&\$% Łʻ), ) = *\$%′  A cfi nnjžBcfa Uʻʻ 'UjfYʻʻGdYU_jb[ 'thfci [\'thY A Ug_ ' < UbbU\ 5fYbXhUbX 'thY`Dcʻjh\vgʻczGcv\lu` = XYbhjmfʻ=h UvUžB 'M. '7 cfbY`ʻl bjj YfgjmiDfYggž &\$\$\$*′  Ga YYlcbž > cY'ʻʻ fca '5f]grchY rcʻ5fYbXhʻ5 D\Ybca Ybcʻc[ ]wUʻʻ9l dʻcfUhjcb cz; cfa gʻcz ? bck 'YX[ YʻUbX DfUvijWi' jb thY' 7 cbYl hcz 7\]X DfchYwijcb 'GcWluʻ K cf_jbʻthYʻl ? ''' Ei UʻjhUhj Y GcWluʻ K cf_š*Y6f8\$%+Ł 'W( = &, ''' fci dʻ; UWjjhUhjcbg Webhjbi Y'' GYYʻA ccXYʻZcf8YhUjʻgʻ′ 5ZYfth tcfjUʻth\jgʻk YY_ZWca dʻYhY mci fʻUZhYf!WUggʻk cf_Vcc_Ybhfmhc WebWi XYʻK YY_, 'fbfybXht²
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# FYgci fWyg

#### DfYgWf]VYX F Ygci fWYg

 $Gh XYbhg `UfY `fYei ]fYX `hc `fYUX `h\Y `fYUX]b[g`Wcad]`YX`]b `h\Y `5FHG\&, +%Gh Xm?]h `lh' H\]g`_]h]g`Uj U]`UV`Y `Zcfdi fW.UgY`Zfca `h\Y `IBGK `6cc_g\cd"$ 

 $\label{limit} D`YUgY`Vf]b[\ 'mci\ f`5FHG\&,\ +\%Ghi\ Xm'?\ ]h'hc`5@@`7`UggYg"`Mci\ f`ghi\ Xm'_]h']bWi\ XYg`U`WcdmcZh\]g Wci\ fgY`ci\ h`]bY"$ 

FYWca a YbXYX FYgci fWyg

B#5

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

Ghi XYbhiZYXVUW\_k]``VY`[Uh\YfYX`h\fci [\a m9I dYf]YbWr`gi fj Ymgž'UbX`mci `k]``VY`[]j Yb`cddcfhi b]hjYg h\fci [\ci hh\Y`gYa YghYf`hc`[]j Y`]bZcfa U``ZYYXVUW\_"'H\]g`Wci fgY`fYWY]j YX`YI W```YbhZYYXVUW\_'Zfca ``Ugh mYUffig`Wc\cfhcZghi XYbhg`]b`&\$% "'H\Yma UXY`rk c`]a dcfhUbhgi [[Ygh]cbg`h\Uh=\Uj Y`hU\_Yb`cb`VcUfX.

%"5ggYgga Ybh'Ghfi Whi fY'! "=\Uj Y'a cX]ZJYX"h\Y'UggYgga Ybh'ghfi Whi fY'hc'UWWca a cXUhY'h\Y'' Ž'WU'YbXUf"

&"'5bbci bWa Ybhg'!'=k]``i d`cUX'j]XYc'gY[a Ybhg'hc'A ccX`Y']b'cfXYf'hc'UXXfYgg']ggi Yg'fY`UhYX'hc UggYgga Ybh'UbX'Wci fgY'Vi q]bYgg"'H\]g'k]``[]j Y'i g'a cfY'ha Y']b'`YWi fYg'hc'X]gW gg'Wci fgY'WcbHYbh'

=j Yfma i W. 'UddfYVJUhY 'h. ]g 'ZYYXVUW\_ž'UbX ``cc\_'Zcfk UfX 'hc']a d`Ya Ybh]b[ 'h. YgY'gi [ [ Yg]cbg']b '&\$% "'6Ygh k ]g\Yg 'Zcf'h. Y 'bYk 'hYfa "

Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g

Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g

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

\_Zmci YbWci bhYf'U'dfcV`Ya 'k \Yb'UhYa dhJb[ 'hc'gi Va ]hmci f'Ugg][ ba Ybhh\fci [ \ 'Hi fb]hJbž'd`YUgY
hY`Yd\cbY'9| hYfbU``Gi ddcfhcb'-', ) '' ' ' %cf'Ya U]`'h\Ya 'cb'Y! hYfbU`hY`hgi ddcfh4 i bgk "YXi "Ui '"'Gi ddcfh
\ci fg'UfY', .\$\$Ua '-'%\$.\$\$da 'cb'k YY\_XUmg'UbX'-.\$\$Ua '-') .\$\$da 'cb'k YY\_YbXg'fl \*) 'XUmg'U'mYUft'' =Zmci
UfY'i bUV`Y'hc'gi Va ]hmci f'Ugg][ ba YbhXi Y'hc'U'ZUi 'hk ]h\'Hi fb]hJb'mci 'a Um'Udd'mZcf'Ub'Y! hYbg]cbžVi hmci
a i ghfYhU]b'mci f'hJW\_Yhbi a VYf'Zfca '9! hYfbU``Gi ddcfhfU'cb[ 'k ]h\'Ubmch\Yf'fY`Yj UbhXcW a Ybhgt'hc
]bWi XY'Ug'Yj ]XYbW'hc'gi ddcfhmci f'Y! hYbg]cb'Udd`]WUhJcb'' =Zmci 'Ya U]`'9! hYfbU``Gi ddcfhmci 'k ]``

#### 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'

⇒ Uddfcdf]UhY 'dUfUd\fUg]b[...7\Ub[]b[ 'U'ZYk 'k cfXg'UbX'd\fUgYg'k \]'Y 'a cghmfYhJ]b]b[ 'h\Y'cf][]bU` ghfi Wh fY 'UbX#cf'dfc[fYgg]cb'cZ]XYUg'cZh\Y'cf][]bU'žUbX']bZcfa Uh]cb'k ]h\ci hUW\_bck `YX[Ya Ybh'H\]g'U`gc Udd`]Yg']b'dfYgYbhUh]cbg'k \YfY'gca YcbY'dUfUd\fUgYg'Ubch\Yf'g']XYUg'cf'k cfXg'k ]h\ci hWfYX]hUbX'hc d]YW]b[ 'hc[Yh\Yf'ei chYg'UbX'dUfUd\fUgYg']bhc'U'bYk 'k \c`Yžk]h\ci hUddfcdf]UhY'fYZYfYbW]b[ "

7 c``i g]cb. 'k cf\_]b[ 'k ]th 'cth Yfg'Vi hidUgg]b[ 'cZZth Y 'k cf\_'Ug'U'dYfgcb'g']bX]j ]Xi U``k cf\_"'7 c``i g]cb'U`gc ]bWi XYg'dfcj ]X]b[ 'mci f'k cf\_'thc'Ubcth Yf'ghi XYbh'VYZcfY'th Y'Xi Y'XUHYZcf'Zcf'th Y'di fdcgY'cZth Ya

- i bXYfgfUbX mci f'f][\hg'UbX'fYgdcbg]V]`]hJYg'Ug'U'gh XYbhUhl BGK
- VY`Uk UfY`cZd`U[]Uf]ga ž`Wcdmf][\hz'l BGK `Gh XYbh7cXY`cZ7cbXi WhUbX`5VWWdhUV`Y`l gY`cZ I BGK `=\forall H`F Ygci f\W\g`Dc`]\m\m
- VY 'Uk UfY 'cZh\Y 'ghUbXUfXg 'cZVY\Uj ]ci f'Yl dYWYX 'cZYj YfmcbY ']b 'h\Y 'l BGK 'Wca a i b]hm
- `cWUHY 'gYfj ]WYg'UbX ']bZcfa UH]cb'UVci hI BGK 'UbX'I BGK '@]VfUfm

Gca Y'cZh\YgY'UfYUg'k]``VY'ZJa]`]Uf'hc'mci žch\Yfg'k]``VY'bYk"'; U]b]b['U'gc`]X'i bXYfgHJbX]b['cZU``h\YfY`UhYX'UgdYWng'cZ9@+69'k]``\Y`d'mci 'a U\_Y'h\Y'a cghcZmci f'ghi X]Yg'Uh'l BGK "'\\hd.#gi VYWn[i]XYg"`]VfUfm'i bgk "YXi "Ui #\`]gY#UVci hY`]gY

5 WUXYa ]W±bZcfa Uhjcb