## 

7c`]b'?fUi gYžDUgWUW\_'JU``Ym'<][\'GW\cc\'\_ \$' - /g ghUbXci hžg\]bYg'Ug'5h\`YhY'cZ'h\Y'K YY\_'k]h\']a dfYgg]j Y 'Uj Y`]b'UW\]Yj Ya Ybhg'UbX'U'dfca ]g]b['Z hi fY"



DUgWUW\_'JU``Ymž'BYk '>YfgYmž'I G5'!'7c`]b'?fUi gYž'Ub'%, !mYUf!
c`X'gYb]cf'Uh'DUgWUW\_'JU``Ym'<][\'GW\cc`ž'\Ug'VYYb'fYWc[b]nYX
Ug'h\Y'5h\`YhY'cZ'h\Y'K YY\_'Vm'H\Y'FYWcfX"'H\]g'ghUbXci h'\Ug
a UXY'ei ]hY'h\Y'gd`Ug\']b'h\Y'k cf`X'cZ'\][\'gW\cc`'hfUW\_'UbX'Z]Y`X
g]bWY'\Y'hcc\_'i d''Uj Y`]b'h\fck ]b[''A gh'hk c'mYUfg'U[cž'UbX'\]g
fci h]bY'VYZcfY'a YYhg']g'Vch\'a Yh]W'`ci g'UbX']bgd]f]b["

?fUi gY ghUfhg \]g a UhW \XUm k ]h\ \U hi f\_Ym UbX 5a Yf] \W b \W YYgY gUbXk ]W \UbX \W Ub [ Yg ]b hc \]g h\ fck ]b [ \WYUhgž U`k Umg \VY [ ]bb]b [ \k ]h\ \h\ Y \YZh \Vcch" < Y \Zc``ck g \h\ ]g \k ]h\ \U gYe i Yb \W cZ ghUh] \W UbX \Xmb Ua ] \WghfYhW \Ygž a U\_]b [ \gi fY \Yj Yfm a cj Ya Yb h`]g \]b cfXYf" < ]g \dfY! \Wca \dYh]h]cb \d`Um ]gh \_] \W\_g \cZ' k ]h\ \Tau 7 fi ]gY \Tau \W \tau \Cf[ \U @|bY \Z' \W \a ]b \Uh]b [ \]b \h\ Y \]\\Cb \W \tau \Cf \K \ca \H\ Y

## F]g]b[~GhUf~cZ~xUj Y~]b

G]bWY'\]g'XYVi h'Uh'h\Y'6Yf[Yb'7ci bhm'FY`Umg']b'&\$&' ž'k\YfY'\Yh\fYk'%(\*!%'UbX'\Y`dYX'\]g'hYUa 'gYW' fY'U'Z]Zh\!d`UWY'Z]b]g\ž?fUi gY'\Ug'g\ck b'YI hfUcfX]bUfm'dfc[fYgg"'5g'U'gcd\ca cfYž'\YUW\]Yj YX'g]I h\'d`UWY'Uh'h\Y'6Yf[Yb'AYYh'cZ'7\Ua dg'k]h\'U'h\fck cZ'%\*\$!) "'A cgh'fYWYbh`mž'\Y'\]h'U'dYfgcbU`'VYghž'k]bb]b['U'ghUhY[fci d'h]h`Y'k]h\'Ub']a dfYgg]j Y'%, \$!%%'h\fck ž'U'a]`YghcbY'h\Uh\\Ug'XfUk b'UhhYbh]cb'Zfca 'Wc``Y[]UhY'dfc[fUa g'gi W\'Ug'6i W\_bY``Ib]j Yfg]hmž\_bck b'Zcf'dfcXi W]b['gi WWYggZi `''Uj Y`]b'Uh\`YhYg"

 $< ]g``cifbYm`\ Ug`bch`VYYb`ZfYY`cZ`gYhVUW\_g"`?fUigY`\ UX`hc`VUhh`Y`U\_bYY`]b``fm`YUf`m`]b``h\Y`ZcchVU```gYUgcbž`a]gg]b[``h\Y`Z]fgh`hk c [UaYg`Vih`VcibW]b[``VUW_`hc`Wcbhf]VihY`g][b]Z]WUbh`m`hc`\]g ZcchVU```hYUag`]adfYgg]jY`fYWcfX`cZ`%$!%`UbX`h\Y]f`&$&(``Bcfh\%ž';fcid'``gYWh]cbU``h]h`Y''`<]g``fYg]`]YbWY`gdYU_g`jc`iaYgž XYacbghfUh]b[``h\Uh`dYfgYjYfUbWY`cZhYb`dUmg`cZZ''$ 

±bhYfYgh]b[`mž'^Uj Y`]b']gb h'?fUi gY g'cb`m'ZcfhY"'±b]h]U``mž'\Y'k Ug XYYd`m']bj YghYX']b'VUgYVU``'UbX'ZcchVU``ž'hfUbg]h]cb]b['hc'hfUW\_']b\cdYg'cZ'Yb\UbW]b['\]g'g\_]``g'cb'h\Y'Z]Y`X"'H\]g'hfUbg]h]cb'\Ug Yj]XYbh`m'dU]X'cZZž'k]h\'\]g'Uh\`Yh]WUW\]Yj Ya Ybhg'fYZYWh]b[Wcaa]ha Ybh'UbX'hU`Ybh"

## =bgd]f]b[ 5WX]Yj Ya Ybhg UbX 7ca dUf]gcbg

± "U"dUfU``Y``ghcfmž'9j Y`mb '6`]gg '\Ug'U`gc'a UXY'k Uj Yg']b 'h\Y fYU`a 'cZ''Uj Y`]b"'8YZYbX]b[ '\Yf'h]h`Yž'g\Y'fYWYbh`m'W]bW\YX'h\Y I G5 'K ca Yb g'HfUW\_'/ ': ]Y`X'I bXYf!&\$ ''Uj Y`]b 'W\Ua d]cbg\]d 'Zcfh\Y'gYWcbX'WcbgYW'h]j Y'mYUfž'UW\]Yj ]b[ 'U'k ]bb]b[ 'h\fck 'cZ%\*, !\$%'Uh'h\Y'I b]j Yfg]hm'cZ'CfY[ cb g'<Umk UfX': ]Y`X"'G\Y'k ]``gccb'Wca dYhY']b'h\Y'K cf`X'I &\$'7\Ua d]cbg\]dg']b'@]a Už'DYfi žg\ck WUg]b[ 'h\Y'Vf][ \h'Z hi fY'Zcf'mci b[ ''Uj Y`]b'h\fck Yfg"

 $6ch ``Uh'`YhYg`g][b]Zm`U`f]g]b[``hfYbX`]b``mci h'```Uj Y`]bž`U`gdcfh`h'`UhXYa UbXg`bch`cb`m`d\mg]WU``ghfYb[h'`Vi h`U`gc`a YbhU``fYg]`]YbWY''$ 

HfU]b]b[ 'fY[]a Ybg'd`Um'U'Wfi W]U``fc`Y']b'h\Y]f'gi WWYgg"'5WWcfX]b[hc'GhUW\_ž'ZcW'g]b[ 'cb'Yl d`cg]j YbYgg'h\fci [\'ghfi Whi fYX'cZZlgYUgcbž'UbX']b!gYUgcb'k cf\_ci hg']g'YggYbh]U``Zcfgi WWYgg"': cf'\][\'gW\cc``Uh\`YhYg'`]\_Y'?fUi gYž'U'f][cfci g'hfU]b]b[d`Ub'h\Uh'ZcW'gYg'cb'ghfYb[h\ž'dck Yfž'UbX'g\_]``'dfcZ]W]YbWm'Wci `Xa YUb'h\Y'X]ZZYfYbW''VYhk YYb'U'[ccX'gYUgcb'UbX'U'gdYWhUW'`UfcbY"

 $\label{thm:converse} \begin{cases} 5g?fUi gY`Wcbh]bi Yg`hc`\cbY`\]g`WfUZhž`ch\Yf`bUa Yg``]_Y`@'_Y \\ DUg\ž`GUi bXfUY`DU`a Yf`\f\Z`UbX`Ck Yb`?YUh]b[``U`gc`WcbhYbX`Zcf UWWc`UXYg`Ug`Uh\`YhYg`cZ'h\Y`k YY_<math>Z$ `fY]bZcfW]b[``h\Y`Wca dYh]h]j Y gd]f]h`Zci f]g\]b[``]b`: `cf]XU g`Uh\`Yh]W`UbXgWUdY'': cf`?fUi gY`UbX mci b[`Uh\`YhYg`Yj Yfmk \YfYz`h\Y`fcUX`U\YUX`]g`Vf][\hz`UbX`]h g YI W]h]b[``hc`h\]b\_`UVci h`h\Y`\Y][\hg`h\Yma ][\h`fYUW\''

8 Y hU]`g	
Cfh	DUgWUW_'JU``Ymž'BYk '≯fgYmž'l G5
EiY``Yb	• k k k "bcfh\ ^YfgYm"Wca
	<ul><li>Vi W_bY``V]gcb"Wca</li></ul>
	• k k k "ghUW_"Wca

6Ygi WXYb G]Y i bg Ui Z. a Y]b!k ]Yb bYh