ARTS2034

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B Ua Y	9a U]`	5j U]`UV]`]lm	@cWUh]cb	D\cbY
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D\cbY. f\$&£'-',) '(,) *

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K YVq]hY. k k k "Ufhq"i bak "YXi "Ui #qUa

 $\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''$

5ggYgga Ybh

F YZYfYbW]b["'Ghi XYbhg'UfY'ZYY'hc'WkccgY'k\]W\Yj Yf'fYZYfYbW]b['gmghYa'h\YmdfYZYf"'< ck Yj Yfž']b a U_]b['h\]g'Wkc]WY'ghi XYbhg'g\ci `X'VYUf']b'a]bX'h\Y'di fdcgY'cZfYZYfYbW]b[.'hc'[i]XY'h\Y'fYUXYf'hc Yj]XYbWYžUbX'k\Yb'bYWYggUfmhc'h\Y'Yj UbhdUfhcZh\Y'gci fW']b'ei Ygh]cb"'5b'Ui h\cf!XUhY'gmghYa k]h\ci hdU[Y'bi a VYfg']g'h\i g'dYfZYWhmUddfcdf]UhY'Zcf'fYZYfYbWg'hc'h\Y'WYbhfU`'WU]a g'cf'[YbYfU` Uf[i a Ybhg'cZg\cfhk cf_gž'Vi hh\Y'gUa Y'gmghYa']g']bUddfcdf]UhY'k\Yb'Whjb['U'bcj Y`ž'U'dcYa ž'U gi VghUbh]U`'ci fbU`'Ufh]WYž'U'gWkc`Ufma cbc[fUd\žcf'U'k cf_cZUbm`Yb[h\'UbX'Wca d`Yl]hm''\d\cqY WJgYgž'dU[Y'cf'`]bY'bi a VYfg'UfY'YggYbh]U`'Zcf'h\Y'fYZYfYbWY'hc'Xc']hg']bhY``YWfi U`k cf_"

K cfX'7ci bhg"5``ei chUh]cbg'UbX'fYZYfYbWYg'UfY']bWi XYX']b'k cfX'Wci bhgžk \]'Y'V]V`]c[fUd\]Yg'UfY'bch'5 a Uf[]b'cZ%1 'UVcj Y'UbX'VY`ck 'h\Y'gh]di `UhYX'k cfX'Wci bhk]``VY'UWWYdhYX'k]h\ci hdYbU`hm'

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8YHJ]`g.

&ž\$\$\$ k cfXgž ZYYXVUW_dfcj]XYX j]U Hi fb]h]b"

 $\label{thm:condition} \mbox{Hi fb]h]b'gYh]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''$

5ggYgga Ybh'& 'HU_Y' < ca Y'9l Ua

8YHJ]`g.

&ž\$\$\$ k cfXgžZYYXVUW_dfcj]XYX j]U Hi fb]h]b"

 $\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}$

F Ygci fWYg F YWca a YbXYX F Ygci fWYg 7 ci fgY '9j U'i Uh]cb 'UbX '8 Yj Y`cda Ybh

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

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

; YbYfU``mž'UggYgga YbhiHug_g'a i ghVY'gi Va]hhYX'Y`YVWfcb]\W)``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`hYfbUhjj 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 i]gii g]b[ih\Yik cfXgicfi]XYUgicZch\YfgiUbXidfYgYbh]b[ih\Ya iUgimci fick b"i=hWJbihU_Yia Ubm Zcfa gžZfca iXYi]VYfUhYiWXYUh]b[ihciUWW]XYbhU`mWcdm]b[iZfca iUigci fWYik]h\ci hiUW_bck iYX[Ya Ybh'

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

• i bXYfgHJbX'mci f'f][\hg'UbX'fYgdcbg]V]`]h]Yg'Ug'U'gh XYbh'Uhil BGK