

7ci fgY'Cj Yfj]Yk

GHJZZ7cbHJWh8YHJ]`g

7cbj Ybcfg

BUa Y	9a U]`	5j U]`UV]`] m	@cWUh]cb	D\cbY
8f"'5XUa ' <i `vyfh<="" td=""><td>U"\i`VYfh4 i bgk "YXi "Ui</td><td>9a U]`'Zcf</td><td>FcVYfh</td><td>- ' ,) ·%%%)</td></i>	U"\i`VYfh4 i bgk "YXi "Ui	9a U]`'Zcf	FcVYfh	- ' ,) ·%%%)
	_	Uddc]bha Ybh	K YVghYf*%\$,	

GWkcc~7cbhJWh~abZcfa Uh]cb

GVXcc``cZhY`5fhg`UbX`AYX]U

Fcca ' %&ž@YjY`' žFcVYfhK YVghYf6i]`X]b[fl %(Ł

D\cbY. f\$&£'-',) '(,) *

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

K YVg]hY. k k k "Ufhg"i bgk "YXi "Ui #gUa

 $\label{eq:hamiltonian} $$HY'GWKcc``cZhY'5ftg'UbX'AYX]U'kci`X``]_Y'hc'FYgdYWM\cong \cong m5W_bck`YX[Y'h\Y'HfUX]hjcbU``7ighcX]Ubgžh\Y'6YXY[U'`fPYbg]b[hcb'WJadigŁž'; UX][U'`fP]hmUbX'5fh\/'8Yg][b'7UadigYgŁ'UbX'h\Y'B[ibbUkU`dYcd'Y'fbighfU`]Ub'8YZYbW': cf\W'5\WJXYam]b'7UbVYffUŁ'cZh\Y'`UbXg'k\YfY'YUW\'WJadig'cZIBGK']g`c\WJhYX''$

7ci fgY⁻8YHJ]`g

7 fYX]hDc]bhg**

Gi a a UfmcZh\Y 7ci fgY

 $\label{thm:conditional} $$H\]g''WcifgY'']b''gcibX''hY'Wkbc'c[m'UbX']hg''WfYUh]j'Y''Udd']WUh]cbg'Vi]'Xg'cb''hkY''g_]'`g''XYjY`cdYX']b''', $$$

⇒XYU``mih\Y`GhiX]c`WiUggYg`k]```VY`ghfYUaYX`VmigY`ZgY`YWhJcbž'UWWcfX]b[`hc`hYVXb]WU``dfcZJWJYbW	V∕ri'

5ggYgga Ybh

5ggYgga Ybh'HUg_g'

5ggYgga Ybh'hJg_	K Y][\h	8iY'8UhY	Gh XYbh@YUfb]b[Ci hWca Ygʻ5ggYggYX
Ghi X]c F YWcfX]b[Dfc YWn	' \$1	\$ <i>&#%</i>\$#&\$&\$`\$).\$\$`DA</td><td>%Ž</td></tr><tr><td>F YgYUfVX 'HUg_'</td><td>&) ı</td><td>DUffi'% '8 i Y '%* h\ 'C WiDUffi'&.
8 i Y '' \$h\ 'C Wh</td><td>&</td></tr><tr><td>7 ca dcg]h]cb Dfc YWi</td><td>()।</td><td>' \$#%%&\$%-'\$).\$\$<sup>-</sup>DA</td><td>%2</td></tr></tbody></table></i>	

5ggYgga Ybh'8YHJ]`g

5ggYgga Ybh% Gh X]c F YWcfX]b[Dfc YWh

GhUfh XUhY.

@Yb[h\."!) a]bg

8YHJ]`g.

Gh X]c fYWcfX]b['dfc YWhfl !) 'a]bgŁ"

K f]hhyb ZYYXVUW_'UbX'bi a Yf]wU`[fUXY Zfca 'hi hcf"

.

 $5\,XX]h]c\,b\,U^{\,\dot{}}\,XYh\,J]\,\dot{}g.$

GYY'A ccX`Y'Zcf'XYhJ]`g"

5ggYgga Ybh& FYgYUfVX HUg_

GhUfh'XUhY.

@Yb[h\.'&\$\$\$'k cfXg

8 YW] g.

F YgYUfW\`dUdYf"

&\$\$\$ k cfXg"

K f]hhyb Zyyxvuw_ ubx bi a yf]wu` [fuxy Zfca 'hi hcf"

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

8YHJ]`g'Uj U]`UV`Y'cb'A ccX`Y

 $\label{thm:continuous} \begin{tabular}{ll} Hi fb]h]b gYhh]b[. H\]g Ugg][ba Ybh]g gi Va]hhYX hAfci [\Thi fb]h]b UbX gh XYbhg WUb gYY Hi fb]h]b g]a] Uf]hm fYdcfhg"$

5ggYgga Ybh' . 7ca dcg]h]cb Dfc YWh

GhUfhXUhY. Bch5dd`]WUV`Y

@Yb[h\.") a]bg

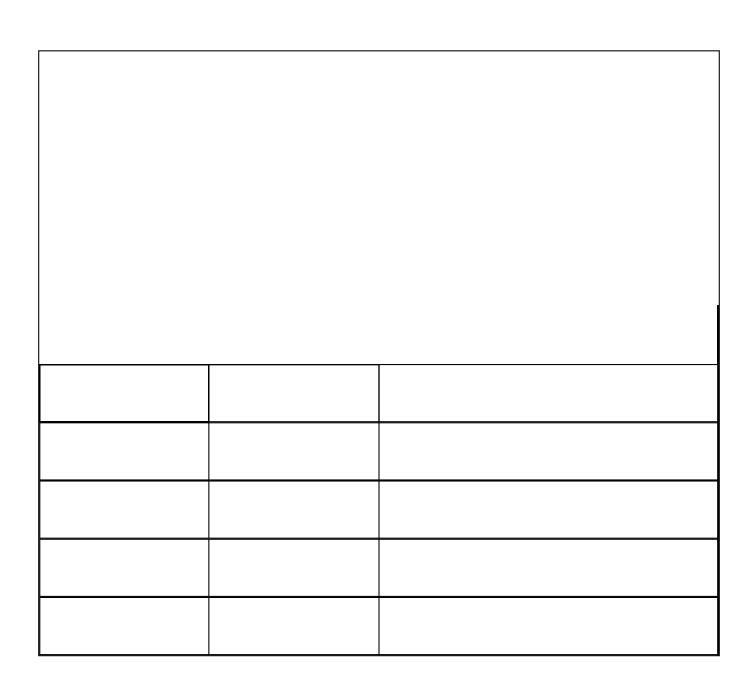
8YHJ]`g.

7 fYUhY 'U'gi VghUbhJU``cf][]bU``gci bX`Wca dcg]hJcb`fUddfcl "') 'a]bgŁ"

K f]hhyb Zyyxvuw_ ubx bi a yf]wu` [fuxy Zfca 'hi hcf"

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

GYY'A ccX`Y'Zcf'XYhJ]`g"



FYgci fWyg

DfYgWf]VYX F Ygci fWYg

- : cfh/]ggiVYWzmcifibYYXh/YZc~ck]b[.
- I G6 ghcfU[Y XYj])W fk UfX Xf]j Yžbcha Ya cfmgh]WŁ
- DYfgcbU` < YUXd\cbYg</pre>

FYWca a YbXYX FYgci fWyg

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

GmbYf[]Ygʻ]gʻXYj Y`cdYXʻi g]b[ˈa m9l dYf]YbWYʻYj U`i Uh]cbgž'UbXʻmci fʻfYgdcbgYgʻUfYʻj Yfmi]a dcfhUbhhc a Yʻʻ@YggʻZcfa U`j YfVU`cfʻYa U]`ZYYXVUW_j]gʻk Y`Wca Yʻh\fci [\ci hˈgYa YghYfʻj]Uʻa mYa U]`U"\i `VYfh4 i bgk "YXi "Ui ž'UbX`a UbmcZh\Y`VYghW\Ub[Yg`\Uj Y`VYYbʻh\YʻfYgi `hcZh\]g"`Mci `WUbʻa U_Y`Ub Uddc]bha Ybhhc`W\Uh'Uha mcZZWY`Ubmh]a Yʻh\fci [\ci hˈh\YʻgYa YghYf"

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

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

Image: Ybwei bhyfu'dfcv'ya k \yb'uhhya dhjb['hc'gi va]hmci f'Ugg][ba Ybhh\fci [\ 'Hi fb]h]bž'd'YUgY

Hy'Yd\cby'9| hy'fbu''Gi ddcfhcb'-',) "''' %cf'Ya U] hya 'cb'Yl hy'fbu'hy'ngi 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"'=Z'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'mZcf'Ub'Yl hy'bg]cbž'Vi hmci
a i ghfYhJ]b'mci f'h]W_Yhbi a VYf'Zfca '9| hy'fbu''Gi ddcfhfU'cb['k]h\ 'Ubmch\Yf'fy'Yj UbhXcW a Ybhgthc
]bWi XY'Ug'Yj]XYbW'hc'gi ddcfhmci f'Yl hy'bg]cb'Udd']WUh]cb"'=Zmci 'Ya U]''9| hy'fbu''Gi ddcfhmci 'k]'`
Ui hca Uh]WJ'`mfYW']j Y'U'h]W_Yhbi a VYfZ'Vi h]Zmci 'hy'Yd\cby'mci 'k]``bYYX'hc'gdYW]Z]WJ'`mUg_'Zcf'cby''
Hi fb]h]b'U'gc'dfcj]XYg'i dXUhy'g'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk]hyf''

; YbYfU`mž'UggYgga YbhiHug_g'a i ghVY'gi Va]hhYX'Y`YVWfcb]\WJ``mij]U'Y]h\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ba Ybh''=b']bgHJb\W'g'k \YfY'h\]g']g'bchdcgg]V`Yž']hk]```VY'gHJhYX'cb'mci f'\\circ i fgY'g'A ccX`Y'g]hY'k]h\U`hYfbUh]j Y'gi Va]gg]cb'XYHJ]`g"

cfi]bZcfa Uhjcbicbi\ckihcigi Va]hUgg][ba Ybhgicbi]bYij]UiA ccXiY.i\hdg.#gh XYbhi bgk "YXi "Ui #\ck! gi Va]hUgg][ba Ybha ccXiY

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

IBGK [fcidg'd'U[]Uf]ga]bhc'h\Y'Zc``ck]b['WUhY[cf]Yg.

 $7 \text{ cdm}b[...i g]b[...h\Y.gUa Y.cf.j Yfmig]a] \Uf'k cfXg'hc'h\Y.cf][]bU''hYl h'cf']XYU'k]h\ci h'U\V_bck `YX[]b[...h\Y.cf][]bU''hYl h'cf']XYU'k]h'cf']$

- 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 ž'ch\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 cghicZmci f'ghi X]Yg'UhI BGK "'\\hd.##qi VYWfi |XYg"`]VfUfm'i bqk "YXi "Ui #\`]qY#JVci hY`]qY