

ARTS2094

J]gi U`7caaib]WUh]cb

GYa YghYf'Hk c''#'&\$%

7ci fgY Cj Yfj]Yk

GHJZZ7cbHJWh8YHJ]`g

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`] m	@cWUh]cb	D∖cbY
@ci]gY`FUjY``]	`"fUj Y``]4 i bgk "YXi "Ui	A cbXUm'!(k]``V\a mfXfcd']bfiha Y/k Uddc]bha Ybh bYYXYX": cf Uddc]bha Ybhg'Uh ch\Yf'ha Ygžd`YUg` Ya U]`'a Y"	oc o	-',)

'Hi hcfg'

BUa Y	9a U]`	5j U]`UV]`] m	@cWUhjcb	D\cbY
>cg\i U' <ub< td=""><td>°cg∖i U"∖Ub%4 i bgk "YXi "Ui</td><td>6mYa U]`</td><td>B<i>#</i>5</td><td>B<i>#</i>5</td></ub<>	°cg∖i U"∖Ub%4 i bgk "YXi "Ui	6mYa U]`	B <i>#</i> 5	B <i>#</i> 5

GWkcc~7cbhJWh~abZcfa Uhlcb

Fcca " & ž Y j Y " FcVYfhK YVghYf 6i] X]b[

D\cbY. f\$&Ł'-',) '(,) *

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

K YVg]hY. \hhdg.##qUa "Ufhq"i bgk "YXi "Ui

 $\label{eq:hamiltonian} $$HY'GWKcc``cZhY'5ftg'UbX'AYX]U'kci`X``]_Y'tc'FYgdYWM\cong \cong m5W_bck``YX[Y'h\Y'HfUX]tjcbU``7i gtcX]Ubgž h\Y'6YXY[U'`fPYbg]b[hcb'WJa di gŁž'; UX][U'`fP]hmUbX'5fth/ '8Yg][b'7Ua di gYgŁ'UbX'h\Y'B[i bbUk U` dYcd'Y'f5i ghfU']Ub'8YZYbW': cfW''5WJXYa m]b'7UbVYffUŁ'cZh\Y'`UbXg'k\YfY'YUW\'WJa di g'cZl BGK ']g `cWJhYX''$

5 hmy b X Ub WY F Yei] f Ya Yb hg

5 'ghi XYbh']g'Yl dYWYX'hc'UhhYbX'U```WUgg'WcbhUWi\ci fg'Zcf'U'ZUWY!hc!ZUWY'fl &: Ł'cf'V`YbXYX'Wci fgY'UbX Wca d`YhY'U```UWIji]h]Yg'Zcf'U'VYbXYX'cf'Z ``mcb`]bY'Wci fgY"

5 'ghi XYbhik \c'Uff]j Yg'a cfY'h\Ub'%) 'a]bi hYg'``UhY'a UmVY'dYbU`]gYX'Zcf'bcb!UhhYbXUbWY'''=Zgi W\'U'dYbU`hm]g']a dcgYXž'h\Y'ghi XYbha i gh'VY']bZcfa YX'j YfVU``mUh'h\Y'YbX'cZWUgg'UbX'UXj]gYX']b'k f]h]b['k]h\]b'&(\ci fg"

⊋Uʻghi XYbhYl dYf]YbVWgʻ]``bYggža]gUXj Ybhi fYʻcfʻch\YfʻcVWi ffYbWiʻh\Uha U_YgʻUVgYbWʻZca ʻU WUgg#UWjj]hmi bUj c]XUV`Yžcf`Yl dYWgʻhcʻVY`UVgYbhZca ‰Zcfh\Wca]b['WUgg#UWjj]hmžh\Ymg\ci `X`gYY_ dYfa]gg]cbʻZca ʻh\Yʻ7 ci fgYʻ5i h\cf]hmžUbX`k\YfY`Udd`]WfYl dYZY`\$ \$ bh \cf

[fUbh]b['cZUVgYbW' a i gh'VY 'gUh]gZ]YX 'U 'gh 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 'gh XYbhgYY_]b['Uddfcj U``hc 'VY 'UVgYbh'Zcf' a cfY 'h\Ub 'cbY 'a cbh\ 'a i gh'Udd`m]b 'k f]h]b['hc 'h\Y'8 YUb 'UbX'dfcj]XY 'U```cf][]bU``cf'WYfh]ZYX 'gi ddcfh]b['XcW a Ybh'Un]cb"

 $: cf'a\ cfY']bZcfa\ UhJcb'UVci\ hih\ Y'UhHYbXUbWY'dfchcWc`g']b'h\ Y':\ UW\ `hmcZ5fhg'UbX'GcWJU`\\ GWJYbWYg.\ `\underline{hhdg.} \#k\ k\ k''Ufhg''i\ bgk''YXi''Ui\ \#W\ ffYbHghi\ XYbhg\#UWUXYa\]W]bZcfa\ UhJcb\#dfchcWc`g!\ [i\]XY`]bYg\#UWUXYa\]W]bZcfa\ UhJcb#dfchcWc`g!\ [i\]XY`]bYg#UWUXYa\ [i\]XY`]bYyYYA \ [i\]XY`]BYYYA \ [i\]XY`]bYyYYA \ [i\]XY`]bYYYA \ [i\]XY`]bYYYA \ [i\]XY`]bYYYA \ [i\]XY`]bYYYA \ [$

5 WUXYa]W = 1 Zcfa Uhlcb.

: cf`YggYbh]U``ghi XYbh`]bZcfa Uh]cb`fY`Uh]b[`hc.`fYei Yghg`Zcf`YI hYbg]cb/fYj]Yk `cZa Uf_g/cWW dUh]cbU``\YU`h\UbX`gUZ/hm/YI Ua]bUh]cb`dfcWXi fYg/gdYW]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 "Ufhq"i bqk "YXi "Ui #W ffYbhqhi XYbhq#UWUXYa]W]bZcfa Uh]cb#dfchcWc`q![i]XY`]bYq#

7ci fgY 8YHJ] g

7 fYX]hDc]bhg *

Gi a a UfmcZh\Y 7ci fgY

Gi VYWh5fYU. ? WW[Sł 5g/fgdWS` V FWUZ` a aYk

J]gi U``Wca a i b]WUrjcb`]b`WcbhYa dcfUfma YX]U'rmd]WU``mWca V]bYg'U'fUb[Y'cZfYgci fWg'!'k f]hhYbžj]gi U`ž Ui fU'žgdUrjU`"K Y'XYj Y`cd'U'gYhcZhYWkb]ei Yg'UbX'ZfUa Yk cf_g'rc'UbU`mgY'h\YgY'Wca d`Yl 'hYl hgž YgdYW]U``mh\Y]f'j]gi U``Wca dcbYbhg"'K Y'k]``Wcbg]XYf'U'fUb[Y'cZ]a U[Yg'UbX'hYl hg'UWfcgg'U'j Uf]YhmcZ a YX]U'd`UhZcfa gž'Zfca 'bYk gdUdYfgž'UXj Yfh]gYa Ybhgža U[Un]bYgž'hc'k YV'g]hYgž'UbX'W`hi fU``cVYWhg"'K Y k]``XYj Y`cd'U''[fUa a Uf''Zcf'UbU`m]b['h\YgY'hYl hg'UbX'h\Y'fc`Y'h\Ymd`Um]b'a U_]b['a YUb]b['z']b dfcZYgg]cbU'ž'di V`]WUbX'dYfgcbU``WcbhYl hg"

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

 $\% \] XYbh] Zmh, Y _Ymdf] bW] d`Yg`cZU`gcW] U`!gYa] ch] WUddfcUW, hc `h, Y `UbU`mg] g`cZj] gi U``hYl hg have a summer of the control of t$

&" gmghYa Uh]\WU``m'UbU`mgY`U`k]\XY`fUb[Y`cZ\WcbhYa dcfUfmij]gi U``hYl hg`' "Uf[iY`Zcf`Ub`]bhYfdfYhUh]cb`cZh\YgY`hYl hg`\VUgYX`cb`h\Y`UbU`mg]g

("g]h UHY UbX Wf]hei Y h YgY hY l hg]b fY `Uh]cb hc gc W[U ž W `hi fU `UbX dfc Z/gg]cbU `WcbHY l hg

HYUWX]b[GlfUhY[]Yg

 $H \setminus]g'Wci fgY'hYUWXYg'U'WcfY'gYhcZUbU'mf]WU''g_] \cap g'UbX'gc'Yl hYbXYX''YWi fY']bdi h']g'Uddfcdf]UhY''' 7 YbhfU']nYX''YWi fYgž']bWi X]b['i gY'cZj']XYc'Wca dcbYbhg'UbX'fY`UhYX''YUfb]b['cV'YWgž'k']`''VY'i gYX'hc a Ud'UbX'XYa cbghfUhY'WbhfU''WcbWfdhg'''5 hh\Y'gUa Y'f]a Yž'h\Y'UbU'mf]WU''hcc`g'bYYX'hc'VY'Udd`]YX'hc UWi U''hYl hgž'UbX'Yl hYbXYX'X]gW gg]cb']g'bYYXYX'hc'Yl d`cfY'Wca d`Yl]h]Ygž'\YbW''ZUWY!hc!ZUWY'hi hcf]U'''ha Y]g'YggYbhJU'''Hi hcf]U'g'k]`''VY'i gYX'hc'dfUWf]WY'h\Y'Udd`]WUhJcb'cZ'h\YgY'WcbWYdhg'hc'hYl hi U''UbU'mg]g''UbX'hc XYj Y`cd'ghi XYbhgfiUV]']h]Yg'hc'Uf['i Y'Zcf'Ub']bhYfdfYhUhJcb'VUgYX'cb'UbU'mg]g''$

5ggYgga Ybh

H\YfY`UfY`h\fYY`UggYgga YbhitUg_g`hc`Wca d`YhY''Mci `a i ghWca d`YhY`UbX`\UbX`]b`U```h\fYY`fUg_g`]b`cfXYf hc`dUgg`h\]g`Wci fgY"'H\]g`a YUbg`h\Uhmci `k]```ZU]`]Zmci `Xc`bch\UbX`]b`cbY`fUg_'Yj Yb`]Zmci `\Uj Y`U`hchU` [fUXY`cZcj Yf`) \$`Zfca `h\Y`ch\Yf`hk c`Ugg][ba Ybhg"

 $\label{eq:localization} $$Mcia ighUhhybX`U`a]b]a ia `cZ', $i `cZWUggYg`flYWi fYg`UbX`h hcf]U`gŁ'hc`VY`fY[UfXYX`Ug`\Uj]b[`Z `Z]``YX h\Y`fYei]fYa Ybhg`cZh\Y`Wci fgY"`5 `fc```k]```VY`hU_Yb`]b`h\Y``YWi fY`UbX`h hcf]U``hc`fYWcfX`mci f`UhhYbXUbW\"$

@YWhifYg UfY bchifYWcfXYX Zcf h\]g WcifgY"

5ggYgga Ybh'HUg_g'

5ggYgga Ybh'hJg_	K Y][\h	8i Y'8UHY	Gh XYbh@YUfb]b[Ci hWca Ygʻ5ggYggYX
Hi hcf]U``dfYgYbhUh]cbf&\$`	&\$ı	Bch5dd`]WUV`Y	B#5
5bU`mg]g'UbX'9ggUmf(\$'	(\$1	&-#%\$#&\$% `\$).\$\$`DA	B#5
±b!WUgg'H/glf(\$'	(\$1	Bch5dd`]WUV`Y	B#5

5ggYgga Ybh'8YhJ]`g

5ggYgga Ybh% Hi hcf]U`dfYgYbhUh]cbf&\$

GHJfhXUhY. Bch5dd`]WUV`Y

@Yb[h\.')!+a]bihYgŽg`]XYg

8YHJ]`g. '±bX]j]Xi U``dfYgYbHJh]cb`cZ)!+'a]bi hYg"Gh XYbhg`fYWY]j Y`]b!WJgg`UbX`k f]hhYb`ZYYXVUW<u>"</u>"

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

D`YUqY`qYY`A ccX`Y`Zcf`Z\```XYhU]`g"

Hi fb]hjb gYhjb[. `H\]g Ugg][ba Ybh]g gi Va]hhYX h\fci [\`Hi fb]hjb UbX gh XYbhg Xc bchgYY Hi fb]hjb g]a]`Uf]hmfYdcfhg"

5ggYgga Ybh'& 5bU'mg]g'UbX'9ggUmf(\$

GHJfh:XUhY.

@Yb[h\. &\$\$\$ k cfXg f% \$\$ a]bž&) \$\$ a Ul Ł

8YHJ]`g. `&\$\$\$`k cfXg`f% \$\$`a]bž`&) \$\$`a UI Ł"`H\]g`]g`h\Y`Z|bU``UggYgga Ybh'HUg_"K f]HYb`ZYYXVUW_`dfcj]XYX"

 $\label{thm:limit} \begin{array}{ll} \mbox{Hi fb]h]b"gYhh]b" . "H\]g"Ugg][ba Ybh"]g"gi Va]hhYX"h\fci [\ \ 'Hi fb]h]b"UbX"gh XYbhg"Xc"bchgYY"Hi fb]h]b g]a]"Uf]hmfYdcfhg" \\ \end{array}$

5ggYgga Ybh' . '\ph!WUgg'hYghf(\$

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

Gh XYbhg UfY Yl dYWYX hc di hh\Y]f bUa Yg UbX gh XYbhbi a VYfg cb Yj YfmdU[Y cZh\Y]f Ugg][ba Ybhg"

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

#mci YbWci bhYf'U'dfcV'Ya k \Yb'UhYa dhJo['hc'gi Va]hmci f'Ugg][ba Ybhh\fci [\'Hi fb]h]bž'd'YUgY
hY'Yd\cbY'9l 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'mYUfŁ"'#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 hYbg]cbž'Vi hmci
a i ghfYhJ]b'mci f'h]W_Yhbi a VYf'Zfca '9l hYfbU''Gi ddcfhfU'cb['k]h\'Ubmch\Yf'fY'Yj UbhXcW a YbhgŁ'hc
]bWi XY'Ug'Yj]XYbW'hc'gi ddcfhmci f'Yl hYbg]cb'Udd']WUh]cb"'#mci 'Ya U]''9l hYfbU''Gi ddcfhmci 'k]''
Ui hca Uh]WU''mfYWf']j Y'U'h]W_Yhbi a VYfž'Vi h]Zmci 'hY'Yd\cbY'mci 'k]'''bYYX'hc'gdYW]ZJWU''mUg_'Zcf'cbY"
Hi fb]h]b'U'gc'dfcj]XYg'i dXUhYg'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk]hYf"

; YbYfU``mž'UggYgga YbhitUg_g'a i ghVY'gi Va]hhYX'Y`YWfcb]WU``mj]U'Y]h\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ba Ybh'' =b']bghUbWfg'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''

@UhY 5 ggYgga YbhDYbU`hJYg

- K cf_'gi Va]hh'X`%\$`hc`% 'XUmg`UZhYf`h\Y`gh]di `UhYX`XYUX`]bY`k]```VY`UggYggYX`UbX`ZYYXVUW_dfcj]XYX`Vi h'U`a Uf_'cZnYfc`k]```VY`fYWcfXYX"`\Zh\Y`k cf_'k ci `X`\Uj Y`fYWf]j YX`U'dUgg`a Uf_'Vi h'Zcf h\Y``UhYbYgg`UbX`h\Y`k cf_']g`U`Wca di `gcfm'Wci fgY`Wca dcbYbh'f\i fX`Y`fYei]fYa Ybh\ž`U'gh XYbhk]``VY`XYYa YX`hc`\Uj Y`a Yhh\Uh'fYei]fYa Ybh\
- K cf_'gi Va]hhYX`&\$`cf`a cfY`XUmg`UZhYf`h\Y`gh]di `UhYX`XYUX`]bY`k]```bchVY`UWWdhYX`Zcf UggYgga YbhUbX`k]```fYWY]j Y`bc`ZYYXVUW_ža Uf_'cf`[fUXY"'=Zh\Y`UggYgga YbhHUg_']g`U`Wca di `gcfm Wca dcbYbhcZh\Y`Wci fgY`U'ghi XYbhik]```fYWY]j Y`Ub`l bgUh]gZJWcfmi: U]``fl : Ł`[fUXY`Ug`U`fYgi `hcZ i bgUh]gZJWcfmidYfZcfa UbWY`]b`Ub`YggYbh]U``Wca dcbYbhcZh\Y`Wci fgY"

H\]g^]bZcfa Uh]cb^]g^U^gc^Uj U]^\$

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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["

 $7c^{i}$ g]cb. 'k cf_]b['k]th. 'cth. Yfg'Vi h'dUgg]b['c\Zth. Y'k cf_'Ug'U'dYfgcb'g']bX]j]Xi U''k cf_"'7c''i g]cb'U'gc

- 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

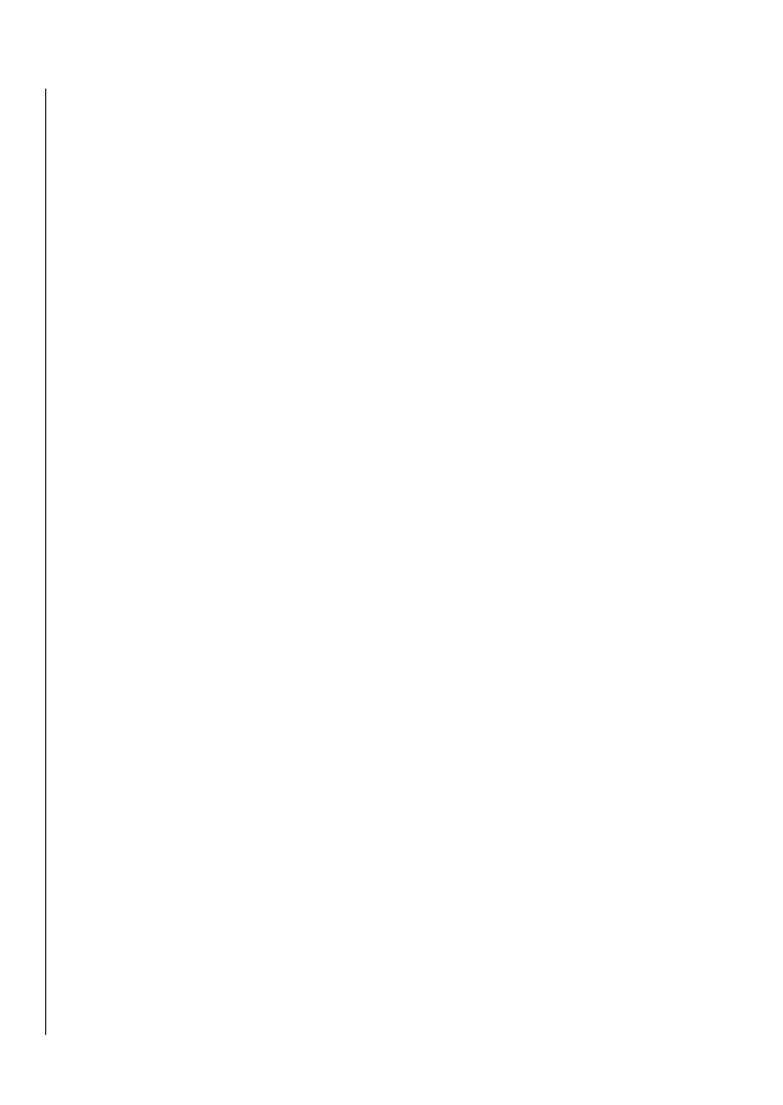
Gca Y'cZh\YgY'UfYUg'k]``VY'ZJa]`]Uf'hc'mci ž'ch\Yfg'k]``VY'bYk"'; U]b]b['U'gc`]X'i bXYfgHJbX]b['cZU``h\YfY`UhYX'UgdYWfg'cZ9@ ${\mathfrak G}$ 9'k]``\Y`d'mci 'a U_Y'h\Y'a cghicZmci f'ghi X]Yg'UhI BGK "f\hd.#gi V\YWfi \\X\yg''\YfUfm'i bgk\\"YXi\\"Ui\#\`\]qY\#JVci \\Y\\]qY\\

7ci fgY GWX YXi `Y

J]Yk 'WUgg'ha YhUV'Y

H]a YHJV`Y

8 UHY	HmdY	7 cbhYbh
K YY_'%'&' '>i `mi!'&-	`>i`m'@YWhifY	@97HI F 9. "A C B "&"
		Cif'hYIhg.'k\UhifUb[Y'cZhYIhg'k]``'kY'VY W&bg]XYf]b[3
		Cif'UddfcUVX.'gcWJU`'gYa]chJVg'UbX'gmghYabYhk cf_g
		Cif'hcc`g.'a YUb]b[g'UbX'a YhUZ bWf]cbg/
		Cifghufhjb[dc]bhg. XYbchuhjcb UbX Webbehuhjeb"
		H\Y``YWi fY`g`]XYg`k]```VY`\YfY"
		@YWhifYg"UfY"bchifYWcfXYX"Zcf"h\]g"WcifgY"
		F 958=B; . "D@95G9"A 5? 9"GLF9"MCL "F 958 H< 9G9"69: CF9"H< 9"@97HLF9
		f%±?fYgg:/ 'J Ub'@YYi k Yb'f&\$\$*±7\UdhYf'%'
		f&L: @UW/mžB]W_"``% -, `;_SYWS`VDWbdWeWfSf[a`, = Wk Ua`UWbfe[? WW[SEfgV[WeBYk Mcf GhA Uff]bfg DfYgg O'\UdhYf&cb`mQfl LfCdh]cbU`L'j Ub'@YYikYbžH"&\$\$);`fdaVgU[YEaU[S^EW_[af[Ue'@cbXcb.FcihYX[Y'G=\UjYid`cUXYX'dd"+!(&cb`mcb'f7cbbchUh]cbfžh\ci[\mcik]``Z]bX'h\Y'k\c`Y'cZh\Y'W\UdhYf'fY`YjUbhZcf'UbibXYfgHUbX]b['cZgcW]U``gYa]cf]Wg'acfY'VfcUX`m/`cc_'Zcf'h\Y'Vcc_']b'h\Y'`]VfUfm'Q
		HI HCF =5@:Bc'hi hcf]U`g'h\]g'k YY_/hi hcf]U`g'VY[]b
K YY_'&.'' \$'>i `m'!') 5i [i gh	@YWhi fY	@97HIF9.¨'\$`>i`m'`H\Y`±bh\cfb\\/fgctbkUYb`fl AYHUZ ibb\(v)cb\n\Y`VcQ



	DfYgYbhYf^&.
	5`gc.'≢b!WUgg'hi hcf]U`'Yl YfW]gY.'k f]h]b['i d
	l

K YY_', .'%\$'GYdhYa VYf'! %* 'GYdhYa VYf	@YWi fY	F958-B; ."fM2:?fYgg/ 'J Ub'@YYi k Yb'f&\$\$*E7\Ud& fR2:fCdficbU'::DU biYf27/A Uffibz'>"F/UbX bgk cfihz'@/f&\$% EDWSV[Y H[egS^@Sd5fihwe, ;_SYW3' Ske[e aX5Z[YdW ie B[UfgdW4aa] e' @cbXcbz'9ei]bcl ""'O'\UdHYf" 'cb'mO7\UdHYf" fY'UhYg'tc'h\Y'fYdfYgYbrUhjcbU''a YHUZ bWijcb""+h [cYg']bitc Z fh\Yf'!'UbX'X]ZZfYbh! XYHU]'Zfca ?fYgg UbX'j Ub @YYi k Ybz'Vi hi]g'k cfih.'h\Y'YZfffQ HI HCF-5@'6UgYX'cb'K YY_"*"YWi fY'UbX fYUX]b[g DfYgYbHYf'% DfYgYbHYf'% DfYgYbHYf'.Q @97HI F9.'% 'GYdHYa VYf"'H\Y'FYdfYgYbHUhjcbU'' A YHUZ bWijcb. 'WcbWrdh' U''dfcWrggYg F958-B; .'fM2:?fYgg/' 'J Ub'@YYi k Yb'f&\$\$*E7\Ud' B6.'H\]g']g'U'fYU''mHCI; < 'W\UdHYf''''K Y'k]'''ZeW'g cb'h\Y'VugJWX]ghbWijcb'VYik YYb'bUffUhj' Y'j g WcbWrdh' U'zUbX'k]h\]b'WcbWrdh' U'zVYik YYb''mHCI;	< `W\Udh

		Udd`m'Zcf'GdYW]U`'7cbg]XYfUh]cb'hc'fYg]h''D`YUgYgYY'G5A'GW\cc`']bZcfaUh]cb'cb'UggYggaYbhdfcWYXifYg" D`YUgY'Vf]b['D9B#G'hc'h\Y''YWhfY'fdUdYfgidd`]YXE'''D'YUgY'VY'cb'had YXX'hc'ghUmZcf'h\Y'XifUh]cb'cZh\Y'' YadhmgdUWW'VYhk YY'
K YY_'%\$.'%C WcVYf'!'+ C WcVYf	@YWi fY	%C7HC69F/BCH©97HIF9 HC85M

		@ \YfU\hifY`/`JYfVU``5fh`\\Yf]\UbWg`UbX 8YjY`cdaYb\g`]b`GW\cc``9b[`]g\`Jc``)%`Bc"`&`dd '&!(\$
		fl LfC dhjcbU'LA UW_Yb! < cfUf]_žA Ufm&\$\$' '"5 hY``]b['Gma V]cg]g']b'h\Y'8]gWci fgY'cZ < UhfYX. A i 'hja cXU'BYk g'HYI hg'UVci hh\Y'"7\]'XfYb C j YfVcUfX"'5ZU]ffi'3gefoS{\$` DWh[W aX3bb{W} > [Yg[ef[Ue''&*'f&L'dd%!*''B6.'h\Y'j]gi U''UbU`mg]g]b'h\]g'dUdYf']g'fY'Uhj Y`mg]a d'Y'Wca dUfYX'hc'h\Y a cfY'hYW\b]WU''ZfUa Yk cf_']b'? fYgg'UbX'j Ub @YYi k Yb'fh\ci [\']hXcYg'i gY'gca Y'cZh\Uh'žVi h]h dfcj]XYg'U'j YfmfYj YU']b['UbU`mg]g'cZU'Wcblfcj Yfg]U Yd]gcXY']b'5i glfU']Ufg'\]ghcfm'
		HI HCF=5@. '6UgYX'cb'K YY_'\%%@YWfifY'UbX FYUX]b[g
		DfYgYbhYf'%
		DfYgYbhYf*&.
		B6. DF9G9BH9FG: CF'K 99? '&'B9LH'K 99?. MCIF'DF9G9BH5H€B'K =@69'65G98'CB'H<9'K 99? '%'@97HIF9ž'=9'H<9'85M69: CF9 MCIF'DF9G9BH5H€B''GC'MCI'B998'HC'69 F958M'
		Ofygybhyf".Q
K YY_'%&.'%) 'CWfcVYf'! &%'CWfcVYf	@YVVi fY	@97 HI F 9. %) 'C WcVYf' bhYfdfYhUhjcbż ZcfY[fci bX]b[žk f]h]b[i d" F 958 B; . 'fWz'F Uj Y``]ž'@" f&\$%+Ł'fB Uj][Uh]b['h\Y [Ud VYhk YYb hYl hUbX WcbhYl h]b'j]gi U``UbU`mg]g. ZcfY[fci bX]b['UbX]bhYfgYa]cg]gfi [b'8" 5`a Y]XU f9X"ŁBYk 'DYfgdYWnj Yg'cb'J]gi U``5bU`mg]g.: fca HYl hhc'7cbhYl hž'A YfWUXc. '6fUn]`
		f&L:FUj Y``]ž'@''`&\$\$\$''6YmcbX'g\cdd]b[.:WcbgHi WH]b[h\Y'GmXbYm'C`mad]Wg']b''!8'HYIH''FWj'f&\$'f(Ldd(,-!)%)
		5`gc.'@cc_'cj Yf'h\Y'a UbmfYUX]b[g'Zfca 'dfYWYX]b[k YY_g'k \]W\'[]j Y']b!XYdh\'hYI hUbU`mg]gžY['? bcl ž A UW_Yb! <cfuf]_ž'a fhf]yž'yhw<="" i="" td="" wa=""></cfuf]_ž'a>
		HI HCF = 5 @. ''6 UgYX'cb'K YY_''&''YWf fY'UbX fYUX]b[g
		DfYgYbhYf'%
		DfYgYbhYf'% DfYgYbhYf'&.

	®fYgYbfYf".Q

FYgci fWyg

DfYgWf]VYX F Ygci fWYg

H\Y`Wci fgY`hYI hVcc_`]g`; "`? fYgg`UbX`H"'j Ub`@YYi k Yb`f&\$\$*ŁF YUX]b['=a U[Yg. 'h\Y`[fUa a Uf`cZj]gi U`XYg][b`@cbXcb. 'F ci hYX[Y`f&bX`9X]f]cbŁ"

 $H\[g^{g}\]g^{h}Y^{g}Ya\]bU^{V}cc_{]}b^{h}Y^{g}Y^{X}UbX^{U}g^{d}fcXi\ WYX^{h}Y^{g}Ua\ Yk\ cf_{k}\]WX^{k}Y^{i}\ gY^{j}b^{h}Y^{W}ci\ fgY^{u}+i\Ug\\]bgd]fYX^{a}\ i\ WX^{g}\ fhY^{f}fYgYUfW^{u}Mci\ WUb^{i}\ gY^{h}\]g^{V}cc_{]}b^{i}df]bhcf^{j}b^{Y}YWfcb]WZcfa\ Uhz^{i}\ hmci\ a^{i}\ gh^{U}j\ YUWW^{g}g^{h}c^{j}h^{i}$

FYWca a YbXYX FYgci fW/g

: i fh\Yf'fYUX]b['k]``VY``]ghYX'cb'A ccX`Y`UbX`Uj U]`UV`Y`j]U'h\Y'f@9; 5BHCfi`]VfUfm`]b_"

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

 $\label{eq:linear_continuous_con$

=a U[Y 7 fYX]h

6cX]Yg'/ '=bHYfZJWYg'&\$%*

7F = 7CG

7F =7 C G 'Dfcj]XYf'7cXY. '\$\$\$-,;