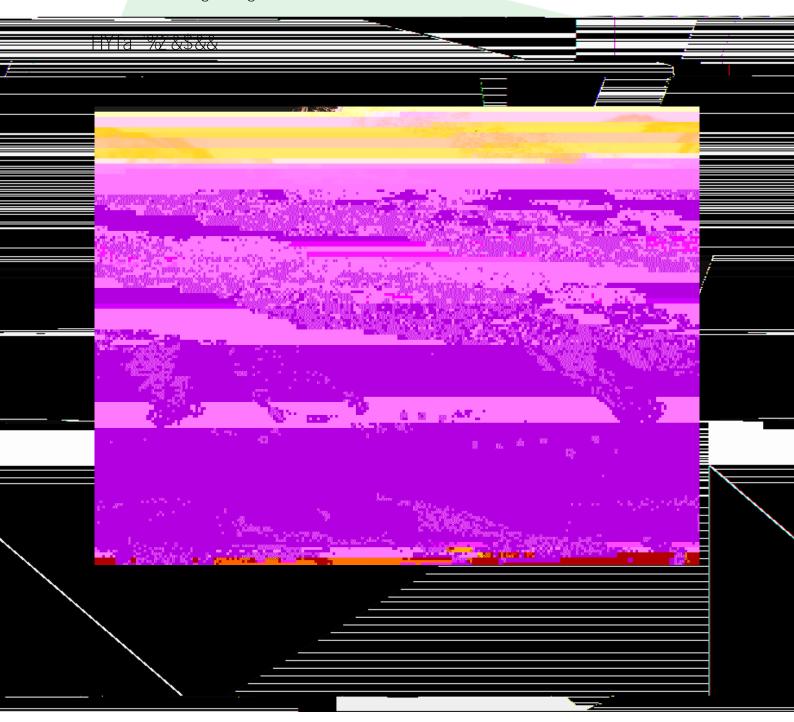


GSOE9758

BYhk cf_'GmghYa g'5fWX]hYWhi fY



7ci fgY⁻Cj Yfj]Yk

GHJZ7cbHJWh8YHJ]`g

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`] m	@cWUh]cb	D\cbY
J]'Um'G]j UfUa Ub	j_]Um4_i_bgk_"YXi_"Ui_	A cb'- Ua !(da	; %+ Fcca (('	-',) '*)++

GWXcc`7cbHJWh =bZcfa Uh]cb

7 cbgi `hUhjcbg. '@YWhi fYf Wcbgi `hUhjcb'hja Yg'k]``'VY'UXj]gYX'Xi f]b['h\Y'Zjfgh`YWhi fY" Mci 'UfY'k Y`Wca Y'hc'Ya U]`'h\Y'hi hcf'cf``UVcfUhcfmXYa cbghfUhcfžk \c'WUb'Ubgk Yf mci f'ei Yhf&k Y`Wca Y'hc'Ya U]`'h\Y'hi hcf'cf``UVcfUhcfmXYa cbghfUhcfžk \c'WUb'Ubgk Yf

D\cbY

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fŽ*%'&Ł'-',) ',) $$'-Bi WYi g'Ghi XYbh'<i V

fŽ*%'&Ł'-',) '+**%'-'9b[]bYYf]b['±0Xi ghf]U`'HfU]b]b[

fŽ*%'&Ł'-',) '' %+-'-'I BGK 'Ghi Xm'5VfcUX'UbX'I BGK '9I W\Ub[Y'fZcf']bVci bX'ghi XYbhgŁ
.
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9a U]`

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

 $\hbox{Ghi XYbhg'UfY'ghfcb[`m'YbWc'i fU[YX'hc'UhhYbX'U```WUggYg'UbX'fYj]Yk'``YWhi fY'fYWc'fX]b[g''' } \\$

7ci fgY'GWXYXi `Y

J]Yk 'WUgg'ha YhUV'Y

H]a YHJV`Y

8UHY	HmdY	7cbhYbh	
K YY_"%"%(": YVfi Ufm! % ": YVfi Ufm	@YWhifY	⇒hfcXiWhjcb'hc'h\Y'5fW\]hYWhifY'dfcWYgg	
K YY_'&.'&%: YVfi Ufm! &) ': YVfi Ufm	@YWhifY	6i g]bYgg'A cXY`'7 Ubj Ug'f6A 7Ł'J]g]cbgž; cU`gž FYei]fYa Ybhg'fJ; FŁ	
K YY_" ."&, ": YVfi Ufm! ("A UfVX	@YWhifY	HY`Wcž7`ci XžUbX'9I WXUb[Y'5fWX]hYWh fYg	
K YY_"(. "+"A UfWX"!"	@YWhifY	BUNJcbU``6fcUXVUbX'BYkkcf_fB6BŁ	
K YY_")."%("A UfVX"!"% A UfVX	DfYgYblUl]cb	Dfc:YWighU[Y:%dfYgYbhUh]cb	
K YY_'*.'&%'A UfVX'!'&) A UfVX	5ggYgga Ybh	A]X! hY fa 'hY gh	
K YY_"+."&, "A UfVX"!"% 5df]"	@YWhifY	€H'BYhk cf_g	
K YY_', .'('5df]`!', '5df]`	DfYgYblUljcb	DfcYVNghJ[Y'&'dfYgYbhJh]cb	
K_YY_''%%'5df]`'!'%) 5df]`	@YWhi fY	Dfc[fUa a UV`Y`BYhk cf_g	

FYgci fWyg

DfYgWf]VYX F Ygci fWYg

H\Y`fYWca a YbXYX`ff\\ci [\'bchfYei]fYXE`fYZVfYbWY`Vcc_g`Zcf`f\\]g`Wci fgY`UfY.`fUE`Df]gWj``U`C ddYb\Y]a Yfž "Hcd!8ck b`BYkk cf_`8Yg][b"ž'H\]fX`9X]h]cbž'7]gWc`DfYggž &\$\\$\$`UbX`fVE`>Ua Yg`8"`A W7 UVYž''BYkk cf_5bU`mg]gž'5fW\]hYWfi fYž'UbX`8Yg][b"ž' fX`9X]h]cbž'A cf[Ub!? Ui Za Ubž'&\$\$+"

FYWca a YbXYX FYgci fW/g

GYWNjcbg'Zfca ij Ufjci g'ch\Yf'Vcc_gž'dUdYfgž'UbX'ch\Yf'fYUXjb['a UhYfjU``k]``'VY'i gYX'h\fci [\ci h'h\jg Wci fgY/]bZcfa Uhjcb'UVci h'h\YgY'k]``'VY'dcghYX'cb'h\Y'Wci fgY'A ccX`Y'dU[Y'UbXZh\Y'k YV!dU[Y.\hdg.##gi V'YWmg"YY"i bgk "YXi "Ui # gcY-+), #

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

H\]g`Wci fgY`]g`i bXYf`WcbgHJbhfYj]g]cb`]b`cfXYf`hc`]a dfcj Y`h\Y``YUfb]b[`ci HWca Yg`Zcf`U``ghi XYbhg"`D`YUgY Zcfk UfX`UbmZYYXVUW_fdcg]hj Y`cf`bY[Uhj YE'cb`h\Y`Wci fgY`hc`h\Y`Wci fgY`Wcbj YbYf`cf`j]U`h\Y`7 ci fgY`UbX HYUW\]b[`9j U`i Uhjcb`UbX`\=a dfcj Ya YbhDfcW\gg\"Mci `WJb`U`gc`dfcj]XY`ZYYXVUW_hc`9@GC 7 k\c`k]``fU]gY mci f`WcbW\fbg`Uhghi XYbhZcW\g`[fci d`a YYh]b[g\"5g`U`fYgi `hcZdfYj]ci g`ZYYXVUW_cVhJ]bYX`Zcf`h\]g`Wci fgY UbX`]b`ci f`YZZcfhg`hc`dfcj]XY`U`f]W\`UbX`a YUb]b[\Z\```YUfb]b[\YI dYf]YbW\z`k Y`\Uj Y`Wcbh]bi YX`hc`Yj U`i UhY UbX`a cX]Zmci f`XY`]j YfmUbX`UggYgga Ybha Yh\cXg\"

5 WUXYa]W<cbYglmUbX D`U[]Uf]ga

5 WUXYa]W<cbYghmUbX D`U[]Uf]ga

D`U[]Uf]ga `]g`h\Y`i bUW_bck `YX[YX`i gY`cZch\Yf`dYcd`Y'g`k cf_ž`]bWi X]b[`h\Y`Wcdm]b[`cZUgg][ba Ybhk cf_g UbX``UVcfUhcfmfYgi `hg`Zfca `ch\Yf`ghi XYbhg"`D`U[]Uf]ga `]g`Wcbg]XYfYX`U`Zcfa `cZUWUXYa]Wa]gWcbXi WhžUbX h\Y`I b]j Yfg]hm\Ug`j Yfmghf]Whfi `Yg`h\Uh`]bWi XY`gca Y`gYj YfY`dYbU`h]Yg": cf`I BGK `dc`]WjYgž'dYbU`h]Yg`UbX]bZcfa Uh]cb`hc`\Y`d`mci `Uj c]X`d`U[]Uf]ga ž`gYY`\hdg.#ghi XYbh'i bgk "YXi "Ui #d`U[]Uf]ga "'Hc`Z]bX`ci h]Zmci i bXYfghUbX`d`U[]Uf]ga 'WcffYWhmž'hfmh\]g`g\cfhiei]n. \hdg.#ghi XYbh'i bgk "YXi "Ui #d`U[]Uf]ga !ei]n"

; YbYfU`7cbXiWhUbX6Y\Uj]cif

7 cbg]XYfUh]cb"UbX`fYgdYWhZcf"h\Y`bYYXg`cZmci f`ZY``ck `ghi XYbhg`UbX`hYUW\]b[`ghUZZ]g`Ub`Yl dYWhUh]cb" 7 cbXi Whk \]W\`i bXi `mX]gfi dhg`cf`]bhYfZYfYg`k]h\`U`WUgg`]g`bchUWWdhUV`Y`UbX`ghi XYbhg`a UmVY`Ug_YX`hc`YUj Y`h\Y`WUgg"

5 WUXYa]W + DZcfa Uhjcb

7CJ=8%: !=a dcfhJbh'<YU`h\ FY`UhYX'Bch]\W'

 $\label{thm:linear} $$ Mcif'(YU)h(U)X'h(Y'(YU)h(CZh)cgY']b'mcif'WUgg']g'Wf]hWU''mi]a\ dcfhUbh''McifaighghUmUh(CaY']ZmcifUfYg''YU'h(Cf'(U)Y'YYYb'UX)]gYX'hc'gY'Z]gc'UhY'VmBGK_(YU)h(Cf'(U)YfbaYbhUih(Cf)hJYg'''7iffYbhUYfhg'UbX'U$

5ddYbX]I . '9b[]bYYfg'5i ghfU`]U'f95Ł'DfcZYgg]cbU` '9b[]bYYf'7ca dYhYbWm GHJbXUfX

Dfc[fUa '±bHYbXYX'@YUfb]b['Ci HWca Yg	
?bck `YX[Y`UbX`g_]```VUgY	
D9%%7ca dfY\Ybg]j Yžfh\YcfmVUgYX`i bXYfgfUbX]b[`cZfh\Y`i bXYfd]bb]b[`bUfi fU``UbX d\mg]WU``gW]YbW'g`UbX`fh\Y`Yb[]bYYf]b[`Z bXUa YbfU`g`Udd`]WUV`Y`fc`fh\Y`Yb[]bYYf]b[`X]gW]d`]bY	
D9%"&"7cbWYdh U``i bXYfgHJbX]b['cZh\Y'a Uh\Ya Uh]Wgzbi a Yf]WJ``UbU`mg]gzigHJh]gh]Wgz'UbX Wca di hYf'UbX']bZcfa Uh]cb'gW]YbWYg'k\]W\'i bXYfd]b'h\Y'Yb[]bYYf]b['X]gW]d`]bY	
D9%" =b!XYdh\i bXYfgHJbX]b[cZgdYV]JU`]ghVcX]Yg`cZ_bck `YX[Y`k]h\]b`h\Y`Yb[]bYYf]b[X]gVJd`]bY	
D9%"('8]gWYfba YbhcZ_bck `YX[Y`XYj Y`cda YbhUbX`fYgYUfW\`X]fYWf]cbg`k]h\]b`h\Y Yb[]bYYf]b['X]gWJd`]bY	
D9%) '? bck `YX[Y'cZYb[]bYYf]b['XYg][b'dfUWf]WY'UbX'WcbhYl hi U``ZUWcfg']a dUWf]b['h\YYb[]bYYf]b['X]gW]d`]bY	
D9%"* `I bXYfgHJbX]b[`cZh\Y`gWcdYž'df]bW]d`Ygž'bcfa gž'UWVci bHJV]`]h]Yg`UbX`Vci bXg`cZ gi gHJ]bUV`Y`Yb[]bYYf]b[`dfUWf]WY`]b`h\Y`gdYW]Z]WX]gW]d`]bY	
9b[]bYYf]b['Udd`]WUh]cb'UV]`]hm	
D9&"%5dd`]WUh]cb`cZYghUV`]g\YX`Yb[]bYYf]b[`a Yh\cXg`hc`Wca d`Yl `Yb[]bYYf]b[`dfcV`Ya gc`j]b[
D9&"&": `i Ybh'Udd`]WUh]cb'cZYb[]bYYf]b['hYVXb]ei Ygž'hcc`g'UbX'fYgci fWYg	
D9&"' '5dd`]WUh]cb'cZgmghYa Uh]WYb[]bYYf]b['gmbh\Yg]g'UbX'XYg][b'dfcWYggYg	
D9&"('5dd`]WUh]cb'cZgmghYa Uh]WUddfcUWXYg'hc'hXY'WcbXi Wh'UbX'a UbU[Ya YbhcZYb[]bYYf]b[dfcYWng	
DfcZYgg]cbU``UbX`dYfgcbU``Ultf]Vi lYg	
D9' "%"9h\]WU``W&bXi Wh'UbX'dfcZYgg]cbU``UWW&i bHUV]`]hm	
D9' "&"9ZZYWNjjY"cfU``'UbX"k f]MnYb"Wcaaib]WUNjcb"]b"dfcZYgg]cbU``'UbX``UmXcaU]bg	
D9' "' '7 fYUhjj Yž']bbcj Uhjj Y'UbX'dfc!UWhj Y'XYa YUbci f	
D9' "('DfcZYgg]cbU`i gY'UbX'a UbU[Ya YbhcZ]bZcfa Uh]cb	
D9' ") 'C fXYf`ma UbU[Ya YbhcZgY`ZïUbX'dfcZYgg]cbU``WcbXi Wh	
D9' "* '9ZZYW¶j Y'HYUa 'a Ya VYfg\]d'UbX'HYUa ''YUXYfg\]d	