

BIOM4953

F YgYufWx 'H\Yg]g'7

HYfa &Z&\$&&



7ci fgY`Cj Yfj]Yk

GHJZ`7cbHJW`8YHJ]`g

7cbj Ybcfg

BUa Y	9a U]`	5j U]`UV]`]m	@cW]h]cb	D\cbY
A]WUY`GH]j Ybg	hYglg"V]ca YXYb[4 i bgk "YXi " Ui	6m5ddc]bha Ybh		

GWXcc``7cbHJW`bZcfa Uh]cb

Gh XYbhGYfj]W]g`W]b`VY`WcbHJW]X]j]U`i [i.bgk "rc# YVZcfa g"](#)

7 ci fgY'8YHJ`g

I b]hg'cZ7 fYX]h(

Gi a a UfmcZ\Y'7 ci fgY

H\Y' h\Yg]g'dfcj]XYg'Ub'cddcfh b]hmZcf'mci 'hc'Vf]b['hc[Y\Yf'Yb[]bYYf]b['df]bW]d'Yg'YUfbYX'cj Yf mci f'dfYj]ci g'mYUfg'cZgh XmUbX'Udd'mh\YgY'df]bW]d'Yg'hc']b]bcj Uhj Y'mgc'j Y'dfcV'Ya g'gi W\Ug'h\Y XYj Y'cda YbhcZU'gdYW]ZWXyg[bZ'dfcW]gg'UbX#cf'h\Y]bj Ygh[Uh]cb'cZU'\mdch\Yg]g" H\Yg]g'dfc'YW]g'UfY W'ca d'Yi Z'cdYb!YbXYX'dfcV'Ya g'h\UhU'ck'fccca'Zcf'mci f'WYU]h]]mZ'UbX'h\Y'UW'ei]g]h]cbZ'UbU'm]g]g'UbX]b]h]fdYU]h]cb'cZfYgi 'hg" H\YfY'UfY'a i 'h]d'Y'dcgg]V'Y'gc'i h]cbg'cf'W'cbW] g]cbg'Uh'h\Y'ci hgYh'UbX'gi Z]W]Ybh W'ca d'Yi]m]hc'fYei]fY'U'XY[fY'cZ'dfc'YW]d'Ubb]b["H\Y' h\Yg]g'fYei]fYg'mci 'hc'Z'fa i 'U]h'dfcV'Ya g']b g]W]Ybh]Z]Wcf'Yb[]bYYf]b['h'fa g'za UbU[Y'Ub'h'W]b]W]d'fc'YW]h'UbX'Z]bX'gc'i h]cbg'VmUdd'm]b['g]W]Ybh]Z]WUbX Yb[]bYYf]b['a Y'h'cXg" Mci 'k]'U'gc'XYj Y'cd'mci f'UV]]m]hc'k'cf_]b'U'fYgYUfW'UbX'XYj Y'cda Ybh Ybj]f]cba Ybh'Mci 'a i gh]XYbh]Z]mU'gi dYf]]gcf'UbX'dfc'YW]d]cf'hc'Ybfc'']b[]b'h]g'W'ei fgY"

7 ci fgY'5]a g

H\Y' h\Yg]g'dfcj]XYg'Ub'cddcfh b]hmZcf'h\Y'gh XYbh'hc'Vf]b['hc[Y\Yf'Yb[]bYYf]b['df]bW]d'Yg'YUfbYX'cj Yf h\Y]f'dfYj]ci g'mYUfg'cZgh XmUbX'Udd'mh\YgY'df]bW]d'Yg'hc']b]bcj Uhj Y'mgc'j Y'dfcV'Ya g'gi W\Ug'h\Y XYj Y'cda YbhcZU'gdYW]ZWXyg[bZ'dfcW]gg'UbX#cf'h\Y]bj Ygh[Uh]cb'cZU'\mdch\Yg]g" H\Yg]g'dfc'YW]g'a i gh VY W'ca d'Yi Z'cdYb!YbXYX'dfcV'Ya g'h\UhU'ck'fccca'Zcf'gh XYbh'WYU]h]]mZ'UbX'h\Y'UW'ei]g]h]cbZ'UbU'm]g]g'UbX]b]h]fdYU]h]cb'cZfYgi 'hg" H\YfY'a i ghVY'a i 'h]d'Y'dcgg]V'Y'gc'i h]cbg'cf'W'cbW] g]cbg'Uh'h\Y'ci hgYh'UbX gi Z]W]YbhW'ca d'Yi]m]hc'fYei]fY'U'XY[fY'cZ'dfc'YW]d'Ubb]b['Z'ca 'h\Y'gh XYbh'H\Y' h\Yg]g'fYei]fYg'h\Y gh XYbh'hc'Z'fa i 'U]h'dfcV'Ya g']b'Yb[]bYYf]b['h'fa g'za UbU[Y'Ub'Yb[]bYYf]b['dfc'YW]h'UbX'Z]bX'gc'i h]cbg'Vm Udd'm]b['Yb[]bYYf]b['a Y'h'cXg" Gh XYbh]U'gc'XYj Y'cd'h\Y]f'UV]]m]hc'k'cf_]b'U'fYgYUfW'UbX'XYj Y'cda Ybh Ybj]f]cba Ybh'

7 ci fgY'@YUfb]b['Ci hW'ca Yg

- % " 8 Yj Y'cd'U'XYg][b'cf'U'dfcW]gg'cf']bj Ygh[U]h'U'\mdch\Yg]g'Z'ck]b[]bXi ghfm'UbX'dfcZ]gg]cbU' Yb[]bYYf]b['gh'UbXUfXg"
- & " 7 f]h]W]m'fYZYW]h]cb'U'gdYW]U']ghVcXmcZ_bck'YX[Y'fY'U]h'X'hc'h\Y]f'h\Yg]g'hc'd]W'
- ' " 5 dd'mg]W]Ybh]Z]WUbX'Yb[]bYYf]b['a Y'h'cXg'hc'gc'j Y'Ub'Yb[]bYYf]b['dfcV'Ya "
- (" 5 bU'm]gY'XU]h'cV'YW]j Y'mi g]b['ei Ub]h]f]h]j Y'UbX'a U]h'Ya U]h]W]a Y'h'cXg"
-) " 8 Ya cbgh'U]h'cfU'UbX'k'f]h]b'W'ca a i b]W]h]cb']b'dfcZ]gg]cbU'UbX'Um]Xca U]bg"
- * " Hc'gc'j Y'V]ca YX]W]d'fcV'Ya g'VmUdd'm]b['7 @C g'%)

HYUW]b['Gh'U]h[]Yg'

H\Y' W'ei fgY']g']h]i [\h]Ug'Ub']bX]j]Xi U'fYgYUfW'dfc'YW]z'hc'XYj Y'cd'U'Yj Y'cZfYgYUfW'g_]`g'UbX Ui h]bca m'

Gh XYbh]g']b'h]g'W'c'cf]h]k]' W'ca d'Y]h' h\Y]f'h\Yg]g'cj Yf'h'fY' h'fa g'f(Z(Z(E'cf'cj Yf'h'c' h'fa g'f(Z, E'5 gi a a UfmcZ\Y'UggYgga Ybh]g'Ug'Z'ck g

H\Yg]g'5. 'h]g]]b]h]bXYX'h\UhH\Yg]g'5' W'c] Yf'h\Y'g'W'cd]b[z'd'Ubb]b[z'UbX'W'ca d'Y]h]b['dfYdUfU]h]cbg'Zcf'h\Y d'fc'YW]h' Gh XYbh]g'a i gh'U]j Y'W'ca d'Y]h'X'h]g'UggYgga Ybh'UbX'dUggYX']b'cfXYf'hc'Ybfc'']b'6-€A (-)' "H\]g W'ei fgY']g'k'cf'h' %\$i 'cZ'mci f'Z]bU'h\Yg]g']fUXY"

H\Yg]g'6. H\Y'df]a Ufm]b]h]b]h]cb'VY']bX'H\Yg]g'6']g'hc'Ybgi fY'gh XYbh]g'gh]m]cb'h'UW'k]h'h\Y]f'dfc'YW]g

UbX'dfc'YWhk cf_ Ug'hYmidfc[fYgg'h'fci [\ 'h'Y'mYUf" 'H\]g'gi V'YWh]g'k cft'h '%\$i 'cZmci f'ZbU'h'Yg]g'[fUXY"
Gh'XYbth'g'a i gh'\Uj'Y'Wca d'Yh'X'h\]g'UggYgga Ybh'UbX'd'UggYX']b'cfXYf'hc'Ybfc``]b'6€A (-)' "'H\]g'Wci fgY
]g'k cft'h '%\$i 'cZmci f'ZbU'h'Yg]g'[fUXY"
H\Yg]g'7. 'H\Yg]g'7 'Wcb]bi Yg'h'Y'dfc'YWhk cf_" 'H\Y'_YmXY'j' YfUV'Y'j'g'h'Y'K f]h'Y'b'F Ydcf'h'Z'U'cb[g]XY'U
dcg'h'f'dfYgYbh'U'h'cb" 'H\]g'gi V'YWh]g'k cft'h ', \$i 'cZmci f'ZbU'h'Yg]g'[fUXY

I dcb'Wca d'Yh'cb'cZH\Yg]g'7 ž'h'Y'ZbU' [fUXY'k]'VY'WU'W'U'h'X'UbX'fYUdd']YX'hc'h\]g'Wci fgY'UbX'h'Yb'hc
6€A (-) %'UbX'6€A (-) &ž'fYd'UW]b['Ubm9"7 "'Wca dcbYbth"

YI d'U]b'mci f'fYgYUfW'hc'Yb[]bYYfg:k \c'UfY'bcHbYVW'ggUf]m]b'mci f'ZY'X'cZgh Xn'
*" 8YdYbX]b['cb'h'Y'gcW]U'X]gHUbW]b['fYghf]W]cbgZ'h]g'UggYgga Ybhk]''Y]h'Yf'U_Y'd'UW'cb]bY'cf
Ug'U'dcghY'f'gYgg]cb"

H\]g'g'bchU'Hi fb]h]b'Ugg][ba Ybh

5XX]h]cbU'XYH]g

Bch'U'Uh'h'Y'dcghY'f]g'Xi Y']b'K 99? ; "

5ggYgga Ybh&. 'H\Yg]g'F'Ydcfh

8i Y'XUHY. 'A cbXUmK YY_'%%'%%) - da

H\Y'U]a 'cZH\Yg]g'7 'g'hc'Z]bU]gY'mci f'fYgYUfW'fYgi 'hg'UbX'X]ggYa]bUH'h'Ya ']b'Ve'h'Ub'cfU'UbX'k f]hYb
a UbbYf''H\]g]g'h'Y'Z]bU'_'YmdUfhcZVY]b['U'gi W'W'ggZ 'f'fYgYUfW'Yf''Hc'h'UhYbXZ'h'Y'UggYgga YbhUg_g
dfcj]XY'gh XYb'g'k]h'U'fYU]g]h]WYI dYf]YbW'cZVY]b['U'fYgYUfW'Yf''

H\YfY'UfY'' 'UggYgga YbhUg_g'Z'f'H\Yg]g'7 "

F'Ydcfh

H\Y'k f]hYb'fYdcfh]g'h'Y'Z]bU'XcW a YbhU]h]cb'cZmci f'h'Yg]g'dfc'YW' 'hg\ci 'X'VY'Uddfcl]a UH'm) \$'dU[Yg
]b'Yb[h'f'YI W' X]b['fYZ'fYbW'g'UbX'UddYbX]W'g'

H\Y'h'Yg]g'W'cb'h'bhk]''VY'UggYggYX'UW'W'c'fX]b['hc'h'Y'ghUH'X'h'Yg]g'U]a g'k \]W'a UmVY'U'U'YI dYf]a YbhU'cf
g]a i 'Uh]cb!VUgYX'VE'XYg][b'cf'W'W]h]W'fYj]Yk g''H\Y'UggYgga Ybhk Y][\h]b[g'UfY'g'ck b'VY'ck "'D'YUgY
bc'h'U'Uh'h'YgY'UfY'cb'm'UggYgga YbhW]h]f]U''H\Y'h'Yg]g'gf'f' W' fY'ci h]bY'g'Ybh]fY'mi d'hc'mci "

H\Y'a Uf_'VfYU_'Xck b'Z'f'h]g'fYdcfh]g'Ug'Z'ck g

% " 8]W'W' h'U'f'Yj]Yk #/UW_[fci bX'UbX'di'f]h]g]g'h]h]gZ'h]h]b'Z'cb'h]h]f'f'&\$i ƒ %
&" 9I YW'h]cb'cZ'h'Y'fYgYUfW'dfc'YW'Z'ei U']mcZUb'm]g]gZ'X]gW'gg]cb'cZ'fYgi 'hg'f) \$i ƒ
' " 7cbW'g]cbg'UbX'j U'i Y'UXXYX'f&\$i ƒ
(" 8cW a YbhdfYgYbhU]h]cb'f'f'&\$i ƒ

5ggYgga Ybh' . 'DUfh]W]dUh]cb

5ggYgga Ybh'Yb[h'. 'Cb]bY'Gi fj Ym
8i Y'XUHY. '5Z'f'gi Va]gg]cb'cZ]bU'h'Yg]g'fYdcfh'

DUfh]W]dUh]cb

% 5 hYbXUbW'Uh'UV'a YYhb[g
(" 8)][YbW'UbX'Wca dYhYbW']b'dYfZcfa]b['hY'hUg_
% 5a ci bhczk cf_'UbX'Yb[U[Ya Ybhk]h'dfcV'Ya
& F]g_'UggYgga Ybhg'Wca d'Yh'fk \Yb'fY'Yj Ubh
' " C hYf'dfc'YVh'gdYWjZYj]XYbW'fY"["'UV'Vcc_'Wca d'Yh'cbk

5 hYbXUbW`F Yei]fYa YbHg

Gh XYbHg`UFY`gfcfb[`mYbWci fU[YX`fc`UhhYbX`U`WUggYg`UbX`fYj]Yk`YWhi fY`fYWcfX]b[g"

7 ci fgY`GW`YXi `Y

Bc`YWhi fYg`]b`h`]g`Wci fgY"

[J \]Yk`WUgg`ha`YhUV`Y](#)

H]a`YhUV`Y`

8UHf	HmdY	7cbhYbh
K YY_ ; . % `>i `m!`&& >i `m	5ggYgga Ybh	DcgHf`DfYgYbhU]cb`cb` : f]XUmcZK YY_ ;
Gh XmK YY_ ; . `5i [i gh! %%5i [i gh	5ggYgga Ybh	:]bU`F Ydcfh8i Y`A cbXUmK YY_`%%Z`%%) - da
	5ggYgga Ybh	Gi Va]hmc i f`dfc`YWhiYI]hZ`fa "

F Ygci fWg

DfYgWf]VYX F Ygci fWg

F Ygci fWg'k]`VY'a UXY'Uj U]UV'Y'rc` \Y'd'ghi XYbHg [i]XY'hYa`]b'hY]f'ci fbYmZcf'H\Yg]g'5"

9I hYbg]cbg

Mci`Wb'Udd'mZcf`gdYWU`Wcbg]XYfU]cb`k` \Yb`]`bYgg'cf'ch\Yf'WfW`a` gHUbWg`]bHfZYf'k`]h`mci`f` UggYgga` YbhdYfZc'fa` UbW"

C h\Yf'Udd`]W]h]cbg`Zcf'YI`hYbg]cb`cZgi`Va`]gg]cb`cZh\Yg]g`fYdcfHg`fY"[`"Yei`]da` YbhVfYU`Xck`bZ`YHwL

```
% 8 ]gW`gg'hY`dcgg]V` ]mciZUb`YI`hYbg]cb`k` ]h`mci`f`gi`dYfj` ]gcf`Zfgh`
&" F`YeI`Ygh`WUb`h`Yb`VY`cX[`YX`Vmih`Y`ghi`XYbh` \YfY` \hdl.##]bmi`f`Wca`#m&hdnj`" H\Y`gi`dYfj` ]gcf`k` ]`
  h\Yb`fYW` ]`Y`Ub`Ya`U` ]`Ug` ]b[`h`Ya`rc`Uddfc]`Yz`VY`Zc`fY` ]h` ]g`YgWU`UH`X`rc`h`Y`XYW]g]cb`d`Ub`Y`"
' " F`YeI`Ygh`a`i`ghVY`cX[`YX`VmK`YY`_*`cZ`h`fa` "
(" D`Ub`Y`XYW]g]cb`k` ]`VY`a` UXY`Vm`Yb`X`c`Zk`YY`_`+"
)" H\Y`XYW]g]cb`k` ]`VY`a` UXY`Vm`U`d`Ub`Y`-`Wcbg]gh]b[`c`Z`h`Y`<`c`G`f`b`f`h`Y`f`b`ca` ]b`Y`Y`Z`H\Y`g]g`
  7`cc`f`X]b`U`rc`f`z`Ub`X`%`c`h`Y`f`d`Y`f`g`c`b`"
*" Gh`XYbHg`g` \`ci`X`VY`U`Y`f`f`X`rc`h`Y`Z`U`W`h`h`U`h`h` ]g` ]g`b`ch`[`i`U`f`U`b`h`Y`X`z`Ub`X`h`i`g`g` \`ci`X`b`ch`f`Y`m`cb`
  [`Y`h` ]b[`Ub`YI`hYbg]cb`"
+" H`m`d`WU`n`z`YI`hYbg]cbg`U`f`Y`[`f`U`b`h`X`I`D`H`C`" `k`YY`g`" H\Y`Y`b[`h`c`Z`h`Y`YI`hYbg]cb`b`Y`Y`X`g`rc`V`Y`
  f`YeI`Y`gh`X`Ub`X`^`g`h`Z`Y`X`Vm`h`Y`gi`d`Y`fj` ]gcf`" D`Ub`Y`k` ]`XYW]XY`h`Y`Y`b[`h`c`Z`h`a`Y`[`f`U`b`h`X`"
" `
"
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DfcWXi fY]Zmci`ZU]`H\Yg]g'5z'6'cf'7

: U]`]b`H\Yg]g'5`f]bHf]a`fYdcfha`Uf_`O`) \$i` E`-`a`i`ghfY!Ybfc`]b`H\Yg]g'5`U[`U]b`"

: U]`]b`H\Yg]g'6`fgYa`]bUf`a`Uf_`O`) \$i` E`-`a`i`ghfY!Ybfc`]b`H\Yg]g'6`U[`U]b`"

: U]`]b`H\Yg]g'7`-`Gh`XYbHg` \`Uj`Y`h`f`Y`c`d`h`cbg`"

```
% fY!Ybfc`Zcf`H\Yg]g'5z'6`UbX`7`U[`U]b`z`b`Yk`dfc`YW`h`Ub`X`gi`dYfj` ]gcf`
&" fY!Ybfc`Zcf`H\Yg]g'7`U[`U]b`z`g`Ua`Y`dfc`YW`h`b`Y`Y`X`g`Wcbg`Ybhc`Z`U`b`Uddfc`df]U`h`gi`dYfj` ]gcf`/`gh`XYbh`
' " Gh`XYbh`Xc`Yg`Z`f`h`Y`f`k`c`f`z`f`Y!`gi`Va` ]hg`h`Y`g]g`U`Z`h`f`U`a`U`l`c`Z`*`k`YY`g`"5`ag`d`W`a`Uf`_`W`U`dd`Y`X`U`h`
) $i` " `z`gh`b`ch`g`U`h`g`Z`U`W`c`f`m`z`h`Y`b`b`Y`Y`X`g`rc`f`Y!Ybfc`"
"
```

H\]g`Ughicd]cb`]g`cb`m`Uj`U]UV`Y`]Z`h`Y`c`f`[`]b`U`a`Uf`_`k`Ug` (`\$`C`F`]Z`h`Y`g`h`XYbh`]g`]b`h`Y`f`U`gh`g`Ya`Y`gh`Y`f` VY`Zc`fY`[`f`U`X`i`U`h`]cb`f`fY`[`U`f`X`Y`gg`c`Z`h`Y`c`f`[`]b`U`a`Uf`_`L`"

: U]`]b`H\Yg]g'6` / `7`fk` \`Yb`h`U`_`Yb`g]a`i`h`U`b`Y`c`i`g`n`L`-`Gh`XYbHg`a`i`ghfY!Ybfc`]b`H\Yg]g'6`U[`U]b`z`Ub`X`W`U`b`b`c`h`W`c`b`W`f`f`Y`b`h`m`Y`b`f`c`]b`7`" H\Y`m`W`U`b`h`Y`b`h`U`_`Y`H\Y`g]g'7`k` \`Y`b`H\Y`g]g'6` \`U`g`V`Y`Y`b`g`U`h`g`Z`U`W`c`f`]m`W`c`a`d`Y`h`X`"

[bXi`ghfm`VUg`YX`dfc`Y`W`g](#)

K`Y`Y`b`W`c`i`f`U[`Y`g`h`i`XYbHg`rc`g`Y`Y`_`d`U`f`f`b`Y`f`g` \`]d`g`k`]h`]b`Xi`ghf`m`z`g`c`g`h`i`XYbHg`W`U`b` \`U`j`Y`U`W`c`!`gi`d`Y`fj`]gcf`Z`c`a`"

]bXi gfm' <ck Yj Yfz]ZwbZXYbhU]hm]g'fYei]fYXz'U'WcbZXYbhU'X]gWcgi fY'U[fYYa Ybhf7 8 5E']g'cV'] [Uhcfm'
H\Y'U[fYYa Ybhk]'dfch'W'h\Y']bh'`YW' U`dfcdYfmf'] [\hg'cZ'h\Y']bXi gfm' dUf' bYfz' I BGK 'UbX'h\Y' gh XYbh'
Gh XYbh'cf'UWXYa]g'UfY' bchUi h'cf]gYX'hc'g'] [b'WcbZXYbhU'X]gWcgi fY'U[fYYa Ybh'cb'VY\U'ZcZ

Gi Va]gg]cb'cZ5ggYgga YbhiHUg_g

@UVcfUhcfmfYdcfng'UbX'a U'cf'Ugg][ba Ybht'k]''fYei]fY'U' [Bcb'D'U\[\]Uflga '8YWUfUhc'7cj Yf'G\YYH'](#)

5gg][ba Ybht'g\ci 'X'VY'gi Va]H'X'cb'h'a Y''5'XU]'mdYbU'micZ) i 'cZ'hY'a Uf_g'Uj U]'UV'Y'Zcf'hUh
Ugg][ba Ybhk]''Udd'mZcf'k cf_'fYW'j YX'UZ'Yf'h'Y'Xi Y'XUH''5bmiUgg][ba Ybhia cfY'h'Ub') 'XUmg''UH'k]''bch
VY'UW'W'dh'X''H\Y'cb'mYI Ya dh]cb'k]''VY'k \Yb'df]cf'dYfa]gg]cb'Zcf''UH'gi Va]gg]cb'\Ug'VYYb'[fUb'h'X'Vm
h'Y'7ci fgY'W'cfX]bU'cf''9I h'bg]cbg'k]''VY'[fUb'h'X'cb'mcb'a YX]W'cf'W'a dUgg]cbUH'[fci bXg'i bXYf
YI hfYa Y'W'fW'a g'fUb'W'g''

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

D@5; ≠F ≠GA

6Yk UfY`5b`Ugg][ba YbhUUh]bWl XYg`d`U[]Uf]gYX`a UHf]U`k]`fYW]j Y`U`\$i : U]žUbX`gh XYbhtg`k \c d`U[]Uf]gY`a UmZ]`hY`Wci fgY`Gh XYbhtg`k \c d`U[]Uf]gY`k]`Uj Y`hY]f`bUa Yg`YbHfYX`cb`U`d`U[]Uf]ga fY[]ghf`UbX`k]`VY`]UV`Y`hc`X]gW]d`]bUfmiUW]cbž]bWl X]b[`Yl Wl g]cb`Zca `Ybfc`a Ybh`
#]g`Yl dYWYX`hUUhU`gh XYbhtg`a i ghUUhU`h]a Yg`gi Va]hY]f`ck`b`k`cf`_`Zcf`UggYgga Ybh`Gi Va]h]b[`hY k`cf`_`cf`]XYUg`cZgca YcbY`Y`gY`k]h]ci hWYUfmiUW_bck`YX[]b[`hY`gci fW`cZVcffck YX`a UHf]U`cf`]XYUg`]g d`U[]Uf]ga "

5`UggYgga Ybhtg`k \]Wl`mci `UbX`]b`a i gh`Uj Y`U`[Bcb`D`U\[\]Uf\]ga`8YWUfU\]cb`7cj`Yf`G`YYH`H\\]g`\]g`Zcf Vch`\]bX\]j \]Xi U`UbX`\[fci d`k`cf`_`5HUVW`\]h\]c`mci f`Ugg\]\[ba YbhVYZcfY`gi Va \]h\]b\[`\]h\]c`hY`7`ci fgY 7`ccfX\]bUhc`f`cf`UhhY`GVXcc`C`Z\]W"](#)

D`U[]Uf]ga`]g`hY`i`gY`cZUbchYf`dYfgcb`g`k`cf`_`cf`]XYUg`Ug`]ZhYmik YfY`mci f`ck`b`K` \Yb`]h]g`bYW]ggUfmicf XYg]fUV`Y`hc`i`gY`chYf`dYcd`Y`g`a UHf]U`mci`g`ci`X`UXYeI UH`mUW_bck`YX[Y`k` \cgY`k`cfXg`cf`]XYUg`hYm UfY`UbX`k` \YfY`mci`Zci`bX`hY`a`f`[]j]b[`hY`Wca`d`YH`fYZYfYbW`XYH]`gž]bWl X]b[`dU[Y`bi`a`VYffg]H`Y @YUfb]b[`7`YbHfY`dfcj]XYg`Z`fH`Yf`]bZcfa U]cb`cb`k` \UhWcbgh]h`H`g`D`U[]Uf]ga`Uh \Hdg`#]gh XYbHl b]k`"YXi`"U`#]U[]Uf]ga

5WUXYa]WbZcfa Uh]cb

7CI FG9'9J5@! 5H€B'5B8'89J 9@CDA 9BH

Gh XYbhZYXVUW_ \Ug\YdYX'hc'g\UdY'UbX'XYj Y'cd'h]g'Wci fgYž]bWi X]b['ZYXVUW_cVHU]bYX'Zca'cb!
]bY'Yj U'i Uh]cbg'Ug'dUfhcZI BGK 'g'Ug'dUfhcZI BGK 'g'a m9I dYf]YbW' dfcW'gg"Mc'i 'UfY'\][\`m
YbWci fU[YX'hc'Wca d'YH'gi W\ 'Ub'cb!]]bY'Yj U'i Uh]cb'hc'k UfX'h'Y'YbX'cZHYfa "': YYXVUW_UbX'gi [[Ygh]cbg
dfcj]XYX'k]"VY'ja dcfh]bh]b]ja dfcj]b['h'Y'Wci fgY'Zf'Z hi fY'gh XYbthg"

85H9G'HC'BC H9

FYZf'hc'A m BGK 'Zcf'æ dcfh]bh8UH'gžUj U]UV'Y'Uh
[\hfdg.##a m'i bgk "YXi "Ui #gh XYbh#fYgci fW'g#? Ym8UH'g"\ha`](#)

57589A ⇒ '58J ⇒9

: cf]bZcfa Uh]cb'UVci h

- ""B cH'g'cb'UggYgga Ybthg'UbX'd'U[]Uf]ga ž
- ""GdYWU'7 cbg]XYfU]cbgž
- ""GW'cc'Gh XYbh9h]Vg'C Z]W'fz'UbX
- ""69GG

fYZf'hc'h'Y'GW'cc'k YVg]h'Uj U]UV'Y'Uh
[\hfd.##k k k "Yb\[\]bYYf\]b\["i bgk "YXi "Ui #/\]ca YX\]WU'!Yb\[\]bYYf\]b\#

Gi dd`Ya YbhUfm9I Ua]bUh]cbg.

Gi dd`Ya YbhUfm9I Ua]bUh]cbg'Zcf'HYfa '&\$\$&&'k]"VY'\Y'X'cb'fH67 E'g\ci 'X'mci 'VY'fYei]fYX'hc'g]hcbY"

H\]g'Wci fgY'ci h]bY'gYthg'ci hXYgW]dh]cb'cZWUggYg'Uh'h'Y'XUH'h'Y'7 ci fgY'Ci h]bY']g'di V']g\YX" H\Y
bUh fY'cZWUggYg'a UmVXUb[Y Xi f]b['h'Y'HYfa 'UZf'f'h'Y'7 ci fgY'Ci h]bY']g'di V']g\YX" A ccX'Y'g\ci 'X'VY
W'cbgi 'h'X'Zcf'h'Y'i d'hc'XUH' WUgg'XYgW]dh]cbg" 'Z'h'YfY']g'Ubm]bW'cbg]gh'bWn]b'h'Y'XYgW]dh]cb'cZ
UW]j]h]Yg'VYtk YYb'h'Y'I b]j Yfg]m]h]a YHUV'Y'UbX'h'Y'7 ci fgY'Ci h]bY'fUg'i dXUH'X']b'A ccX'Y'Udd']Yg"

⇒a U[Y'7 fYX]h

GmbYf[]Yg']b'Gci bX'&\$%*

7F ⇒CG

7F ⇒CG'Dfcj]XYf'7 cXY. '\$\$\$- , ;

5W_bck `YX[Ya YbhcZ'7 ci bhfm

K Y'UW_bck `YX[Y'h'Y'6YXY[U'dYcd'Y'k \c'UfY'h'Y'fUX]h]cbU'W'g'hcX]Ubg'cZ'h'Y'UbXg'cb'k \]W'I BGK
? Ybg]b[hc'b'W]a di g']g'c'W]h'YX"