

7ci fgY'Cj Yfj]Yk

GHJZ7cbHJWh8YHJ]`g

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`]m	@cWUhjcb	D\cbY
5#DfcZ5bXm; Uc	Li Ygcb["[Uc4 i bgk "YXi "Ui	6mUddc]bha Ybh	; && A cfj Yb 6fck b 6i] X]b[

5Xa]b]ghfUhcfg

B Ua Y	9a U]`	5j U]`UV]`]m	@cWJhjcb	D\cbY
DfcZYggg]cbU` 91 dYf]YbW/ K cf_d`UW/ +bHY[fUHYX @YUfb]b[`fK +@Ł	dfcZYgg]cbU`YI dYf]YbW'4 i bgk "YXi "Ui	Dcghei Yf]Yg'cb h\Y'Wci fgY'Ybei]fm Zcfi a 'cb'A ccX'Y cf'Ya U]' hc UffUb[Y'Ub Uddc]bha Ybh	A cfj Yb 6fck b 6i] X]b[ž @ck Yf ; fci bX	

GWXcc``7cbHJWh'±bZcfa Uh]cb

GW.cc`cZ9Xi WUhcb

5fhgž:8Yg][b:UbX:5fWX]hYWhifY

; fci bX': `ccfž'A cfj Yb'6fck b'6i]`X]b['fl &\$Ł

H. 'Ž * %'f&Ł'-',) '%-++

9. YXi WUhjcb4 i bgk "YXi "Ui

K. `\hdg.#kkk"Ufhg"i bgk "YXi "Ui #YXi WUhjcb

5W_bck `YX[Ya YbhcZ7ci bhfm

 $\label{eq:localized-loca$

 $\label{eq:continuous} \begin{array}{ll} \text{$\stackrel{\cdot\cdot}{\to}$ U[Y'WciftYgmicZh\Y'CZh\Y'Dfc'J]WY!7\lubWY``cf'$$$ bX][Ybcig']$$ Ybcig'ghfUhY[m] $$ $$ U[Y'WciftYgmicZh\Y'CZh\Y'Dfc'J]WY!7$$ $$ U[Y'WciftYgmicZh\Y'CZh\Y'Dfc'J]WY!7$$ $$ U[Y'WciftYgmicZh\Y'CZh\Y'Dfc'J]WY!7$$ $$ U[Y'WciftYgmicZh\Y'CZh\Y'Dfc'J]WY!7$$ $$ U[Y'WciftYgmicZh\Y'CZh\Y'Dfc'J]WY!7$$ $$ U[Y'WciftYgmicZh\X'Ch'Zh\Y'Dfc'J]WY!7$$ $$ U[Y'WciftYgmicZh\X'Ch'Zh\Y'Dfc'J]WY!7$$ $$ U[Y'WciftYgmicZh\X'Ch'Zh\X$

7ci fgY 8YHJ] g

$I b hg c Z 7 f Y X h^*$

K cf_`cUX

%) \$`\ci fg`]bWi X]b[`WUgg`WcbHUWh\ci fgž`fYUX]b[gž`WUgg`dfYdUfUh]cbž'UggYgga Ybhž'Zc``ck 'i d`UWh]j]h]Ygž YhW

Gi a a UfmcZh\Y 7ci fgY

Gi VYWi5fYU. 7UfTReZ_

H\]g`Wci fgY`dfcj]XYg`Ub`cddcfhi b]lmiZcf`ghi XYbhg`hc`i bXYfgHJbX`h\Y`ghfi Whi fY`UbX`dfUWf]WY`cZYXi WUhjcb`]b B GK `UbX`UddfYVJUhY`h\Y`Wc[b]hjj Y`UbX`gcVJYHJ``ZJWcfg`h\Uhg\UdY`ghi XYbhgfiYl dYf]YbW'g`UbX`YXi WUhjcbU`ci hWca Yg"``H\fci [\`U'i b]j Yfg]lmiVUgYX`gYa]bUf`UbX`%) `XUmg`cZgW\cc`!VUgYX`ZJY`Xk cf_ž'h\Y`Wci fgY YbUV`Yg`ghi XYbhg`hc`cVgYfj Y`UbX`]bhYfUWhk]h\`U`X]j YfgY`fUb[Y`cZghi XYbhg`UbX`dfcZYgg]cbU``YXi WUhcfg UbX`hc`UWfj Y`mfYZYWhcb`h\Y`hYUW\]b['UbX``YUfb]b[`h\Uh]g`hJ_]b[`d`UWf']b`Ub`YXi WUhjcbU``]bghjhi hjcb"

7 ci fgY @YUfb]b[Ci hMca Yg

- %" ⇒ XYbhjZmUbX:XYgWf)VY:h\Y:`YUfb]b[:ghfYb[h\g:UbX:bYYXg:cZghi XYbhg:Zfca::X]j YfgY:`]b[i]ghj\Wt W:`hifU'z*fY`][]cig:UbX:gcWjcYWcbca]\WVUW_[fcibXg:UbX:h\Y:]ad`]\WUhjcbg:Zcf:hYUW\]b[
- &": c``ck ``h\Y`_Ymdf]bW]d`Yg`XYgWf]VYX`]b`WcXYg`cZYh\]Wg`UbX`WcbXi WhZcf`h\Y`hYUW\]b[`dfcZYgg]cbž UbX`h\Y`fY`Yj Ubh`Y[]g`Uh]j Yž'UXa]b]ghfUh]j Y`UbX`cf[Ub]gUh]cbU``dc`]W]Yg`UbX`dfcW/ggYg`fYei]fYX`Zcf hYUW\Yfg`UWWcfX]b[`hc`gW\cc``ghU[Y"

5i ghfu`]Ub DfcZYgg]cbu` GhJbXUfXg Zcf HYUVX Yfg

GHJbXUfX		5ggYgga Ybh#g
%"' "%	8 Ya cbglfUhY _bck `YX[Y`cZhYUVX]b['glfUhY[]Yg`h\Uh'UfY fYgdcbg]j Y`hc	%
	h\Y``YUfb]b[`ghfYb[h\g`UbX`bYYXg`cZghiXYbhg`Zfca 'X]j YfgY``]b[i]gh]\\gž	
	Wiring furzifyri][]ci gziubxigcWcywcbca]WVUW_[fci bxg"	
&") "%	? bck 'UbX'i bXYfglUbX'`]hYfUWmUbX'bi a YfUWmHYUVX]b['glfUhY[]Yg'UbX	%
	h\Y]f`Udd`]WUh]cb`]b`hYUW\]b[`UfYUg"	
' ") "%	8 Ya cbglfUhY fUb i bXYfghUbX]b[ŁcZU fUb[Y cZj YfVU UbX bcb!j YfVU	%
	Wca a i b]Wuh]cb ghfuhY[]Yg hc gi ddcfhigh XYbhYb[U[Ya Ybh'	
("%"%	xYbhjZmghfUhY[]Yg hc gi ddcfh]bWi g]j Y gh XYbhdUfhjWjdUhjcb UbX	%
	Yb[U[Ya Ybh]b WUggfcca 'UW]j]h]Yg"	
) "&"%	8 Ya cbglfUhY Ub i bXYfglUbX]b['cZh\Y'di fdcgY'cZdfcj]X]b['l]a Y`mUbX	%
	Uddfcdf]UhY 'ZYYXVUW_'hc 'gh' XYbhg 'UVci hh\Y]f `YUfb]b["	
* "%"%	8 Ya cbglfUhY Ubii bXYfglUbX]b[icZh\Yifc`YicZh\Yi5DGHi]bi]XYbhJZmjb[%ž'&
	dfcZYgg]cbU```YUfb]b['bYYXg"	
+"%"%	I bXYfgHJbX`UbX`Udd`mih\Y`_Ymdf]bW]d`Yg`XYgWf]VYX`]b`WcXYg`cZYh\]Wg	%ž*&
	UbX`WcbXi WhZcf`h\Y`hYUW\]b[`dfcZYgg]cb"	

BUh]cbU`Df]cf]hm5fYU'9`UVcfUh]cbg

•	Df]cf]miUfYU		5ggYgga Ybh#g
l	3. 3	%ž'&ž'' ž'(ž') ž'* ž'* ‰	
	-g`UbXYf`9Xi WUηcb		

	8	@ MfUWmUbXBiaYfUWm	%ž'&ž'' ž'(ž') ž'* ž'+ž', 'ž- ž'%\$ž'%%ž'%&ž	%ž'&
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ſ	9	Ghi XYbhgʻk]h\ʻGdYWJU`	%ž'&ž'' ž'(ž') ž'* ž'+ž', ž'-	%
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Ī		HYUW.]b[Gh XYbhg Zfca Bcb!	%ž'&ž'' ž'(ž') ž'* ž'+ž', ž'- ž'%\$ž'%%	%
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HYUW]b[GhfUhY[]Yg

DfcZ/gg]cbU``Yb[U[Ya YbhWcbg]ghg`cZU'%) `XUmd`UW/a Ybh`]b`gW\cc\$

`UWYa

.X .X

5ggYgga Ybh

5ggYgga Ybh'hUg_	K Y][\h	8iY'8UHY	7 ci fgY @YUfb]b[Ci hWca Yg 5ggYggYX
%":HYUWX]b[:'Ugg]ghUbWY'UbX Zcfi a 'dcghg) \$1	K]h\]b") "XUmg"cZd"UWYa Ybh Wca d`Yh]cb	&
&"`9j]XYbWY`cZ DfcZYgg]cbU`]ga `F Ydcfh) \$1	K]h\]b^) `XUmg`cZd`UWYa Ybh Wca d`Yh]cb	&

5ggYgga Ybh% HYUW]b[Ugg]ghUbW UbX Zcfi a dcghg

8i Y'XUhY. K]h\]b") 'XUmq'cZd'UWa YbhWca d'Yh]cb

8 i f]b['mci f'z]Y`Xk cf_'Ug'U'hYUW\]b['Ugg]ghUbhmci 'k]``gi ddcfhU'fY[i `Uf'WUggfcca 'hYUW\Yf'UbX'cVgYfj Y \ck 'gh XYbhg``YUfbž\ck '`]hYfUWhUbX'bi a YfUWhg_]``g'XYj Y`cdž\ck 'YZYWhj Y'hYUW\Yfg'k cf_'k]h\ 'h\Y]f gh XYbhg`UbX`\ck 'gW\cc`g'Z bWfjcb'Ug'cf[Ub]gUhjcbg"'Mci 'k]```VY'Ug_YX'hc'k cf_'k]h\ 'ga U```[fci dg'cZ gh XYbhg'cf']bX]j]Xi U'g'k]h\]b'h\Y 'WUggfcca 'cf']b'U'\ca Yk cf_'Wi V"''Mci 'k]``'U'gc\Uj Y'h\Y'cddcfh b]hmc cVgYfj Y'mci f'WUggfcca 'hYUW\Yf#gž'UbX'k]``'WcbXi WhU'fUb[Y'cZ]bZcfa U``cVgYfj Uhjcbg'ZcW gYX'cb'h\Y 5i ghfU`]Ub DfcZ\gg]cbU'`GhUbXUfXg'Zcf'HYUW\Yfg"'Mci 'k]``'dcghimci f'fYgdcbgYg'hc'gYj Yb'X]ZZ\fYbh E i Ygh]cb'UbX'5bgk Yf'Zcfi a g'cb'h\Y'Wci fgY'A ccX'Y'UbX'fYd`mhc'Uh`YUghcbY'ch\Yf'dcghZfca Ubch\Yf'gh XYbh]b'YUW\'cZh\Y'gYj Yb'Zcfi a g"'H\Y'Wca d'YhJcb'cZh\Y'Zcfi a 'dcghg'UbX'fYgdcbgYg']g'U\i fX'Y'fYei]fYa Ybhgc'mci 'k]``bchdUgg'h\]g'Wci fgY'i b`Ygg'mci 'dcghhc YUW\'cZh\Y'gYj Yb'Zcfi a g"UbX k f]h'U'fYgdcbgY'ch\Yf'dcghZfca 'Ubch\Yf'gh XYbh]b'YUW\'cZh\Y'gYj Yb'Zcfi a g"UbX k f]h'U'fYgdcbgY'ch\Yf'dcghZfca 'Ubch\Yf'gh XYbh]b'YUW\'cZh\Y'gYj Yb'Zcfi a g"UbX k f]h'U'fYgdcbgY'ch\Yf'dcghZfca 'Ubch\Yf'gh XYbh]b'YUW\'cZh\Y'gYj Yb'Zcfi a g"UbX

5ggYgga Ybh& 9j]XYbW cZDfcZYgg]cbU`]ga FYdcfh

8i Y'XUhY. K]h\]b") 'XUmq'cZd'UWYa YbhWca d'Yh]cb

5g'U'HYUWXYf'9Xi WUhjcb'Ghi XYbhmci 'UfY'fYei]fYX'hc'UWhijb'U'dfcZ\gg]cbU``a UbbYf'Uh'U```hja Yg'Xi f]b['h\Y Z]Y`Xk cf_'d`UW\a Ybh''H\]g']bWi XYg'a U]bhU]b]b['gUhjgZJWcfmUhYbXUbW\z'VY]b['di bWhi U'z'XfYgg]b[Uddfcdf]UhY`mz'WcdYfUhjb['k]h\ 'ghUZz'XYa cbghfUhjb['\][\!'Yj Y```Ub[i U[Yz`]hYfUWhUbX'bi a YfUWhg_]``gz i bXYfhU_]b['U'fUb[Y'cZghfi Whi fYX'cVgYfj Uhjcbgz'dUfh]WjdUhjb['UWhj Y`m]b 'WUggz'k cf_]b['Wc``UVcfUhj Y`m]b h\Y'gWxcc``Ybj]fcba YbhUbX'XYa cbghfUhjb['Uhhjhi XYg'UbX'UWhjcbg'h\Uh'UhY'Uddfcdf]UhY'UbX'U`][bYX'k]h\h\Y'WcfY'ghUbXUfXg'UbX'WcXYg'cZWcbXi Whi]b'h\Y'hYUW\]b['dfcZYgg]cb"'9j]XYbW'cZdfcZYgg]cbU`]ga ']g'U'\i fXY'fYei]fYa YbhUbX']g'UggYggYX'Vmh\Y'7 ccdYfUhjb['hYUWXYf''

H\Y`9j]XYbWfcZDfcZfgg]cbU`]ga 'F Ydcfhi]g'h\Y`fYgdcbg]V]`]mmcZh\Y`7ccdYfUh]b['hYUW\YffgL"'H\Y`fYdcfhi]g k f]hh/b'Wc``UVcfUh]j Y`mk\YfY'h\YfY'UfY'hk c'cf'a cfY'WcdYfUh]b['HYUW\Yfg"'H\]g'fYdcfhibYYXg'hc'VY X]gW ggYX'k]h\'h\Y'HYUW\Yf'9Xi WUh]cb'Gh XYbhidf]cf'hc']hVY]b['g][bYX"'H\Y'fYdcfhig\ci `X'VY'Wcbg]ghYbh k]h\'ghfYb[h\g#UfYUg'Zcf'WcbWfb'X]gW ggYX'h\fci [\ci hh\Y'DfcZfgg]cbU`'9b[U[Ya Ybhid`UWa Ybh'

H\Y'7ccdYfUhJb['hYUW\Yf#g'k]```UggYgg'YUW\'HYUW\Yf`9Xi WUhJcb'Ghi XYbh'U[U]bgh'h\Y'; fUXi UhY'HYUW\Yf GhUbXUfX'XYgWf]dhcfg']bWi XYX'\YfY'Ug'k Y```Ug'h\Y'_YmUhf]Vi hYg"'H\Y'hYUW\Yf'YXi WUhJcb'ghi XYbh'k]```Vi]'X h\Y]f'i bXYfghUbX]b['cZh\Y'gY'YWhYX'[fUXi UhY'ghUbXUfX'XYgWf]dhcfg'h\fci [\'dUfh]WjdUhJcb']b'cb']bY'Zcfi a g Ug'k Y```Ug'h\fci [\'cVgYfj UhJcb'cZhYUW\]b['k\]'ghicb'h\]g'YI dYf]YbWY"'H\Y'hYUW\Yf'YXi WUhJcb'ghi XYbh g\ci 'X'VY'UV'Y'hc'X]gW gg'h\Y]f'i bXYfghUbX]b['cZh\YgY'XYgWf]dhcfg'k\Yb'mci 'Ug_'h\Ya "': cf'YUW\ghUbXUfX'XYgWf]dhcf'UbX'_YmUhff]Vi hYz'h\Y'`Yj Y``cZUW\]Yj Ya Ybh]g'UggYggYX'Ug.

B8. Bch8Ya cbghfUhYX

K H. K cf_]b[Hck UfXg

8. 8 Ya cbqlfUllYX

H\Y'7ccdYfUhjb['hYUWXYf#g']g'U'gc'Ug_YX'hc'dfcj]XY'U'ei U`]hUhjjY'Wca a Ybhicb'h\Y'XY[fYY'cZdfcZYgg]cbU`Yb[U[Ya Ybhih\Y'HYUWXYf'9Xi WUhjcb'Ghi XYbhiXYa cbghfUhYX'Xi f]b['h\Y'%) 'XUmg'cZDfcZYgg]cbU`9b[U[Ya Ybhid`UW'a Ybh'

5XX]h]cbU`XYhJ]`g

H\Y`c|YfU```fYgi`hZcf'98GH&\$\$&`]g`[fUXYX`GUh]gZJWcfmcf'I bgUh]gZJWcfm'

#i]g'mci f'fYgdcbg]V]`]hmUg'h\Y'ghi XYbhhc'Ybgi fY'h\Y'<u>9j]XYbW'cZDfcZ/gg]cbU`]ga 'F Ydcfh</u>iUbX'<u>5 HYbXUbW</u> F YWcfXg'UfY'Wca d'Yh'X'dfcdYf'mUbX'g][bYX']b'U```cZh\Y'fYei]fYX'UfYUg"'Mci 'UfY'hc'gi Va]hVch\'cZh\YgY XcW a Ybhg'hc'h\Y'A ccX'Y'UggYgga Ybhgi Va]gg]cb'Vcl ']b'h\Y'5 ZhYf'DfUWgYWjcb"

5 hmyb XUb WY F Yei]fYa Yb hg

GW.cc`cZ'9Xi WUh]cb'5HYbXUbWYFYei]fYa Ybh

H\Y`GW\cc``cZ9Xi WUhjcb`fG98EfYei]fYgʻghi XYbhgʻa YYhUʻa]b]a i a `UhhYbXUbW\fYei]fYa YbhcZ, \$i `cZU`` gW\YXi `YX`WUggYgʻf]"%"`YWhi fYgž'hi hcf]Uʻgž'k cf_g\cdgž'gYa]bUfgE'Zcf'U```Wci fgYg"'5hhYbXUbW\f]b`dYfgcb`]g fYei]fYX`Zcf'hi hcf]Uʻgž'gYa]bUfgž'UbX`k cf_g\cdg`k \Yb`Wci fgY`UfY`XY`]j YfYX`]b`ZJW\fa cXY"'=h]g'h\Y fYgdcbg]V]`]micZghi XYbhgʻhc`Ybgi fY`h\Uhih\Y]f`UhhYbXUbW\f`]g`fYVcfXYX`Zcf'h\Y`ZJW\fc`ZJW\fY]h\Yf`Vm Y`YWhfcb]Wa YUbgʻcf'j]U`Ub`UhhYbXUbW\fY[]ghYf"'5hhYbXUbW\f']b`cb`]bY`cf'V`YbXYX`a cXY`k]```VY`UggYggYX h\fci [\`X][]hU`": i fh\Yf`]bZcfa Uhjcb`WUb`VY`Zci bX`\\YfY"

Fygci fWyg

DfYgWf]VYX F Ygci fWYg

 $\label{thm:compared} $$ \hdg.\#k \ k \ "i \ bgk "YXi "Ui \ \#Jfrg!XYg][\ b!UfW.]hYWh \ fY\#ci \ f!gW.cc`g\#Xi \ WUh]cb\#gh \ XYbh`]Z/\#Wci \ fgY! $$ \bZcfa \ Uh]cb\#dfcZYgg]cbU`!YI \ dYf]YbWM $$$

Gi Va]gg]cb cZ5ggYgga YbhHUg_g Hi fb]h]b Gi Va]gg]cb

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"`=hWJb`hJ_Y`a Ubm Zcfa gžZca `XY`]VYfUhY`W\YUh]b['hc`UVW]XYbhJ``mWcdm]b['Zfca `U`gci fWY`k]h\ci hUW_bck `YX[Ya Ybh'

IBGK [fcidgdu[]Uf]ga]bhch\YZc``ck]b[WUhY[cf]Yg.

 $\begin{tabular}{ll} \hline \textbf{7.cdm}b[...] g]b[...] MY cf'j Yfmg]a] ``Uf'k cfXg'hc'h\Y'cf][] bU``HYI hcf']XYU'k]h\ci h`U\W_bck ``YX[]b[...] b[...] MY cf'i g]b[...] bU``HYI hcf']XYU'k]h\ci h`U\W_bck ``YX[]b[...] b[...] MY cf'i g]b[...] bU``HYI hcf']XYU'k]h\ci h`U\W_bck ``YX[]b[...] b[...] bU``HYI hcf']XYU'k]h\ci h`U\W_bck ``YX[]b[...] b[...] bU``HYI hcf']XYU'k]h\ci h`U\W_bck ``YX[]b[...] b[...] bU``HYI hcf']XYU'k]h\ci h`U\W_bck ``YX[]b[...] bU```HYI hcf']XYU'k]h\ci h`U\W_bck ``YX[]bU```HYI hcf']XYU'k]h\ci h`U\W_bck ``YX[]bU````HYI hcf']XYU'k]h\ci h`U\W_bck ``YX[]bU````HYI hcf']XYU'k]h\ci h`U\W$

5 WUXYa]W±bZcfa Uhjcb

8 i Y 'hc 'Yj c'j]b['UXj]WY 'VmB GK '< YU'th žighi XYbhg'a i gh'WkYW_'Zcf'i dXUhYX']bZcfa Uh]cb 'fY[UfX]b['cb`]bY 'YUfb]b['Zcf'U``'5fhgž'8Yg][b 'UbX'5fWk]hYWhi fY 'Wci fgYg'th]g'thYfa 'fJ]U'A ccX'Y'cf'Wci fgY']bZcfa Uh]cb dfcj]XYX"Ł