

MUSC2603

A UHYf]U`g`UbX`Ghfi Whi fYg`cZA i g]W(

HYfa 'Hk c''##'&\$%-

7 ci fgY⁻Cj Yfj]Yk

`GHJZZ`7cbHJWhi8YHJ]`g`

'7cbj Ybcfg'

BUa Y	9a U]`	5j U]`UV]`]m	@cWUhjcb	D∖cbY
>c∖b`DYhYfgcb	MdYhYfgcb4 i bgk "YXi "Ui		%\$)žFcVYfh KYVghYf 6i]X]b[-',)`(,+\$

°@Y₩ni fYfg'

BUa Y	9a U]`	5j U]`UV]`]m	@cWUh]cb	D∖cbY
>c∖b`DYHYfgcb	*dYh∕fgcb4 i bgk "YXi "Ui		%\$)`FcVYfh KYVghYf 6i]`X]b[- ' ,)

"Hihcfg"

B Ua Y	9a U]`	5j U]`UV]`]m	@cWUh]cb	D∖cbY
< Uff]gcb ⁺ 7c ^{**}]bg	∖"₩ć``]bg4 i bgk "YXi "Ui	d`YUgY`WcbHJWhij]U		
		Ya U]`		
DUi ``7 i hUb	gUa 4 i bgk "YXi "Ui	D`YUgY`WcbHJWhDUi	×	
		j]U`Ya U]`. dUi `W hU		
		b4]WciX"Wca		

GWXcc``7cbHJWhi=bZcfaUh]cb

Fcca '' &z Yj Y`' FcVYfhK YVghYf6i]X]b[

D\cbY.`f\$&Ł`-`,)`(,)*

9a U]`. <u>'gUa 4 i bgk "YXi "Ui</u>

K YVg]hY. <u>http://thtt</u>

H\Y'GW\cc``cZh\Y'5fhg'UbX'AYX]U'k ci `X``]_Y'hc'FYgdYWMZ ``m5W_bck `YX[Y'h\Y'HfUX]h]cbU``7i ghcX]Ubgž h\Y'6YXY[U``fPYbg]b[hcb'WUa di głź; UX][U``f7]hm'UbX'5fh/ '8Yg][b'7Ua di gYgŁ'UbX'h\Y'B[i bbUk U` dYcd'Y'fБi ghfU`]Ub'8YZYbWY': cfWY'5WUXYam']b'7UbVYffUŁ'cZh\Y``UbXg'k\YfY'YUW\'WUa di g'cZI_BGK ']g `cWUhYX"

7ci fgY[·]8YHJ]`g

7 fYX]hDc]bhg^{·*·}

Gi a a UfmcZh\Y'7 ci fgY

GiVYWhi5fYU.? ge[U

H\]gʻWcfYʻWci fgYʻYI hYbXgʻh\Yʻgh XYbHgʻ_bck `YX[YʻcZh\Y`a UhYf]Uʻgžghi Wi fYgžUbXʻdfcWfggYgʻcZhcbUʻ a i g]WhcʻUbʻUXj UbWYX`YjY`j]Uʻh\Yʻgh XmUbXʻUdd`]WUhjcbʻcZ\Ufa cb]WUbXʻa YʻcX]WdfUWfWgʻ]bʻVch UXj UbWYXʻWci bhYfdc]bhž'ZcWig]b[ʻdUfhimcbʻh\Yʻgh XmcZh\Y`a i g]WcZ>"G"`6UWXžUgʻk Y```UgʻYUfm&\$h Wibhi fmiK YghYfbʻUfha i g]WWca dcg]hjcbžUbX`]bWi X]b[ʻUbʻYI Ua]bUhjcbʻcZh\Y`]a d`]WUhjcbgʻZcfʻgi W a i g]WU`dfUWfjWigʻcbʻch\Yf`ghmYgʻgi WX`Ugʻdcdi `Ufʻa i g]WUbXʻtJnn"`Ghi XYbhgʻk]``XYjY`cdʻhYWb]WU` _bck`YX[Y`UbXʻg_]```]bʻh\Y`UbU`mg]gʻUbX`Udd`]WUhjcbʻcZUddfcdf]UhYʻa YʻcX]WUbX`\Ufa cb]WY`UVcfUhjcbž Vci bhYfdc]bhUbX`WcbhfUdi bhU``hYWb]ei Yžj c]WY!YUX]b[žUbX'a i g]WU``Zcfa "`9I YfWjgYgʻ]bʻUXj UbWYX Vca dcg]hjcbU``WfUZhdfcj]XY`h\Yʻghi XYbhk]h\`h\Y`cddcfhi b]mihc`XYa cbghfUhY`h\Y]f`]b]hjUhjj Y`UbX`WfYUhjj]m k]h\]bʻgY`YVMYX`ghmYgʻcZa i g]WU`dfUWfjWY`UbX`fYgYUfWX"

7cifgY`@YUfb]b[`CiHWcaYg

- %" a UghYf`_bck `YX[Y`cb`h\Y`a UhYf]U`g`žghfi WhifYgžUbX`dfcWYggYg`cZW\fca Uh]WhcbU``a i g]WUhUb UXj UbWYX``Yj Y`"
- &" 5bU`mgY WX fca Uh]Wa Y`cXmUbX`\Ufa cbm]b Vch\ % h\ Wbh fmWcbhfUdi bhU`ghmYg`Ug`k Y```Ug`YUf`m &\$h\ WY bh fma i g]WU`ghmYgž]bWi X]b[`dcdi `Uf`a i g]WUbX`Unn"
- ' "Udd`m_bck `YX[Y`UbX`g_]```]b`f\Y`i gY`cZW\fca Uf]Wa Y`cXmUbX`\Ufa cbmhc`f\Y`]XYbf]Z]WUf]cb`UbX WebhYI hi U`]gUf]cb`cZ_Ym&\$f\`WFbh fma i g]WU``k cf_g"
- ("Udd`mth.Y]f`XYj Y`cd]b['a i g]WU``_bck `YX[Y`UbX`g_]```hc`a i g]Wa U_]b[žk \Yth.Yf`]hVY`dYfZcfa]b['cf Wca dcg]b["`
-) " XYa cbgHUHY WcfY`g_]``g`]b`a i g]WJUbg\]dž]b`dUfhJW `Ufža i g]W`]HYfUWhžgWcfY`fYUX]b[žUi fU` X]gWf]a]bUH]cbžUbX`H\Y`dYfZcfa UbWY`cZUXj UbWYX`W\fca UHJW\Ufa cb]Wdf]bWJd`Yg"`

HYUWX]b[GhfUhY[]Yg

Ghi XYbhgʻUhhYbXʻUʻk YY_`mcbY!\ci f``YWhi fYʻcbʻa i g]Wh\YcfmUbXʻ\Ufa cbm'Uʻk YY_`mcbY!\ci f`h hcf]U``cb \Ufa cbmUbXʻUbU`mg]g/UbXʻUʻk YY_`mcbY!\ci f`k cf_g\cd`cbʻUi fU``g_]``g"

@YWfifYg`]bjc`jY`WUgg`YIYfW]gYg`]b`aig]Wh\YcfmUbX`\Ufacb]WUbU`mg]g`UbX`UfY`Ui[aYbhYX`k]h\`gcibX fYWcfX]b[gždckYfdc]bhidfYgYbhUh]cbgžUbX`WUgg`ei]nnYg"

H\Y`\Ufacbmihincf]U``dfcj]XYg`h\Y`ghiXYbhg`k]h\`h\Y`cddcfhib]hmihc`Wcad`YhY`]b!XYdh\`UbU`mg]g`cZgY`YWhX aig]WU``YIUad`Yg`]b`giddcfhicZh\Y``YWhifY`gYf]Yg"

5i fU``K cf_g\cdg`]bj c`j Y`WUgg`UWIj]h]Ygž`]bHYbg]j Y`Xf]``gžUbX`YI YfW]gYg`]b`h\Y`UbU`mg]g`cZgY`YWHX a i g]WU``YI Ua d`Yg`XYg][bYX`hc`XYj Y`cd`UXj UbWYX`Ui fU``dYfWfdh]cb"'

5ggYgga Ybh

5```UggYgga Ybhi]hYa gžUg]XY`Zfca `]b!WUgg`hYghgžUfY`hc`VY`gi Va]hhYX`j]U`A ccX`Y"

#i]g'I BGK 'Dc']Whith Uh'U'''ghi XYbhg'a i gh'UhhYa dh'5@@'UggYgga Ybhg']hYa g'k]h\]b'U'Wci fgY"

Ghi XYbhgʻa i ghiUWX]Yj YʻUʻfDUggfia Uf_ʻZcfʻh\Yʻ<Ufa cbmWca dcbYbhhcʻVYʻUk UfXYXʻUʻfDUggfia Uf_ʻZcf h\YʻWci fgYʻcj YfU``"

5ggYgga YbhHUg_g

5ggYgga YbhˈtJg_	K Y][∖h	8iY'8UHY	GhiXYbhi@YUfb]b[CihWcaYgʻ5ggYggYX
Aig]W@]hYfUhifY`	%) I	Bch5dd`]WUV`Y	(Ž)
<ufa cbmif@yw<b="">i fYŁ</ufa>	* \$1	Bch5dd`]WUV`Y	%ž&ž ž(ž)
5i fU``K cf_g\cd`fHi hcf]U`Ł	&) ı	Bch5dd`]WUV`Y	%ž&ž ž(

5ggYgga Ybh8YHJ]`g

5ggYgga Ybh% Aig]W@]hYfUh fY

GHJfhXUHY.Bch5dd`]WUV`Y

8YHJ]`g. `GY`ZX]fYWYX`ghi Xmk]h. `U`ZbU``YI Ua ": YYXVUW_`dfcj]XYX`VmfYgi `hZcf`YI Ua "

5XX]h]cbU``XYHJ]`g.

H\Y`Aig]W@]hYfUhifY`YIUa`]g`U`kf]hHYb`YIUažk\]W\`HU_Yg`d`UWY`Xif]b[`h\Y`bcfaU``<Ufacbm@YWhifY h]aYg`cb`HiYgXUm\$*`5i[ighfKYY_`%\$E`]b`KYVghYf`; %+"`GhiXYbhg`g\ci`X`UhhYbX`h\Y`YIUa`\Y`X`Uhh\Y `YWhifY`h]aY`Zcf`k\]W\`h\YmUfY`ZcfaU``mYbfc``YX"

5`h\ci [\`gca Y`cZh\Y`k cf_g`cb`h\Y`@]hYfUh fY`@]ghk]```VY`X]gW ggYX`]b`h\Y`5i fU``h hcf]U`gž`]h]g`YUW gh XYbhg`fYgdcbg]V]`]hmhc`a U_Y`h\Y`h]a Y`hc`gh XmYUW\`cZh\Y`k cf_g`cb`h\Y``]gh'

D`YUgY`gYY`h\Y`A i g]W@]hYfUhi fY`@]ghžUj U]`UV`Y`cb`A ccX`Y"`H\]g`YI Ua `Wcbgh]hi hYg`%) + `cZh\Y`cj YfU```a Uf_ Zcf`A I G7`&\$*' "

Hi fb]h]b`gYh]b[.`H\]g`]g`bchU`Hi fb]h]b`Ugg][ba Ybh

5ggYgga Ybh& <Ufa cbmf@YWi fYŁ

GhUfhXUhY. Bch5dd`]WUV`Y

8YHJ]`g. DcfhZc`]c`cZ<Ufa cbmUbX`7 ca dcg]h]cb`9I YfW]gYg.`lk c`]b!WUgg`hYghg`UbX`cbY`Wca dcg]h]cb YI YfW]gY"K f]hYb`ZYYXVUW_`dfcj]XYX`Vm`YWhi fYf"

5XX]h]cbU``XYhJ]`g.

 $\label{eq:hamiltonian} H\Y`<Ufa\ cbmDcfhZc`]c`Wca\ dcbYbh]g`VUgYX`cb`h\fYY`UggYgga\ Ybh]hYa\ g`h\UhUfY`UggcW]UhYX`k\]h\`h\Y`\\WcbhYbhcZVch\`h\Y`<Ufa\ cbm@YWh\ fY`UbX`h\Y`<Ufa\ cbmGh\ X]c.$

5ggYgga Ybhi%" =b!WUgg'hYgh\Y`X`]b'h\Y`bcfa U```YWfi fY`h]a Y`cb'Hi YgXUmi\$- `>i`mfK YY_`*\Z`]b'; %+Z'h\]g hYgh]g'k cfh\'%) = `cZh\Y`hchU``a Uf_`Zcf'h\Y`Wci fgY"

5ggYgga Ybh&"'=b!WUgg'hYghfcf'g]a]`UfŁ'\Y`X`]b'h\Y'bcfa U``Gh X]c'h]a Y'cb'K YXbYgXUm\$+'5i [ighfK YY_ %\$Łž']b'K YVghYf'' \$*ž'h\]g'hYgh]g'k cfh\'%)ı 'cZh\Y'hchU``a Uf_'Zcf'h\Y'Wci fgY"

5ggYgga Ybh' "'U'7ca dcg]h]cb'hUg_'hc'VY'gi Va]hhYX'j]U'A ccX`Y'Vmi(da 'A cbXUmi‰'5i [i gh'fVY[]bb]b['cZ K YY_'%zih]g'Ugg][ba Ybh']g'k cfh.'' \$i -cZh\Y'hchU`a Uf_'Zcf'h\Y'Wci fgY"

D`YUgY'BchY. '#i]g'I BGK 'Dc`]Wmh\Uh'U``'ghi XYbhg'a i gh'UhhYa dh'5@@'UggYgga Ybhg']hYa g'k]h\]b'U Wci fgYž'UbX'ghi XYbhg'bYYX'hc'UhhU]b'U'fDUggfia Uf_'Zcf'h\Y'<Ufa cbm'Wca dcbYbh'hc'VY'Uk UfXYX'Ub cj YfU```fDUggfia Uf_'Zcf'h\Y'Wci fgY'''

Hi fb]h]b gYh]b[. H\]g]g bchU Hi fb]h]b Ugg][ba Ybh

5ggYgga Ybh' . 5i fU`K cf_g\cd fHi hcf]U`Ł

GHJfhXUHY.Bch5dd`]WUV`Y

8YHJ]`g. `Dcfhzc`]c`cZ5i_fU``9I_YfWjgYg.`cbY`hfUbgWf]dhjcb`YI_YfWjgY`UbX`cbY`]b!WUgg`Ui_fU``hYgh'K_f]hhYb ZYYXVUW_`dfcj_]XYX`Vmih_hcf"

5XX]h]cbU``XYhJ]`g.

H\Y'5i fU``Hi hcf]U``Wca dcbYbhWcbg]ghg`cZh\Y'Zc``ck]b['UgYgga Ybh]hYa g.

(E) i fu`]U'dfc[fUa f]) i 'E'' #i]g'U'fYei]fYa YbhkhUh5@@gh XYbhg']b'A I G7 '&* \$' 'a i ghVY'k cf_]b['k]hA'thY 5i fU`]U'fl7 `ci X'J Yfg]cbE'YUf!HfU]b]b['gcZk UfY'' #o'&\$% žth]g'gcZk UfY''\Ug'VYb'dfcj]XYX'ZcfYUWX'gh XYbh VmhY'GWLcc``cZhY'5fhg'UbX'A YX]U'''=Zmci 'k YfY'bchYbfc``YX']b'U'A UhYf]U'g'UbX'GHi Wh fYg'cZA i g]W Wci fgY']b'HYfa '%2'&\$% ž'UbX'h\i g'Xc'bchW ffYbhm\Uj Y'UWWg'nc '5i fU`]Užd'YUgY WcbhUWhhY'7 ci fgY 7 cbj Ybcf'Ug'gccb'Ug'dcgg]V'Y'nc'UffUb['Y'UWWgg''Gh XYbhg'UfY'YI dYWfYX'nc'k cf_'k]h\thY'5i fU`]U'YUf! HfU]b]b['gcZtk UfY'h\fci [\ci hhYfa ''5'a]b]a i a 'gHUbXUfX'Zcf'YUWL'k YY_']g'gYhci h]b'h\Y'5i fU`]U'Ybhg'a i gh Vca d'YhY'5@@UggYgga Ybhg']hYa g'k]h\]b'U'Wci fgYžgc']Zmci 'Xc'bchWca d'YhY'h\Y'5i fU`]U'5ggYgga Ybhmci k]``fYWf]j Y'U'': U]''; fUXY'Zcf'h\Y'A I G7 '&*\$' '7 ci fgYžYj Yb']Zmci '\Uj Y'Wca d`YhYX'U``ch\Yf'UggYgga Ybh]hYa g''

Œ i fU``5bU`mg]g`f) ı Ł`]g`Xi Y`cb`H\i fgXUm%%>i `mifK YY_`*Ł"`D`YUgY`gi Va]hmci f`Ugg][ba Ybhih\fci [\ h\Y``]b_`h\Uhk]``VY`a UXY`Uj U]`UV`Y`]b`h\Y`A I G7`&*\$' `A ccX`Y`a cXi `Y"

•`G][\hg]b[]b[`f)ı ŁUggYggYX`]b`bcfa U``5i fU``h hcf]U``ha Yg`cb`H\i fgXUm\$, `5i [i ghfK YY_'%\$Ł"

Hi fb]h]b gYh]b[. H\]g]g bchU Hi fb]h]b Ugg][ba Ybh

5HYbXUbWYFYei]fYaYbhg

7 ci fgY GWX YXi `Y

J]Yk WUgg'ha YHJV`Y

H]a YHJV`Y'

8 UHY	Hmd Y	7 cbhYbh		
K YY_`%`' `>i bY`!`+`>i bY	@YWhitY	< Ufa cbm@YWi fY. Hi YgXUm\$(`>i bYž %\$"\$\$Ua !%%" \$Ua ž&"\$\$da !' "' \$da ž]b K YVghYf ; %+		
		@YWMifYf.`>c\b`DYhYfgcb		
		=bhfcXiW1jcb`hc`h∖Y`WcifgY"		
		D@95G9`BCH9.`Hihcf]U`g`UbX`GhiX]cg`VY[]b`]b K_YY_`&"		
K YY_`&.`%\$`>i bY`!`%(>i bY	@Y₩i fY	< Ufa cbm@YWi fY. Hi YgXUm%%>i bYž %\$"\$\$Ua !%%"' \$Ua ž&"\$\$da !' "' \$da ž]b K YVghYf ; %+		
		@YWMifYf.`>c\b`DYHYfgcb		
	Gh X]c	< Ufa cbmGh X]c. K YXbYgXUm‰ >i bYž%\$"' \$Ua !‰"\$\$da ž‰"\$\$da !%"' \$da ž K YVghYf'' \$*"		
		Hihof. Dui `7ihUb		
		5 'Z ```gW\YXi `Y'Zcf'hcd]Wg`]bWi XYX'h\Y'< Ufa cbm Ghi X]cg'k]``'VY'a UXY'Uj U]`UV`Y'cb'A ccX`Y"		
	Hi hcf]U`	5i fU``Hi hcf]U`.`H\i fgXUm'% `>i bYž ‱"\$\$Ua ! &"' \$da ž`&"' \$da ! &"\$\$da ž`]b`K YVghYf ' \$*"		
		Hihcf. < Uff]gcb 7 c``]bg		
		5 'Z ```gWXYXi `Y 'Zcf'hcd]Wg]bWi XYX'h\Y '5i fU` Hi hcf]U`g`k]``'VY a UXY 'Uj U]`UV`Y 'cb 'A ccX`Y"		
K YY_'' .`%+`>i bY`!`&% >i bY	@YWM fY	< Ufa cbmi@YWni fY. Hi YgXUm% `>i bYž %\$"\$\$Ua !%%" \$Ua ž&"\$\$da !' "' \$da ž`]b`K YVgHYf ; %+		
		@YWhifYf.`>c\b`DYhYfgcb		
	Gh X]c	 < Ufa cbmGh X]c. K YXbYgXUm% '>i bYž %\$"' \$Ua !%&"\$\$da ž'&&"\$\$da !%"' \$da ž'K YVghYf'' \$*" 		
		Hihof. DUi `7i hUb		
	Hi hcf]U`	5i fU`Hi hcf]U`.'H\i fgXUm&\$`>i bYž		
I	I			

		‰"\$\$Ua!‰" \$da ž‰" \$da!&"\$\$da ž]bK YVgh/f '\$*"
		Hi hcf. < Uff]gcb 7 c ``]bg
K YY_(.`&(`>i bY`!`&, >i bY	@YWM fY	< Ufa cbm@YWi fY. Hi YgXUm&) `>i bYž %\$"\$\$Ua !%%" \$Ua ž&"\$\$da !' "' \$da ž]b K YVghYf ; %+
		@YWMifYf.`>c\b`DYHYfgcb
	Gh X]c	< Ufa cbmiGhi X]c. K YXbYgXUm&* '>i bYž %\$"' \$Ua !%&"\$\$da ž'&&"\$\$da !%"' \$da ž'K YVghYf'' \$*
	Hi hcf]U`	Hi hcf. DUi ``7 i hUb 5 i fU``Hi hcf]U`.`H\i fgXUm&+`>i bYž ‰"\$\$Ua !&"' \$da ž`&"' \$da !&"\$\$da ž`]b`K YVghYf ' \$*"
		Hihof. < Uff]gcb 7 c``]bg
K YY_")."%">i `m'!") ">i `m	@YWhifY	Hi YgXUm\$&`>i `m`BC`@97HI F 9"
(, , , , , , , , , , , , , , , , , , ,		
	Gh X]c	<ufa `="" cbmighi="" k="" x]c.="" yxbygxum\$'="">i `mž %\$"' \$Ua !‰"\$\$da ž'‰"\$\$da !%"' \$da ž'K YVghYf'' \$*</ufa>
	Gi fU``Hi hcf]U`.`H\i fgXUr	ŇÅ ^{\$} i≿ ^j E ^b ØŬi ``7 i hUb
	GYa]bUf	

		J
-		

FYgci fWg

DfYgWf]VYX F Ygci fWfg

FYWca a YbXYX⁻FYgci fWYg

<Ufa cbm@YWH fY HYI HVcc_.

H]hY. H\Y'A i g]W]Ubfg; i]XY'hc'H\YcfmUbX'5bU`mg]g 5i h\cffgŁ'>UbY'D]dYf'7`YbX]bb]['UbX'9`]nUVYh\'A Ufj]b'K Ygh Di V`]g\Yf. K "K "'Bcfhcb'/ '7 ca dUbm'=bW' 9X]h]cb.'' fX'9X]h]cb MYUf. '&\$%+

<Ufa cbmGh X]c HYI hVcc_.

H]hY. H\Y'>Unn H\Ycfm6cc_

'5i h∖cf. A Uf_'@Yj]bY

MYUf. '%- -) #&\$%%

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

Ghi XYbhZYYXVUV_`]g`cb`h`]g`Vći fgY`]g`[Uh`YfYX`dYf]cX]WU``mUbX`]g`U`k Umg`WUfYZ ``mWcbg]XYfYX`k_]h``U j_]Yk `hc`UWNjb[`cb`]hWcbghfi Whjj Y`mk \YfYj Yf`dcgg]V`Y''`: YYXVUV_`]g`[Uh`YfYX`Vmj Uf]ci g`a YUbg`]bWi X]b[h`Y`cWWUg]cbU``]bZcfa U``cb!`]bY`ei Ygh]cbbU]fY`UbX`j_]U`h`Y`a cfY`Zcfa U``a m91 dYf]YbWY`DfcWigg"

 ⊕``][\hcZdfYj]cig'ZYXVUW_Zca 'gh XYbhg']b'h\]g'WcifgY'acfY'ZcW g`\Ug'VYYb'[]j Yb'hc'ibXYfgHUbX]b[\UfacbmUbX'\Ufacb]WWcbWrdhg'Ug'h\YmfY`UhY'hc'Unn'UbX'ch\Yf'aig]WghmYg''G]a]'Uf'mž'U'VfcUXYf'fUb[Y cZaig]WJ``ghmYg']g'fYZYfYbWfX'UbX'YIUa]bYXžYgdYWJU``mk]h\]b'h\Y'UifU``UbX'aig]W`]hYfUhifY WcadcbYbhgž]b'cfXYf'hc'Zfh\Yf'Yb\UbWf'UbX'Wcbgc`]XUhY'h\Y'gh XYbhg'ibXYfgHUbX]b['cZh\cgY'WcbWfdhg''

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

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

#mci 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'9I HYfbU'`Gi ddcfhcb'- ' ,) '' ' '%cf'Ya U]`'h\Ya 'cb'YI 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'mYUfŁ"'#mci UfY'i bUV'Y'hc'gi Va]hmci f'Ugg][ba YbhXi Y'hc'U'ZJi 'hk]h.'Hi fb]hjb'mci 'a UmUdd`mZcf'Ub'YI HYbg]cbž'Vi hmci a i ghfYhU]b'mci f'hjW_Yhbi a VYf'Zfca '9I HYfbU'`Gi ddcfhfU'cb['k]h.'Ubmch\Yf'fY'Yj UbhXcW a YbhgE'hc]bWi XY'Ug'Yj]XYbWY hc'gi ddcfhimci f'YI HYbg]cb'Udd`]WUh]cb"'#mci 'Ya U]`'9I HYfbU'`Gi ddcfhimci 'k]`` Ui hca UhjWU'`mfYWY]j Y'U'hjW_Yhbi a VYfž'Vi h]Zmci 'HY'Yd\cbY'mci 'k]``bYYX'hc'gdYWJZWU``mUg_'Zcf'cbY" Hi fb]hjb'U`gc'dfcj]XYg'i dXUHYg'cb'h\Y]f'gmgHYa 'gfUhi g'cb'Hk]hYf"

; YbYfU``mž'UggYgga YbhHUg_g'a i ghVY'gi Va]HHXXYYWYfcb]WU``mj]U'Y]H\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ba Ybh''=b`]bgHUbWYg'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''

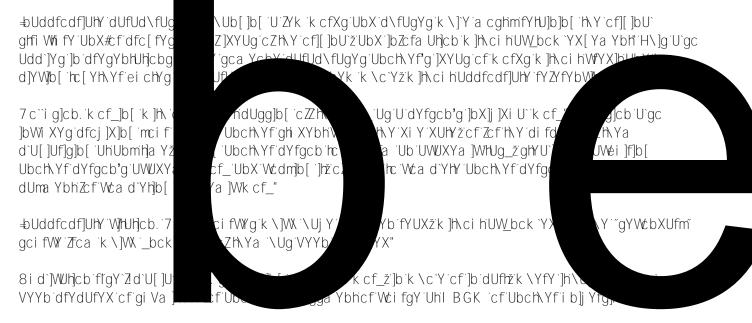
: cf`]bZcfa Uh]cb`cb`\ck 'hc`gi Va]hUgg][ba Ybhg`cb`]bY`j]U`A ccX`Y.`\hhdg.##gh XYbh'i bgk "YXi "Ui #\ck! gi Va]hUgg][ba Ybha ccX`Y

5WUXYa]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"`=h\WUb`hU_Y`a Ubm Zcfa gžZfca `XY`]VYfUhY`W\YUh]b['hc`UWW]XYbhU``mWcdm]b['Zfca `U`gci fWY`k]h\ci hUW_bck `YX[Ya Ybh'

IBGK [fcidgidiU[]Uf]ga]bhcih,YiZciick]b[WUhY[cf]Yg.

7 cdm]b[..'i g]b['thY'gUa Y'cf'j Yfmg]a]`Uf'k cfXg'tc'thY'cf][]bU``thYI hcf']XYU'k]thci hUW_bck `YX[]b['thY' gci fW'cf'i g]b['ei ctUt]cb'a Uf_g"'th\]g'U`gc'Udd`]Yg'tc']a U[Ygž'Ufh'UbX'XYg][b'dfc'YWfgž'Ug'k Y```Ug dfYgYbtUt]cbg'k \YfY'gca



7 cffYWhifYZYfYbWjb['dfUWhjWWg.