

6fck UfX '7ci bhm'VUbg'gY``]b['Xf]j Yf g'`]WYbgY'Uddc]bha Ybhg hc'ghfYUa `]bY'gYfj]WYg'UbX'Yb\UbW'di V`]W]bhY[f]hmž YZZYWh]j Y']a a YX]UhY`m"



6fck UfX '7ci bhmž'l G5 ! '6fck UfX '7ci bhm'\Ug'hU_Yb'U
g][b]Z]WUbh'ghYd'hck UfX 'W' fV]b['h\Y'dfUWh]WY'cZ'gY``]b['Xf]j Yf g
`]WYbgY'Uddc]bha Ybhgž'U'a cj Y'gdi ffYX 'Vm'Wca a i b]hm'WcbWYfb
UbX'f]g]b['Zfi ghfUh]cbg"'5g'fYdcfhYX 'Vm'7Uf]VVYUb'B Uh]cbU`
K YY_`mž'h\Y'6fck UfX'HUI'7c``YWhcf g'CZZ]WY'Ubbci bWYX'h\]g
]a dcfhUbh'WXUb[Y'cb'\$| bY'%%ž'&\$&) "'H\Y'i bUb]a ci g`m'dUggYX
CfX]bUbWY'&\$&)!&\$'dfc\]V]hg'h\Y'UXj Yfh]g]b[ž'a Uf_Yh]b[ž'cf
ci hf][\h'gU'Y'cZ'Uddc]bha Ybhg'Zcf'Xf]j Yf g'`]WYbgY'gYfj]WYg
dfcj]XYX'Vm'h\Y': `cf]XU'8YdUfha Ybh'cZ'<][\k Um'GUZYhm'UbX
A chcf'JY\]WYg'Ug'k Y```Ug'h\Y'6fck UfX'HUI'7c``YWhcf g'CZZ]WY''

H\]g`cfX]bUbWY`Wca Yg`]bhc`YZZYWh`]a a YX]UhY`mž`U``ck]b[`Zcf`gk]Zh UWh]cb`U[U]bgh`h\cgY`k\c`UhhYa dh`hc`dfcZ]h`cZZ`Ub`U`fYUXm Wfck XYX`8 A J`gmghYa "'7ca d`U]bhg`UVci h``cb[``]bYg`Uh`8 A J`cWUh]cbg`UbX`fYdcfhg`cZ`]bX]j]Xi U`g`fYgY``]b[`Uddc]bha Ybh`g`chg Zcf`Ug`a i W\`Ug`` &) \$`dfca dhYX`gk]Zh``Y[]g`Uh]j Y`UWh]cb"'6fck UfX 7ci bhm`HUI '7c``YWhcf`5VVYm`5^Um]`YI dfYggYX`[fUh]hi XY`Zcf`h\YbYk``Uk ž`\][\`][\h]b[`]hg`fc`Y`]b`a U]bhU]b]b[`di V`]WgYfj]WY]bhY[f]hm`UbX`]a dfcj]b[`YZZ]W]YbWm'

:]bY'Ghfi Whi fY'UbX': i hi fY'=a d`]WUh]cbq

c``ck]b[']b'6fckUfX g'ZcchghYdgž'A]Ua]!8UXY'7cibhm'U`gcdUggYX'U'g]a]`Uf'cfX]bUbWY'h\]g'mYUfž'fY]bZcfW]b['U'fY[]cbU`Wcaa]haYbh'hc'ghcdd]b['h\YgY'dfUWh]WYg'h\Uh'\]bXYf'UWWYgg'hcYggYbh]U`'gYfj]WYg"'5g'h\Y'diV`]WacV]`]nYg'U[U]bgh'h\]g']ggiYž'h\Y[cU`'fYaU]bg'WYUf.'ghfYUa`]bY'h\Y'dfcWYggYg'UbX'aU_Y'8AJgYfj]WYg'UWWYgg]V`Y'hc'U``:`cf]XU'fYg]XYbhg"

H\Y`6YbYZ]hg`cZ`U`A cXYfb]nYX`8A J 5ddc]bha Ybh`GmghYa

 $\label{lem:hc} Hc~i~gY~h\ Y~c~b~]bY~Uddc~]bha~Ybh~hc~c~ž~fYg]XYbhg~g]a~d~m~bYYX~hc~$

gY`YWh'h\Y]f`W]h]nYbg\]d ghUhi gž'k\]W\`]bWi XYg`cdh]cbg`Zcf`I "G" W]h]nYbgž`]a a][fUbhgž`UbX`bcb!]a a][fUbhgž`VYZcfY`W\ccg]b['h\Y gdYW]Z]WgYfj]WY`h\Ym`bYYX"`K\Yh\Yf`]h g`fYbYk]b[`U``]WYbgY`cf hU_]b[`U`Xf]j]b[`hYghž`\Uj]b[`U`WcbZ]fa YX`Uddc]bha Ybh`WUb`gUj Y j U`i UV`Y`h]a Y"

H\]g^]g^dUfh]W^\Uf`m^\Y`dZ\\^]b^6fckUfX^7cibhm\%k\YfY'idWca]b[
W\Ub[Yg^UfY^cb^h\Y^\cf]ncb^Ug^h\Y^HUI^7c\`YWhcfg^cZZ]W\dfYdUfYg
hc^hU_Y^cj Yf^8AJ^cdYfUh]cbg^]b^giaaYf^&\\$&*"'H\Y^Wcibhmg
ZcW^gcb^acXYfb]n]b[^gYfj]W\g^k]\``\cdYZ\\``m^YUgY^h\Y^VifXYb^cb
fYg]XYbhg"

5 WW gg]b[8 A J = b Zcfa Uh]cb A UXY 9 Ugm

H\Y`W\Ub[Yg`Xcb h`f gh`ghcd`Uh`Uddc]bha Ybhg"\dot `UXX]h]cbžh\Y
8 A J`k YVg]hY`dfcj]XYg`U``]gh`cZ`Wci bhm`cZZ]W\gž`Wca d`YhY`k]h\
UXXfYggYgž`d\cbY`bi a VYfgž`UbX`h\Y]f`cdYb]b[`\ci fg"`I gYfg`WUb
bUj][UhY`h\fci [\`U``]gh`h\Uh`]bWi XYg`6fck UfX`UbX`*) `ch\Yf
Wci bh]Yg`YUg]`m`h\fci [\`:`cf]XU`8 A J g`Uddc]bha Ybh`dU[Y"
H\]g`Ybgi fYg`h\Uh`:`cf]X]Ubg`WUb`Z]bX`h\Y`bYUfYgh``cWUh]cb`UbX
gYfj]W\g`k\Yb`h\Ym`bYYX`h\Ya `a cghž`Z fh\Yf`Vc`ghYf]b[`YZZcfhg`hc
]a dfcj Y`cj YfU```UVW\gg`UbX`gUh]gZUWh]cb"

5g'6fck UfX'7ci bhm'gYhg'U'dfYWXYbh'Zcf'VYhhYf'a UbU[Ya Ybh'cZ 8AJ'gYfj]WYgž'`cWJ``fYg]XYbhg'WUb'`cc_'Zcfk UfX'hc'U'a cfY cf[Ub]nYX'gmghYa 'h\Uh'df]cf]h]nYg'h\Y]f'h]a Y'UbX'bYYXg"'H\Y'di g\U[U]bgh'Uddc]bha Ybh'gU`Yg']g''l gh'cbY'ghYd']b'U'`Uf[Yf'YZZcfh'hc Yb\UbW'di V`]WgYfj]WY'ei U`]hm'UWfcgg': `cf]XU"

8 Y hU]`g	
Cfh	6fck UfX 7ci bhmži G5
EiY``Yb	k k k "WUf]VVYUbbUh]cbU`k YY_`m"W
	са
	• k k k "Z`Xa j "bYh
	• k k k "Xa j Z`cf]XU"cf[

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