

ARTS3750

8Yj Y`cda Ybhž'7ca a i b]hm'UbX'9bj]fcba Ybh

HYfa 'C bY''##'&\$&\$

7ci fgY⁻Cj Yfj]Yk

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'7cbj Ybcfg'

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Gi VYWh5fYU. 6WhWab_WfEfgV[We

5fY`mci `]bhYfYghYX`]b`i bXYfghUbX]b[`UbX`hUW_`]b[`]a dcfhUbhYbj]fcba YbhXYj Y`cda YbhWkU``Yb[Yg`]b`h\Y &%ghW/bhi fm3·8 c mci 'h\]b_'U'Wca a i b]lm!VUgYX'UddfcUW\ hc XYj Y`cda YbhUbX'Ybj]fcba Ybha UbU[Ya Ybh XY`]j Yfg'a cfY'gi ghU]bUV`Y`UbX`Yei]hUV`Y`ci hWca Yg3'H\Y'Wci fgY`]bhYffc[UhYg'h\YgY`UbX'a Ubma cfY Wf/h/WU``ei Ygh/cbg'gi ffci bX/b['th\Y'Wca a i b]mtVUgYX'UddfcUVX 'tc'XYj Y`cda YbhUbX'Ybj]fcba YbhU` a UbU[Ya Ybh''H\Y'Wci fgY'Yl dcgYg'mci 'hc'U'gcd\]gh]WUhYX'i bXYfghUbX]b['cZh\Y'W ffYbhXYj Y'cda YbhUbX Ybj]fcba Ybh]ggi Yg UZZYW]b['h\Y k Y``!VY]b['cZ`cWU``Wca a i b]h]Yg]b 5i glfU`]U UbX XYj Y`cd]b['Wci blf]Yg" GdYWZWU``mžh\Y`WcifqY`dfcj]XYq`mci k]h\'h\Y`bYWYqqUfmh\YcfYhWU``VUW_[fcibX`Uq`kY```Uq`U`qYhcZWUqY qh X]Yq'bc'i bXYfqHbX'UbX'HJW `Y'fYU'!k cf'X'Ybj]fcba YbHJ`'UbX'XYj Y`cda YbhVXU``Yb[Yq"'H\fci [\'h\]q Wci fgYzmci k]``\Uj Y'Ub'cddcffi b]mm'c']bhY[fUhY'gcWJU'zYWcbca]WUbX'Ybj]fcba YbhU`'UgdYWg'cZ XYj Y`cda YbhUbX'Ybj]fcba YbhU``]gqi Ygž'UbX'h\Y'WbWYdhq'UfY'X]gW ggYX'h\fci [\'h\Y'`Ybg'cZgi ghU]bUV`Y XY; Y`cda YbhZfca 'U'gcWYhU`dYfgdYWlj Y"'=XYUg'UbX]ggi Yg'UfY'dfYgYbhYX'Ug'WcbhYghYX'YbhlhYg'VYWUi gY cZh\Y'a i `h|d`]W|mcZX]j YfqYžUbX`Uh'h|a YqžX]Ua Yhf]WU``mcddcqYX`qhU_Y\c`XYf`]bhYfYqhq"'H\Y'UddfcUWX`cZ h\Y`Wci fgYžh\YfYZcfYžYgW\Yk g`h\Y`"cbY`f][\hik Um" UddfcUW\ hc`XYj Y`cda YbhUbX`Ybj]fcba Ybh a UbU[Ya Ybh]b ZJj ci f'cZUb UddfcUVX VUgYX cb i bXYfglUbX]b['h\Y'X]j YfgY UbX Wca d'Yl 'gcWJYhU' WcbhYl hg`]b`k \]W\`XYj Y`cda YbhUbX`Ybj]fcba YbhdfcZYgg]cbU`g`cdYfUhY"'8]ZZYfYbhUddfcUW\Yg`hc a Ubu[]b['h\Y'Ybj]fcba YbhUbX'XYj Y'cda Ybhdfc'YWg'UbX'dfc[fUa g'UfY']`i glfUhYX'h\fci [\ci hVma YUbg cZfY`Yj UbhWUgY`gh X]Yg"'Mci k]``VY`UV`Y`hc`Yl d`cfY`k\Yh\Yf'UbX`\ck X]ZZYfYbhdc`]WJYg'UbX`dfUWJWYg'UfY k cf_|b['fbf'bchk cf_|b[Łž'UbX'\ck 'dc`]\/mfYgdcbgYg'\/Wb'\/Y'a UXY'a cfY'Yei]\/UV'Y'UbX'gi g\/U]\bUV'Y'UhI\\Y Wcaaib]mi`YjY`"

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- &" 7 f]h]WU``mUbU`mgY`gca Y`Wca a i b]lm!VUgYX`XYj Y`cda Ybh'UbX`Ybj]fcba Ybh'U``a UbU[Ya Ybh'dc`]WjYg i g]b[`WUgY`ghi X]Ygž'UbX`]XYbh]ZmdchYbh]U``cdh]cbg`hc`UXXfYgg`W\U``Yb[Yg`ZUW]b[`h\Y``cWU` Wca a i b]hYq
- ' " 7 cbXi WigcVJU`gVJYbVW`fYgYUfVX`UbX`UbU`mg]g`]bXYdYbXYbh`mž'UbX`U`gc`]b`U`hYUa `Ybj]fcba Ybhž UbX`XYa cbghfUhY`Ub`UddfYVJUh]cb`cZh\Y`cddcfhi b]h]Yg`UbX`VXU``Yb[Yg`]b`dfcZYgg]cbU``k cf_
- ("8YacbglfUlY'h\Y'XYjY`cdaYbhcZYZYWfjY'Wcaaib])WUhjcb'UbX'Wf]hjWU`'UbU`mg]g'g_j``g'bYYXYX'hcYb[U[Y'k]h\'X]jYfgY'ghU_Y\c'XYfg']bjc'jYX']b'h\Y'Z]Y'X'cZXYjY`cdaYbhUbX'Ybj]fcbaYbhU`aUbU[YaYbh

HYUW]b['GhfUhY[]Yg'

H\Y`Wći fgY`]g`XYg][bYX`]b`U`k Umih\UhiYbWći fU[Yg`mci `hc`hU_Y`U'XYYd`UddfcUW\'hc``YUfb]b["'H\Y`Wći fgY WćbhYbhUbX`h\Y`UXcdh]cb`cZh\Y`hYUW\]b[`ghfUhY[]Yg`UfY`ghi XYbh\W`bhfYX"'H\Y``YUfb]b[`ci hWća Yg`k]```VY UW\]Yj YX`h\fci [\`U'VU`UbWYX`Wća V]bUh]cb`cZhYUW\]b[`UbX``YUfb]b[`UWh]j]h]Yg`gi W\`Ug`gYa]bUfgžfYUX]b[ž WUgg`X]gW gg]cbž[fci d`k cf_ž'cfU``dfYgYbhUh]cbž'UbX`cb`]bY`UWh]j]h]Yg"`8i f]b[`h\Y`gYa YghYfž'mci `UfY YbWći fU[YX`rc`]bhYfUWhk]h\`mci f'dYYfg`UbX`h\Y``YWh fYf`h\fci [\`j Uf]ci g`a YUbgž'gi W\`Ug`h\Y`Wći fgY'g A ccX`Y`g]hY`UbX`Ya U]`g"`GYa]bUfg`UfY`WćbWY]j YX`cZUg`Ub`]bhYfUWhj Y``YUfb]b[`UWhjj]hmk\YfY`mci `WUb`Ug_

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H\YfY`]g`BC`bYYX`hc`ZcW`g`cb`cbY`dUfh]W``Uf`YI Ua d`Y`fh\]g`]g`Zcf`h\Y`bYI hUgg][ba Ybh!''< ck Yj Yfž`mci Wci`X`XfUk`cb`U`fUb[Y`cZgYWcfU``YI Ua d`Ygž'UbU`mg]g`UbX`]bg][\hg`hc`\][\`][\ncddcfhi b]h]Yg`UbX W\U``Yb[Yg`cZYei]hm]b`fY`Yj UbhXYW\bhfU`]gYX`BFA`dc`]W]Yg`UbX`dfUW]W\g"

Gi Va]gg]cb'bchYg.5```UggYgga Ybhg'a i ghVY'gi Va]hhYX'Y`YWfcb]\W\``mcb`mz'h\fci [\'h\Y'fY`Yj Ubh UggYgga YbhHi fb=hb'dcfhU``]b'A ccX'Y"'H\YfY']g'bc'\UfX'Wcdmgi Va]gg]cb'fYei]fYX"

 $\label{eq:higher} \textbf{Hi fb]hjb'gYhjb[.'H\]g'Ugg][ba Ybh]g'gi Va]hhYX'h\fci [\'Hi fb]hjb'UbX'gh XYbhg'Wbb'gYY'Hi fb]hjb'g]a]'Uf]hm fYdcfhg''$

5ggYgga Ybh& 7UgY Gh XmF Ydcfh

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8 YHJ]`g. `Ghi XYbhg`UfY`fYei]fYX`hc`k f]hY`U`WUgY`ghi XmfYdcfhcZ%) \$\$`k cfXg"`±n]bj c`j Yg`h\Y`UbU`mg]g`cZU WUgY`ghi XmfY`UhYX`hc`UbmcbY`cZh\Y`h\Ya Yg. `Wta a i b]hmdUfh]W]dUh]cbž`XYWYbhfU`]gUh]cbžYei]hmž`ZccX qYW f]lmž`X]qUqhYfq`UbX`i fVUb]qUh]cbž`]b`U`Wti bHfmftft'U`fY[]cb6

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

H\Y`G\W.cc``cZGc\WJU``G\WJYb\W'g`[i]XY`]bYg`cb`UHYbXUb\W'`UfY`UjU]`UV`Y`Uh`\Hndg.##gc\WJU`g\WJYb\W'g"Uffg"i bgk "YXi "Ui #ghi XYbhg#FYgci f\W'g#dc`]\WJYg![i]XY`]bYg#

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K YY '' . '&'A UfW.'! '*	GYa]bUf	·) `A UfVX.
A UfVX		Ai`WobeZ[bS`VUa`foba^aX`SfgobS^dWebagdUWe, FobYWWkaXfZW5aa`e1
		D`i g
		9 dagb BdWeW fSf[a`#,?7J;5A. 7 ca a i b]lmck bYfg\]d UbX Wcblfc`]b A YI JWUb ZcfYglfmYbHYfdf]gYg.?Ym]ggi Yg UbX cddcfhi b]hJYg"9 dagb e? aaV WfSe], gi Va Jgg]cb cZ U"\$\$ k cfXg gi a a Ufmcb A ccX`Y'g XJgW gg]cb Zcfi a Vm\%")-da cZ-A UfWX": UJi fY hc gi Va Jhh\Jg gi a a UfmVmXi Y XUHY k J``UZZYWhh\Y a Uf_'U``cWUhYX Zcf gi a a UfmbchY"
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		6 WUW fd5 feSf[a`S`V Wcg[fk [VWhWab_WfS`V W h[da`_W fS^ba fU[We
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		6 WUW fcS1[eWV `SfgcS^dNeagdJW_S`SYW_Wf['; Va`We[S, Abbacfg`[f[WeS`Vd[e]eXad?aUS^SUUag`fST[/[fk
		9 dagbe? aaV WfSe], 'gi Va]gg]cb cZU'' \$\$ k cfXg gi a a Ufmcb A ccX`Y'g X]gW gg]cb Zcfi a 'Vm %") - da 'cZ%* 'A UfW.": U]`i fY 'bc gi Va]hih.]g gi a a UfmVmXi Y XUhY k]``'UZYWhh.Y a Uf_'U``cWUhYX Zcf gi a a UfmbchY"
K_YY_") . "%* "A_UfW\"! "&\$	GYa]bUf	% 'A UfW.

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		7 ca a i b]lmlVUgYX`V]cX]j Yfg]lmiWcbgYfj Ulr]cb`]b H\U]`UbX.`k \c`k]lbgžk \c``cgYg3
		9 dagbe? aaV WfSe], 'gi Va]gg]cb cZU'' \$\$ k cfXg gi a a Ufmcb A ccX`Y'g X]gW gg]cb Zcfi a 'Vm %") - da 'cZ&' 'A UfW.": U]`i fY 'bc gi Va]hih]g gi a a UfmVmXi Y XUhY k]``'UZZYWih\Y a Uf_'U``cWUhYX Zcf'gi a a UfmbchY"
K YY_^*.^&' ^A UfWX^!^&+ A UfWX	GYa]bUf	&* ^A UfVX.
A OIW		5 SeWefgVk #, 7`h[da`_WifS^Ua`eWthSf[a`fZdagYZ >S`VUSdWYdagbe [`@EI ł3gefdS/[S
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		±bX][Ybci gʻWca a i b]lmi]bʻYbj]fcba YbrUʻ WcbgYfj Uh]cbʻ]bʻBYkʻNYUʻUbX. ? Ymi]ggi YgʻUbX ʻYggcbg
		9 dagb e ? aaV WfSe] , 'gi Va]gg]cb cZU ' \$\$ k cfXg gi a a Ufmcb A ccX Y 'g X]gW gg]cb Zcfi a 'Vm %%') - da cZ' \$ A UfW." : U] i fY hc gi Va]hih]g gi a a UfmVmXi Y XUHY k]` UZZYWhhY a Uf_ U`cWUHX Zcf gi a a UfmbcHY"
V VV · · · · · · · · · · · · · · · · ·	Childy EMMillm	0 'E 4fl'
K YY_'+." \$'A UfWX'!" 5df]`	C b`]bY`5Wi]j]hm	& 5df).
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		3 xfwd Ua_ b wf[`Y kagd dwsv[`Y S^aUSfvw Xad fZ[e i Ww] ł wsuz efgvw fi [^i d[fws %" " i adve eg Sdk a Xfzw[d dwsv[`Y S`V egT_ [f fZ[e j]U wti fgYfg a cc X`Y g]hY Tk ##z +b_ ł (3 bd[^z
		@a egT_ [ee[a` ad 'SfWegT_ [ee[a` i [^dWeg'f [` kag TW[`Y STeW f XadfZ[e eW_ [`SdS`V _ Sk SXXVUf fZW _ Sd] S^aUSfWV XadbSdf[U[bSf[a` ž
K_YY_", . '* '5df]`"! '%\$ '5df]`	GYa]bUf	- '5df]`.
		5 SeWefgVk \$, 'Dc`]ħ]WgʻcZYbj]fcba Ybh]bʻA U`UVUf

		<pre>< YUX`UbXž`GmXbYm D`i g 9 dagb BdWeW fSf[a`', 43@9 >367E: Ba'[f[Ue aXU'[_ SfWUZS` YWSVSbfSf[a` [` 4S` Y'SVWeZ 9 dagb e ? aaV'WfSe], 'gi Va]gg]cb'cZU'' \$\$`k cfXg gi a a Ufmcb'A ccX'Y'g'X]gW gg]cb'Zcfi a 'Vm %%") - da 'cZ% '5df]`": U]`i fY'hc'gi Va]hih\]g'gi a a Ufm VmXi Y'XUHY'k]``'UZYWh\Y'a Uf_'U``cWJHYX'Zcf gi a a UfmbchY"</pre>
K YY_''% '5df]`'!'%+ 5df]`	GYa]bUf	%* '5df]`` 7 UgY'Ghi Xm', 'I fVUb]gUh]cb'cZdcj Yfhm!'G'i a XYj Y`cdbYbh]b' ±bX]U D'i g 9 dagb BdWeW fSf[a` (, FZWBZ['[bb]` We E 'g_ e VWhWab_ W f [? S` [S 9 dagb e ? aaV'WfSe], 'gi Va]gg]cb'cZU'' \$\$'k cfXg gi a a Ufmcb'A ccX'Y'g'X]gW gg]cb'Zcfi a 'Vm %") - da 'cZ&\$'5df]'": U]'i fY'hc'gi Va]h'h\]g'gi a a Ufm VmXi Y'XUhY'k]``'UZY\Wh\Y'a Uf_'U``c\WhYX'Zcf gi a a UfmbchY"

a\$ Wallhy Will**%**

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DfYgWf]VYX F Ygci fWYg

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H\YfY`]g'U`gc`gi [[YghYX'gi dd`Ya YbhUfmfYUX]b[``]ghhc`]bWfYUgY`h\Y`VfYUXh\`cZmci f`i bXYfghUbX]b[`cZh\Y Wci fgY'a UhYf]U``UbX`hc`Ugg]ghmci `]b``]VfUfmfYgYUfW\`Zcf`mci f`YggUmg"``F YUX]b[`]g'cf[Ub]gYX`Vmhcd]W h\Ya Y`UbX`X]gW gg]cbgž'Ug`Zc``ck g.

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 $\label{eq:ck_property} $$ \c k \] $$ T'f&$$Md DWfZ[`][`Y DWeagdUW? S`SYW_W f, \c gef[UW E gefS[`ST['ffk S`V ;`V[YW age BWab'Mež @cbXcbž'F ci hYX[Y'ff7 \Udh'f'%']"$

G\fYgh\Už?""? "'f&\$%*\Łž'6 [_ Se aX<gef[UW, 5 a \\WUf[h\WSUf[a\] S\\V 7 cg[fk [\] @\WbS^e 5 a_ g\] [fk 8 ad\\efck\ 5 Xfc]\hi\Di \V\]g\Yfg\\Z'\BYk \\8\Y\\]\\Z'\\\\

? UhYgžF "ž'DUff]gž'H"'UbX'@Y]gYfck]mž'5"'f&\$\$) Łž'K \Uhi]g'gi gHJ]bUV`Y'XYj Y`cda Ybhž'7` h[da` _ W fž'j c`"'(+ž bc"'' ž'dd"'-!&%"

A YVfUhi ž'A "'f\% - , $\$ 'Z'Gi ghU]bUV]`]\text{m'UbX'gi ghU]bUV`Y'XYj Y`cda Ybh' <]ghcf]\text{WLbX'WcbW'dhi U` fYj [Yk ž'7` h[da` _ W fS^; _ bSUf 3ee\text{We_ W f DWh[W ž'j c`"\% ž'dd"(- ' '-') &\\$"

6Yf_YžD"'f&\$\$&\zerog'Gi ghU]bUV`Y`8Yj Y`cda YbhC ZYf'U`BYk '8]fYWf]cb'Zcf'D`Ubb]b[3'7\U``Yb[Yg'Zcf'h\Y Hk Ybml:]fgh7Ybh fmz'<agd S^aXB'S``[`Y>[fW&SfgdWzj c`"'%+z'bc"'%z'dd"'&%' *"'

6 [eUgee[a],

 $8]YgYbXcfZ^cA "`UbX`< Ua]'hcbz^c7"'f%-+\z'H\Y`9Wc`c[]WU``mGi ghU]bUV`Y`8Yj Y`cda YbhDfcWfgg`]b`5i ghfU`]Uz = b`8]YgYbXcfZ^cA "`UbX`< Ua]'hcbz^c7"'flYXg"\z': g_S` 7Ua'aYkl: g_S` 7Ua`a_kz^5``Yb`UbX`I bk]bz^Gh' @YcbUfXgz^dd"`&,)!'$%"$

GmXbYmK UhYffl zvzz9bj]fcba YbhD`Ub`&\$\!\+.`GmXbYmK UhYfgcVYWhj YgzhUf[Yhg'UbX'UWhjcbghca UbU[Y'UbX']a dfcj Y'Ybj]fcba YbhU`dYfzfa UbW\"

) 'A UfW.HF 5; 98MC: 'H<9'7CA A CBG

EW_[Sd

< UfX]bž; "'f%-*, ŁžH\Y'HfU[YXmcZh\Y'7 ca a cbgžEU[W'UW' j c`''%* &ždd"'\&(' !\&(, "

: YYbmž'8 "ž'6Yf_Ygž': "ž'A W7 Umž'6" 'UbX'5 WXYgcbž'>" 'f% - \$\{\) H\Y 'HfU[YXmcZh\Y'7 ca a cbg. 'Hk Ybml Hk c \cdot' MYUfg'@UhYfz': g_ S` 7 Ua'aYkz'j c \cdot''% z'bc "%z'dd"% % "

G\fYgh\Už?""?"'/ `C \Už<"`f&\$%+\Z`'H\YcfYh]WU``UXj Ub\W`g`]b`Wcaai b]m!VUgYX`bUh fU``fYgci fWYa UbU[YaYbh`Cghfca `UbX`VYmcbXz`+b`G\]j U_ch]z`; "z`DfUX\Ubz`l "z`UbX`<Y`a]z`<zf&\$%+\z`D\W\W\[`]Y 8]n\Mg]fm\Bb\M`8\mb\8_1\Mg\aX\B\fgc\S^D\Weagd\W\e?S` SY\W_W\f[`3e[S"`Jc`iaY`%z`9`gY\\]Yfz\%o?z`dd"%`—`(\$"

‰

6 [eUgee[a],

5bh]bcf]ž7"'UbX'6fUmž8"'6"'f&\$\$) Łž7ca a i b]tm/ZcfYghYbtYfdf]gYg'Ug'YbtfYdfYbYi f]U``Z]fa g. '9Wcbca]WUbX']bgh]hi h]cbU``dYfgdYWf]j Yg'Zfca 'A Yl]WcZK affX'6WhWada Wbfzj c`"'' ' z'bc"'- z'dd"'% &-!% (' "

7 i VVU[Yž: "'K "žF"F"8Uj]gž8"FcXff[i Yn DUfYXYgžF"Ac``Yb\Ui YfžM''?fUi g'9`g]bž; "'9": fYmž="5"; cbn½Yn'< Yfb½bXYnž< "'5`VUff½b'< i ff bX'5 Zfaq U` 9Wcbca]W

.

%%·A UfWX·····8979BHF5@€5H€B

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EW_[Sd

 $F \]Vchz^->"7"z^-5"^-5 \ [fuk u^-ubx^-5"^-A "^@ufgcb^-f&$$^+\ Lz^F \ YWbhfu^]n]b[^-k \]^Y \ XYWbhfu^]n]b[^-.'<ck buh]cbu^-[^-cj \ Yfba \ Ybhg^-fYUddfcdf]UhY^-ZcfYghfYgci fWgz^-I adV 6 WhWab_ W fl^-j c^-"'' (z^-bc''-wz^-dd'' % *(!%, *")$

 $G\fYgh\U\check{z}?""?""f\&\$\&\&\check{z}fflck\UfXg'9bj\]fcba\YbhU``9ei\]hm]b``B\YdU`YgY'7ca\ a\ i\ b]hm:\ cfYghfmfiz=b`:\ fYXYf]$\underline{W}_{.}8" ; \ cfXcb'/~; \ fY[\ cfm?"":\ fYY`UbX`ffYX"\L`z';` fWd\Sf[a`S^7`h[da`_W\ fS^<gef[UW\5a_bWf[`Y\5'S[_eS`V]]$Wbb\WUf[hWez'=A\ Di\V`]\WUh]cbgz'< YfhZcfXg\]fYž'I\ ? z'dd"'- +-\%\%"$

п

6 [eUgee[a],

; U``Ya cfYž'7 "ž'A "'8]'; fY[cf]cž'A "'A cY`]cbc`UbX`A "'6fcW_\Ui g'f&\$%) Łž'HfUbgUWf]cb`Wcghgž'dck Yfž'UbX a i `h]!`Yj Y``ZcfYgh'[cj YfbUbW']b'=bXcbYg]Už'7 Ua 'aY[US^7 Ua` a_ [Uežj c`"'\%(ž'dd"'\%*, !\%+- "

GU\]XYžA "žG":Gi dfUha Ubž5":A Ufmi X]žM!!G":?]a 'UbX'@";]YggYb'f&\$%*\Ez8YWYblfU`]gUh]cb'dc`]WmUg fYWYblfU`]gUh]cb'glfUhY[m'ZcfYgha UbU[Ya Ybhi b]hg'UbX'Wca a i b]hm'ZcfYglfmi]b'\DXcbYg]Už;`fWd Sf[a`S^8adWefdk DWh]W ž'j c`"% ž'bc"'%Z'dd"'+,!-)"

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% 'A UfWX '''''7 C A A I B ≠IMID5F H=7 ±D5H€B

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EW_[Sd

5 fbgh/]bž'G"'f%-*--Łž'5'`UXXYf'cZWJhjnYb'dUfhJWJdUhjcbž'<agd S^aX3_ Wd[US`;`ef[fgfWaXB'S``[`Yžjc`"') žbc"(ž'dd"&%*!&&("

5 [fUk U`ž5"'UbX';]Vgcbž7"'f1%--- Łž9bWkUbha Ybh'UbX'8]gYbWkUbha Ybh'H\Y'F c`Y'cZ7 ca a i b]hm']b B Uh' fU`F Yqci fWY'7 cbqYfj Uh'cbžl adV 6 WhWab_ W fl j c`"&+ž'bc"(ždd"'*&-!*(-"

G\fYgh\Už?""?""UbX`A WA Ubi gžD"`f&\$\$, ŁžH\Y`dc`]h]Wg`cZWca a i b]hmdUfh]WjdUh]cb`]b`bUhi fU``fYgci fWY a UbU[Ya Ybhž`Yggcbg`Zfca `Wca a i b]hmZcfYghfm]b`BYdU`ž3gefc\${\sigma} \%` 8adWefckž'j c`"+\%zbc"&\zdd"\%')!\%(*"

8 fYgg`Yfž'K "ž'6i gWXYfž'6"ž'GWXccbž'A "ž'6fcW_]b[hcbž'8"ž'< UnYgž'H"ž'? i ``ž'7 "ž'A W7 Uft\mž'>"ž'UbX'G\fYgt\Už ? "'? "'f&\$%\$\Lz': fca '<cdY'hc'7 f]g]g`UbX'6UW_'5[U]b3'5'7 f]h]\W`; YbYU`c[mcZt\Y'; `cVU`'7 6BFA B UffUh]j Yž'7`h[da` _ W fS^5a`eWthSf[a` ž'j c`"' +ž'bc"%ž'dd"') -%) "

 $\label{eq:huaub} HUa\ Ub[\ \check{z}G\check{z}DUi\ XY`\check{z}?\ /\ G\fYgh\U\check{z}?"?"`f\&\$\%(\ \check{z}:\ Ya\]b]nUh]cb`cZU[\ f]Wi\ `hi\ fY`UbX`]hg`]a\ d`]WUh]cbg`Zcf`ZccX gYW f]hm]b`BYdU`ž'<agd` S^aX8adWefS` V >[hW[ZaaV"] c`"\%\ždd"\&\$-'\ &\"$

; UffUi `Už'< "`B "ž'5"`B]Y\cZUbX'@"`J]ggYf'f&\$%\$\Ez: Ya]b]gUlf]cb'cZ5[f]W`h fY'Ug'Ub'9ZZYWhcZAU'Y'Cih a][fUlf]cb.'I bYIdYWhYX'CihWcaYg'Zfca'>\UdU'8]glf]Whz'9UghYfb'BYdU'z';`fWd Sf[a`S^<agd S^aX;`fWdV[eU[b-{`Sck EaU[S^EU[W UWez'] c'"') z'bc"'&z'dd"') *) '-') ++"'

? YbbYm'@UnUfz'A "'f&\$%&tz'D`UbHJhjcb'fi VVYfz``UbX'[fUVV]b['UbX'gcWjU'!dfcdYfmm'ffUbgZcfa Uhjcb']b gci h\Yfb'@Ucgz'<agd S^aXBWSeS` f E fgV[Wez'] c`"' - z'bc"' ! (z'dd"'%\$%+!%\$' +"

: $fUbWc\check{z} > "7"\check{z}\&\&W"$; $cVU``UbX'[fUVV]b[UbX'ffUYWcf]Yg'cZU[fUf]Ub'WXUb[Y.'5'dfY`]a]bUfmUbU`mg]g\check{z} < agd S^aXSYcSdS` UZS` YW<math>\check{z}$ dd"' $\&\check{z}$ bc"' $\&\check{z}$ dd"' (!) - "

- ^{15}df GMBB9M

EW_[Sd

G\fYgh\Už?""UbX'8YYž>"'f&\$\$, Łž'D`Ubb]b['Zcf'gi ghJ]bUV'Y'XYj Y`cda Ybh' ₺j Ygh][Uh]b['Ybj]fcba Ybh XYj Y`cda Ybh'XYMg]cb'a U_]b[']b'GmXbYmg'A U'UVUf'< YUX`UbXž'6[S'aYgWe [GdTS` B'S` [Y, Fai SdVe E gefS[ST WD WY [a` ež'GmXbYmI b]] Yfg]hmDfYgqž'GmXbYm';]`a ci f'UbX'6`U_Y`mfYXq"Łž'dd"''!&*"'

% '5df]`. ''''G@ AG'5B8'IF65B'DCJ9FHM

•

EW_ [Sd

Fcmž:5"'f&\$\$-Łž'K\m'\DX]U'WUbbchd`Ub']hg'Wh]Yg.'\DZcfaU`]hmž]bgif[YbW'\UbX'h\Y']X]ca'cZifVUb]gUh]cbž'B'\S``[YFZWakzjc'", z'bc"%z'dd"+*'--', +"

6i hu`užB"žJ ubF ccmYbžA "`ubX`DuhY`žF"`f&\$%\$\\zeta dfcj YX`\Yu`h\`ci h\\care a Yg`]b`i fVub`g`i a g`h\fci [\]b\\Zfughfi \\mathrighti d[fuX]b[\zeta u[S^E u[\W u\WS` V ? \\W[u[` \\wedge j c`"+\\zeta dd"-') !- (\\$"`

; cj Yfba YbhcZ±x]U'fl žVžfl G`i a 'XYj Y`cda Ybhdc`]Wm&\$%\$ž@k k k "]bX]UYbj]fcba YbhdcfhU`"cf["]b#Ydcfhg! XcW a Ybhg#g`i a !XYj Y`cda Ybhdc`]Whl&\$%\$Q

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6 [eUgee[a`."

Dcf]cž'9"'UbX'7f]gc`ž'7"'f&\$\$(\{\footnote{z}\)DfcdYffmf][\\hg\footnote{z}\)gYW f]micZhYbi fY'UbX'h\Y'i fVUb'dccf']b'A Yhfc A Ub]'U\(\footnote{z}\): ST[fSf;`fWd`Sf[a`S'\footnote{z}\]i c\"'&; \(\footnote{z}\)dd"'\&\" "

 $7 \ [\ Ybh] \$

.

F]WXUfXgcbžH"'f&\$\$) Łž9bj]fcba YbhU``UggYgga YbhUbX'd`Ubb]b['h\Ycfm'Zci f'g\cfhighcf]Yg'UVci hdck Yfža i `h]d`Y'fUh]cbU`]hmž'UbX'Yh\]Wgž'7` h[da` _ W fS^;_ bSUf 3eeWee_ W f D Wh[W ž'j c`"&) ž'dd"' (%-' *) "

FcV]bgž@"'UbX'8cjYfgžG"'f&\$\$+ŁžBFA 'FY[]cbg']b'5i ghfU`]U. 'h\Y''<UjYg''UbX'h\Y''<UjY'Bchg'ž' 9 WaYc\$bZ[US^D WeW\$dJZž'j c`"'() ž'bc"'' ž'dd"'&+' -&-\$"

FcV]bgcbž>"'f&\$\$(E'Gei Uf]b['h\Y'W]fWY3'Gca Y'h\ci [\hg'cb'Gi ghJ]bUV`Y'XYj Y`cda Ybhž'9Wc`c[]\WJ`9\\chica]\\dignormathci [\hg'cb'Gi ghJ]bUV`Y'XYj Y`cda Ybhž'9\\chica]\\dignormathci [\hg'cb'Gi ghJ]bUV`Y'XYj Y`cda Ybhž'9\\chica]\\dignormathci [\hg'cb'Gi ghJ]bUV`Y'XYj Y`cda Ybhž'9\\chica []\\WJ`

G\fYgh\Už?""UbX'8YYž>"'f&\$\$, ŁžD`Ubb]b['Zcf'gi ghU]bUV`Y'XYj Y`cda Ybh' ₺j Ygh][Uh]b['Ybj]fcba Ybh'XYj Y`cda Ybh'XYW]g]cb'a U_]b[']b'GmXbYm'g'A U`UVUf' < YUX`UbXž'6[S'âYgWe [`GdTS`B'S``[Y, Fai SdVe E gefS[STWDWY[a`e

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

 $I BGK `[fci dg'd`U[]Uf]ga `]bhc'h\Y'Zc``ck]b[`WUhY[cf]Yg.$

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

- 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

5 WUXYa]W±bZcfa Uhjcb

: cf'YggYbhJU`gh XYbh]bZcfa UhJcb'fY`UhJb['hc.

• fYei YghgʻZcfʻYl hYbg]cb/