

HUMS1006

DfYgYbhUhjcb UbX 7 ca a i b]WUhjcb G_]~g

HYfa 'H\fYY''##'&\$&\$

7ci fgY'Cj Yfj]Yk

GHJZZ7cbHJWh8YHJ]`g

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`] m	@cWUhjcb	D\cbY
6fmcb] [·] HfYn]gY	V"ffYn]gY4 i bgk "YXi "Ui		FcVYfh KYVghYf*‰+	Ž*%'&'-',) ()%'

GWkcc~7cbhJWh~abZcfa Uh]cb

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

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D\cbY.'f\$&E'-',)'(,)*

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

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''$

7ci fgY 8YW] g

7 fYX]hDc]bhg * *

Gi a a UfmcZh\Y 7ci fgY

:]bX mci f'j c]WY UbX gdYU_k]h\ WbZ]XYbWY "HY```U 'ghcfmž'd]hW\ 'U 'WbWYdhž'Yb[U[Y'Ub'Ui X]YbWY 'UbX 'g\UfY]XYUg" +b 'h\]g 'Wci fgYž'mci 'k]```YUfb'\ck 'hc 'a U_Y'mci f'a Uf_']b 'h\Y'k cf'X" 'Mci 'k]```XYj Y`cd 'g_]``g']b dfYgYbhYhjcb 'UbX'Wca a i b]WUhjcb'i gYX'Vm]bZi YbhJU```YUXYfgž'Wca dY``]b['ghcfmhY``Yfg'UbX'YZZYWhJj Y dfYgYbhYfg" Mci 'k]``'ghi XmghcfmhY``]b['Vm`YUX]b['UWcfgž'a chjj UhjcbU``gdYYW\Yg'Vmdck YfZi `Wca a i b]WUhcfgž'UbX'di V`]WgdYU_]b[']b'dfcZYgg]cbU``dfUWnJWY" DfUWnJWU``k cf_g\cdg'k]``']bhfcXi WY mci 'hc hYW\b]ei Yg'cZUi X]YbWY'Uk UfYbYggž'd\mg]\WJ``dfYgYbWY'UbX'j c\WJ``dfcYWnJcb"'6mZc``ck]b['YI Ua d`Yg'UbX fY\YUfg]b[']b'WUggž'mci 'k]```XYj Y`cd'h\Y'WcbZ]XYbWY'hc 'dfYgYbhmci f']XYUg']b'Ub'Ui h\YbhJWj c]\WY'UbX Wca a i b]\WJHY'mci f'a YggU[Y'k]h\`WJf]mUbX'Wcbj]\WHcb"

7ci fgY @YUfb]b[Ci hWca Yg

- $%" XYgWf]VY`UbX`Yj U`i UhY`\ck `dfYgYbhYfg`Wcaaib]WUhY`]b`U`fUb[Y`cZ[YbfYg`UbX`WcbhYl hg &" UbU`mnY`UbX`Udd`mdfYgYbhUh]cb`hYVW.b]eiYg`]b'j cWU``dfc<math>\Upsilon$ Wf]cbžd\mg]WU``dfYgYbWYžUiX]YbWY
- ' " d`UbžfY\YUfgY`UbX`XY`]j Yf`Ub`Yb[U[]b[`dfYgYblUh]cb`Zcf`Ub`Ui X]YbW
- ("fygdcbx'Wcbglfi Wfj Y`mhc'dfygYbhUhlcbg'[]j Yb'Vmch\Yfg

Uk UfYbYggž'UbX'WYUf'Wca a i b]WUh]cb

HYUWX]b[GhfUhY[]Yg

H\Y``YWi fYg`gi fj Ymh\Y`[YbfYg`UbX`WcbhYl hg`cZcfU``Wca a i b]\Wlf]cbž'di V`]\WgdYU_]b['UbX`WfYUh]j Y dfYgYbhUh]cb']b' dfcZ\gg]cbU``dfU\Wf\W'`UbX`gc\\]U```]Z\"'H\YmU`gc'\UXXfYgg`_Ym\Wcb\W'dhgž]ggi Yg`UbX UddfcU\\X\yg`]b'\WfYUh]b['Y\ZY\\Mj Y'dfYgYbhUh]cbg\"+\b'h\]g'h\U\\Yf!`YX`ghf\h\[n\x\\Y\Jb['n\x\\Y\'Y\ Uh]b['k]```VY`Yl Ua d`Y! Xf]j Ybž'dfcj]\X]b['U'a cXY``\Zcf`\ck 'ghi XYbhg`\Wb`XYj Y`cd'dfYgYbhUh]cb'g_]``g'\mghi Xm]b['[fYUh df\gYbhUh]cbg'[]j Yb'\m]bZi YbhJ\U```YUXYfg\zh\X'dYf\Zcfa Yfg\z\UbX`\\can a Y``]b['ghcfmh\``Yfg"

H\Y'hi hcf]U'g'dfcj]XY'Ub']bhYfUWlj Y'`YUfb]b['Ybj]fcba YbhZcf'ghi XYbhg'hc 'XYj Y`cd'dfYgYbhUh]cb'g_]``g h\fci [\'dfUWlJWD'`Yl YfW]gYg'UbX']a a YX]UhY 'ZYYXVUW_"'DfUWlJWD'`UWlj]hJYg'hUi [\hi]b'U'k cf_g\cd! a cXY']bhfcXi WY'ghi XYbhg'hc 'hYW\b]ei Yg'cZUi X]YbWY'Uk UfYbYggž'd\ng]WJ``dfYgYbWY'UbX'j cWU``dfc YWlJcb" 6mZc``ck]b['Yl Ua d`Yg'UbX'fY\YUfg]b[']b'WUggž'ghi XYbhg'k]```XYj Y`cd'h\Y'WcbZJXYbWY'hc 'dfYgYbhih\Y]f'ck b ghcf]Yg']b'Ub'Ui h\YbhJWj c]WY'UbX'Wca a i b]WUhY'a YggU[Yg'k]h\'WUf]hmUbX'Wcbj]WlJcb"'H\]g'U'dfUWlJWY! VUgYX'ghfUhY[mZcf'YUfb]b[!VmXc]b["'H\Y'hi hcf]U'g'U'gc'dfcj]XY'h\Y'WcbhYl hZcf'h\Y'ZfghUggYgga YbhHUg_. \\
\ddf\ygYbH\Hgg'UbX'cb']bY'Yl YfW]gYgz'&\I'' a]bi hY'dfYgYbHUhJcbgz'cbY'fYWcfXYX'fUi X]c'cf'j]XYcłz'cbY'`]j Y"
Ghi XYbhg'fY!dYfZcfa 'U'[fYUhgdYYW\'fYWcfXYX'VmUb'UWhcfz'dc`]hJWJUb'cf'`YUXYf''\d'b'U'gYwcbX'hUg_z'ghi XYbhg]a dfcj Y'h\Y'dYfZcfa UbWY'cZU''VUX''dfYgYbhUhJcb"'6ch\'hUg_'dfcj]XY'cddcfhi b]hJYg'hc 'XYgWf]VY'\ck dfYgYbhYfg'Wca a i b]WUhY'UbX'Ya VcXmhYW\b]ei Yg"

H\Y`cb`]bY`WcbHYbh]g`Zcf'dYfgcbU`]gYXz̄gY`Z\X]fYWYX``YUfb]b["'Ghi XYbhg`UfY`cZZYfYX`U`a Ybi `cZcb`]bY WcbHYbhZca `k\]W\`H\YmW\ccgY`U'dYfgcbU`]gYX`gYei YbW'`fY`Yj UbhHc`H\Y]f`ck b`dfcZYgg]cbU``WcbHYl h`UbX]bX]j]Xi U```YUfb]b['bYYXg"'Ghi XYbhg`k]``Wca d`YhY`UgYhbi a VYf`cZa cXi `Yg`Zfca 'h\Y`a Ybi "'H\Y`a Ybi 'k]``]bWi XY`WcbHYbhUbX``YUfb]b['UWfj]h]Yg`]b`H\fYY`gHfYUa g. `ff\&'dfYgYbHUh]cb`[YbfYg`fXfUa Uh]Wa cbc`c[i Ygž [fYUhgdYYW\Ygž'ghcfmHY``]b[ž'gHUbX!i d`Wca YXmž'dc`]h]WU``gdYYW\YgžY`Yj Uhcf'd]HW\Ygž_YmbchY dfYgYbHUh]cbgž'WifYa cb]U``gdYYW\Yg`UbX`gc`cb\f\&\UgdYWg`cZdfYgYbHUh]cb HYW\b]ei Y`fcfU``f\Yhcf]Wzj cWU``dfc`YWf]cbz`UWfjb['HYW\b]ei Yz`Ui X]YbWI`UXXfYggz'gdYU_]b['hc`WJa YfUz``]gHYb]b['UbX`Ug_]b['ei Ygh]cbgz']a dfcj]gUh]cb`UbX`gc`cb\/UbX`fl \LYI Ua d`Yg`cZdfYgYbHJh]cbgz'Vch\

YZZYWIJ Y 'UbX' fi/UXfz' fY'Yj Ubhihc 'h\Y' dfc ZYgg]cbU` 'WcbhYl hg' UbX' X]gW]d`]bY' cZh\Y'ghi XYbhg"' H\Y'cb`]bY 'YUfb]b['ZYYXg']bhc 'h\Y'gYWcbX' UggYgga YbhihUg_. 'Ub' UbU`mi]WU` fYdcfhcb 'U'WJgY'ghi Xmz'%) \$\$'k cfXg" Ghi XYbhg'k f]hY' 'U'fYdcfhUbU`mn]b['WcbhYl hz'[YbfY' UbX'hYW\b]ei Yg']b' U'dfYgYbhUh]cb' W\cgYb' Zfca 'U'`]ghicZ`]j Y'UbX'fYWcfXYX'Yl Ua d'Yg" H\Y'fYdcfhdfcj]XYg' Ub'cddcfhi b]hmZcf'ghi XYbhg'hc'Yj U'i UhY'\ck'dfYgYbhYfg Wca a i b]WUhY' UbX'hc'UbU`mnY'h\Y]f'hYW\b]ei Y"

 $\label{thm:condition} $$HYY'Z_bU''UggYgga YbhHUg_']g'U'gh XYbhYX''YUfb]b['ghfUhY[m''9UWX'gh XYbhdfYdUfYg'Ub'cf][]bU'dfYgYbHJh]cb']b'U'gdYWJZ_W[YbfYžXfUk]b['cb'WcbhYbhh\Uh]g'fY'Yj Ubhhc'h\Ya "'H\YmXY']j Yf'h\Y$

5ggYgga Ybh

5ggYgga Ybh'HUg_g'

5ggYgga Ybh'hUg_	K Y][\h	8iY'8UHY	Gh XYbh@YUfb]b[Ci hWca Ygʻ5ggYggYX
DfYgYbfUljcb ⁻	(\$1	Bch5dd`]WUV`Y	&Ž Ž(
±b!WUggʻUbXʻC b`]bY 91 YfWjgYgʻ	&\$ı	Bch5dd`]WUV`Y	%ž&
5bU`mm]WU``F Ydcfhi	(\$1	Bch5dd`]WUV`Y	%ž&

5ggYgga Ybh'8YHJ]`g

5ggYgga Ybh'% DfYgYbhJh]cb

GhUfhXUhY. Bch5dd`]WUV`Y

@Yb[h\.**a]bihYff+\$\$*kcfX*Yei]jU`Ybh2*dfYgYbhUh]cb

8 YW] g.

* 'a]bi hY 'fl \$\$ 'k cfX'Yei]j U`YbhŁ'dfYgYbhUh]cbž'Y]h\Yf``]j Y`cf'fYWcfXYX`f(\$ı Ł'OXi Y`k YY_g`, 'UbX'- QF i Vf]W]bX]WUh]b['`Yj Y``cZdYf7cfa UbW'`U[U]bghYUW\`UggYgga YbhWf]hYf]Už'k f]hhYb`7cfa Uh]j Y`7ZYXVUW_ž'UbX dYfWbhU[Y`[fUXY"

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

5ggYgga Ybh' ']g'dfYgYbh'X`]b'Y]h\Yf'h\Y`YWi fY`cf'h\Y'hi hcf]U``]b'k YY_g`- 'UbX'%\$`cZh\Y'Wci fgY"'Ghi XYbhg k]``VY`]bj]h'X`hc'W\ccgY'k\Yh\Yf'hc'dfYgYbh']b'h\Y``YWi fY`cf'hi hcf]U`"'Mci 'a UmW\ccgY'hc'dfYgYbh 5ggYgga Ybh' '`]j Y`]b!WUgg`cf'dfY!fYWcfXYX`cb'j]XYc"'Mci 'a i ghdfYgYbh'5ggYgga Ybh' '`]j Y`]b!WUgg`lZmci dfYgYbh'X`5ggYgga Ybh''&'dfY!fYWcfXYX`cb'j]XYc"'GYY'UXX]h]cbU``bchYg`cb'A ccX`Y'fY[UfX]b['th\]g UggYgga Ybh'

Gi Va]gg]cb bch/g. Df/gYbh/X]b WUgg Xi f]b['k YY_g - 'UbX % f% 'cf' & Bcj Ya VYfŁ

Hi fb]hjb gYhjb[. H\]g]g bchU Hi fb]hjb Ugg][ba Ybh

5qqYqqa Ybh& =b!WUqq'UbX'Cb`]bY'9l YfWqYq

GHJfhXUhY.

@Yb[h\. &1 &!' a]bi hY]b! WUgg dfYgYbhUh]cbg

8 YW] g.

&T &T a]bi hY]b! WUgg dfYgYbhUhjcbg ZUWj]hUhYX Vmcb`]bY a cXi `Yg f&\$i hchU'E'Xi Y k YY_g'' // `) Q : YYXVUW_. F i Vf]W]bX]WUhjb[``Yj Y``cZdYfZcfa UbWY U[U]bghYUWX UggYgga YbhWf]hYf]Užk f]hhYb Zcfa Uhjj Y ZYXVUW_ž UbX dYfWYbhU[Y [fUXY"

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

5qqYqqa Ybh' . '5bU`mh|WU` F Ydcfh

GHJfh:XUhY.

@Yb[h\." T") \$\$ k cfX UbU mh\W\"fYdcfhq

8 YW] g.

' 'I ') \$\$'k cfX`UbU`mh]WU``fYdcfng`f(\$ı Ł'-'i d`cUXYX'j]U`Hi fb]h]b"OXi Y`k YY_g`(ž+ž'%\$QF i Vf]W]bX]WUh]b[``Yj Y` cZdYfZcfa UbW'`U[U]bghYUW.`UggYgga Ybh'Wf]hYf]Už'k f]hhYb`Zcfa Uh]j Y`ZYYXVUW_ž'UbX`dYfWfbhU[Y`[fUXY"

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

@Yb[h\." I') \$\$ k cfXg 8 YhJ]g. 7 UgY ghi Xm" \deliver 1 \deliver 1 \deliver 3 \deliver 5 i Vf]W]bX]WUhb["Yj Y` cZdYfZcfa UbW" U[U]bghYUW\ UggYgga YbhWf]hYf]Už k f]hYb Zcfa Uhj Y ZYYXVUW_ž UbX dYfW bhU[Y [fUXY" 5XX]hJcbU`XYhJ]g. 5 ggYgga Ybh&"%Xi Y K YXbYgXUm + C WcVYf') .\$\$da "5 ggYgga Ybh&"&Xi Y K YXbYgXUm &, C WcVYf') .\$\$da "5 ggYgga Ybh&" Xi Y Gi bXUm&) Bcj Ya VYf') .\$\$da "

5 hm/b XUb WY F Yei]fYa Ybhg

 $\hbox{Ghi XYbhg'UfY'ghfcb[`mYbWci fU[YX'hc'UhhYbX'U```WUggYg'UbX'fYj]Yk ``YWhi fY'fYWcfX]b[g''] }$

7ci fgY'GWXYXi `Y

<u>J]Yk "WUgg"hja YHUV"Y</u>

H]a YHJV`Y

8 UHY	Hmd Y	7 cbhYbh
K YY_'%''%('GYdhYa VYf'! %''GYdhYa VYf	Hcd]W	@]ghYb]b[ž'9b[U[]b[ž'7 cbbYWn]b[
K YY_'&.'&%GYdhYa VYf'! &)'GYdhYa VYf	Hcd]W	GdYU_]b[#Jc]W]b[^%^CfU^]hm
K YY_'' .'&, 'GYdhYa VYf'! &'C WcVYf	Hcd]W	GdYU_]b[#Jc]W]b[*&:`DfcgcXmUbX`F\Yhcf]W
K YY_'(.') 'C WcVYf'!'- C WcVYf	Hcd]W	6Y\Uj]b[#9a VcXm]b['%'; Yghi fYg
K YY_`).	Hcd]W	6Y\Uj]b[#9aVcXm]b[^&.`DfclYa]Wg
K YY_'*."%-"CWvcVYf"!"&' CWvcVYf	Hcd]W	6fYU_'K YY_'bc'WUggYg
K YY_'+.'&*'CWvcVYf'!'' \$ CWvcVYf	Hcd]W	Ghcfm]b[#5ZZYWh]b[
K YY_', .`&Bcj Ya VYf'!`* Bcj Ya VYf	Hcd]W	A YX]UI]b[#DfcYW]b[
K YY_''- 'Bcj Ya VYf'! % 'Bcj Ya VYf	Hcd]W	

FYgci fWyg

DfYgWf]VYX`F Ygci fWYg`

Bch'Uj U]`UV`Y

FYWca a YbXYX FYgci fWYg

BchUj U]`UV`Y

Gi Va]gg]cb cZ5ggYgga YbhHUg_g Hi fb]h]b Gi Va]gg]cb

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

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

7 cdm]b[.'i g]b['h\Y'gUa Y'cf'] Yfmg]a]`Uf'k cfXg'hc'h\Y'cf][]bU`h\I hcf']XYU'k]h\ci hUW_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'dfc'YWgž'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["

7 c``i g]cb. 'k cf_jb['k]h\ 'ch\ Yfg'Vi h'dUgg]b['cZZh\ Y 'k cf_'Ug'U'dYfgcb'g']bX]j]Xi U``k cf_"'7 c``i g]cb'U`gc]bWi XYg'dfcj]X]b['mci f'k cf_'hc'Ubch\ Yf'ghi XYbhVYZcfY'h\ Y 'Xi Y 'XUhYzcf'Zcf'h\ Y' di fdcgY'cZh\ Ya d`U[]Uf]g]b['Uh'Ubmh]a Yz'dUm]b['Ubch\ Yf'dYfgcb'hc'dYfZcfa 'Ub'UWUXYa]WhUg_z'ghYU']b['cf'UWei]f]b[Ubch\ Yf'dYfgcb'g' UWUXYa]Wk cf_'UbX'Wcdm]b[']hz'cZYf]b['hc'Wca d`YhY'Ubch\ Yf'dYfgcb'g' k cf_'cf'gYY_]b[dUma YbhZcf'Wca d`Yh]b['UWUXYa]Wk cf_"

±bUddfcdf]UhY`W]hUh]cb.`7]h]b[ˈgci fW/gˈk \]WX`\Uj Y`bchVYYb`fYUXžk]h\ci hUW_bck`YX[]b[ˈh\Y`″gYWcbXUfm″gci fW/Zfca ik \]WX`_bck`YX[Y`cZh\Ya`\UgʻVYYb`cVhU]bYX"

8 i d`]\WUh]cb`ffgY`Zd`U[]\Uf]ga "Ł`gi Va]\h]b[`mci f`ck b`k cf_ž]b`k \c`Y`cf`]b`dUfhžk \YfY`]h\Ug`dfYj]ci g`m VYYb`dfYdUfYX`cf`gi Va]\hYX`Zcf`Ubch\Yf`UggYgga Ybhcf\Wci fgY`UhI BGK `cf`Ubch\Yf`i b]j Yfg]\m'

7 cffYWhfYZYfYbWb[dfUWhWyg.

- DUfUd\fUq]b[žgi a a Uf]q]b[žYggUmk f]h]b['UbX'h]a Y'a UbU[Ya Ybh
- 5ddfcdf]UhY'i gY'cZUbX'Uhff]Vi h]cb'Zcf'U'fUb[Y'cZa UhYf]U`g']bWi X]b['hYl hž']a U[Ygž'Zcfa i `UY'UbX WbWYdhg"

±0X]j]Xi U``Ugg]ghUbWr`]g`Uj U]`UV`Y`cb`fYei YghZfca `H\Y`@YUfb]b[`7 YbhY`f\hd.#k k k "`Wi bgk "YXi "Ui #£" Ghi XYbhg`UfY`U`gc`fYa]bXYX`h\UhWUfYZ ``h]a Y`a UbU[Ya Ybh']g`Ub`]a dcfhUbhdUfhcZghi XmUbX`cbY`cZh\Y]XYbh]Z]YX`WUi gYg`cZd`U[]Uf]ga `]g`dccf`h]a Y`a UbU[Ya Ybh'`Ghi XYbhg`g\ci `X`U``ck `gi Z]W]Ybh'h]a Y`Zcf fYgYUfW\z`XfUZh]b[`UbX`dfcdYf`fYZYfYbW]b[`cZgci fWg`]b`dfYdUf]b[`U```UggYgga Ybh']hYa g"

IBGK @]VfUfmU`gc`\Ugʻh\Y`9@&9`hcc``UjU]`UV`Y`hc`Ugg]ghmci`k]h\`mcif`ghiXmUhIBGK"`9@&9`]g XYg][bYX`hc`]bHfcXiWY`bYk`ghiXYbhg`hc`ghiXm]b[`UhIBGK`Vih]hWUb`U`gc`VY`U`[fYUhfYZfYg\Yf`Xif]b[`mcif

- i bXYfghUbX'mci f'f][\hg'UbX'fYgdcbg]V]`]h]Yg'Ug'U'ghi XYbh'Uhil BGK
 VY'Uk UfY'cZd`U[]Uf]ga ž'Wcdmf][\hžI BGK 'Ghi XYbh'7cXY'cZ7cbXi Wh'UbX'5WW'dhUV`Y'I gY'cZ I BGK '=7 H'F Ygci fWfg'Dc`]Wh

5 WUXYa]W + DZcfa Uhjcb

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

- fYei Yghg Zcf Yl hYbg]cb/
- `UhY 'gi Va]gg]cbg'[i]XY`]bYg/
- fYj]Yk cZa Uf_g/

O