< YfbUbXc'AUb'G\cchg'HYYb'8if]b[A Uf]'iUbU'H\YZh'5hhYadh']b'Gdf]b['<]``</pre>

5b'% !mYUf!c`X`]b'<YfbUbXc'7cibhm`g\ch'U'hYYb'Xif]b['U a Uf]'i UbU'h\YZh'UhhYa dh']b'\$bY/\Y'ZUWYg'a i`h]d`Y'UggUi`h WXUf[Yg"



6fca `Ym`5j Ybi Yž`Gdf]b[`<]``Ž: `cf]XUŽ'I G5 `!` =b`U`ghUfh`]b[Yd]gcXY`h\Uh`\Ug`fU]gYX`WcbWYfbg`UVci himci h\`Wf]a Y`]b`<YfbUbXc 7ci bhmž`U``cWU``a Ubž`%, !mYUf!c`X`A]W\UY``5Xf]Ub`BUbnf]cž`]g ZUW]b[`gYf]ci g`W\Uf[Yg`UZhYf`U``Y[YX`m`g\cch]b[`Uh`hk c`hYYbU[Yfg k \c`UhhYa dhYX`hc`ghYU``\]g`a Uf]^t UbU"`H\]g`]bW]XYbh`i bZc`XYX`cb \$ bY`%(ž`&\$&) ž`]b`Gdf]b[`<]``ž`: `cf]XUž`Vf]b[]b[`hc``][\h`h\Y dfYWUf]ci g`VU`UbWY`VYhk YYb`mci h\Zi ``a]gW\]YZ`UbX`gYf]ci g WcbgYei YbWYg"

H\Y'g\cch]b[``YZh'U'%(!mYUf!c`X'Vcm']b'ifYXžYbXif]b[`[ibZ]fY h\Uh'ghfiW_'\]a`]b'h\Y'\]d'UbX'Ufa": cfhibUhY`mž'\]g']b'if]Yg'UfY fYdcfhYX'hc'VY'bcb!`]ZY!h\fYUhYb]b[ž'UbX'\Y'kUg'dfcadh`m'hU_Yb hc'U'bYUfVm`\cgd]hU``Zcf'hfYUhaYbh"5`cb[g]XY'\]a`kUg'U'%)!mYUf! c`X`a U`Y`k \cž`Vm`W\UbWYžYgWUdYX`d\mg]WU``\Ufa `Xi f]b[`h\Y W\Uch]WYj Ybh"`=b]h]U``mž`h\Y`Xi c`WU]a YX`h\Ym`k YfY`UhhUW_YX`Vm Ub`i b_bck b`UggU]`Ubh`Zfca `Ub`i b]XYbh]Z]YX`j Y\]WY/`\ck Yj Yfž XYYdYf`]bj Ygh][Uh]cb`fYj YU`YX`U`a cfY`]bh]a UhY`WcbbYWh]cb"`=h hi fbYX`ci h`h\Uh`h\Ym`_bYk `BUbnf]c`UbX`k YfY`gW\Ya]b[`hc`hU_Y \]g`a Uf]'i UbU`k \Yb`h\Y`g\chg`k YfY`Z]fYXž`Ug`: cl`%' `BYk g fYdcfhg"

H Y 5 ffYgh Ub X 7 V f[Yg

: c``ck]b['h\Y ']bW]XYbhž']h'k Ug'cb`m'U'a UhhYf'cZ'h]a Y'VYZcfY``Uk YbZcfWYa Ybh'WUi [\h'i d'k]h\ 'BUbnf]c"'Cb'\$ `m'%' ž'&\$&) ž'XYdi h]Yg UffYghYX'\]a 'Uh'\]g'fYg]XYbWY'cb'6fca `Ym'5j Ybi Y"'BUbnf]c'bck ZUWYg'a i `h]d`Y'W\Uf[Ygž']bWi X]b['U[[fUj UhYX'VUhhYfmž U[[fUj UhYX'UggUi `hž'UbX'X]gW\Uf[]b['U'Z]fYUfa ']b'di V`]W'5g'h\]g ghcfm'i bZc`Xgž'a Ubm'UfY'`YZh'k cbXYf]b['UVci h'h\Y'VfcUXYf]a d`]WUh]cbg'cZ'gi W\'j]c`YbWY'Ua cb['mci h\g"

5 F]g]b[HfYbX]b Mci h\ 7f]a Y

H\Y'WebWYfb'cj Yf'mci h\'Wf]a Y']g'bch'k]h\ci h'a Yf]h"'5WWefX]b['hc ghUh]gh]Wg'Zfca 'h\Y': `cf]XU'8YdUfha Ybh'cZ'\$i j Yb]`Y'\$i gh]WYža Ubm mci b['dYcd`Y']b': `cf]XU'Z]bX'h\Ya gY`j Yg']b'hfci V`]b['g]hi Uh]cbg h\Uh'ZfYei Ybh'm`YUX'hc'UffYgh"'H\Y'ghUhY'cdYfUhYg'&%'A j Yb]`Y XYhYbh]cb'WYbhYfgž'k \]W\'bch'cb'mcZZYf'gi dYfj]g]cb'Vi h'U`gc Wf]h]WU`'YXi WUh]cbU`'UbX'a YbhU`'\YU'h\'gi ddcfh'gYfj]WYg'Zcf'h\cgY]b'W'ghcXm''H\Y'CZZ]WY'cZ'<YU'h\'GYfj]WYg'i bXYf'h\Y'8 ≫Ybgi fYg h\Uh'h\YgY'ZUW]`]h]Yg'dfcj]XY'Wea dfY\Ybg]j Y'\YU'h\WUfY'hc 'A j Yb]`Ygž'U]a]b['Zcf'fY\UV]`]hUh]cb'fUh\Yf'h\Ub'A gh'di b]g\a Ybhž fYZYWh]b['U'[fck]b['i bXYfghUbX]b['h\Uh'gi ddcfh]b['mci h\g'WD fYX]fYWh'h\Y]f'dUh\g'hck UfXg'a cfY'dcg]h]j Y'Z hi fYg''A cfY fYgYUfW\'Zfca 'h\Y'8 ≫`\][\`][\hg'h\Uh'Ua cb['mci h\g'U[YX'%\$!%+ž j Uf]ci g'gcW]U`'ZUWhcfg gi W\'Ug'dcj Yfhmž'Wc[b]h]j Y'XYZ]W]hgž'UbX `ck'gW\cc`']bj c`j Ya Ybh_d`Um'U'fc`Y']b'h\Y]f'']_Y`]\ccX'hc'Yb[U[Y]b'Wf]a]bU`'UWhg"

 $\label{eq:ghubble} GhUh]gh]Wg`Wc``YWhYX`fYjYU``h\Uh`h\Y`UffYgh`fUhY`Zcf`mcih\g`U[YX %\$!\%+`]b`5`UWXiU`7cibhm`]b`&$&'`KUg`bchUV`m`\][\`Uh`'("%`dYf$

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

8YhU]`g	
Cfh	6fca `Ym5j Ybi YžGdf]b[<]``ž: `cf]XUžI G5
EiY``Yb	• k k k "Zcl %' bYk g"Wca
	• k k k "X ^~"ghUhY "Z`"i g
	• k k k "Z`\YU`h\W\Ufhg"[cj

5g'k Y'fYZYWh'cb'h\Y'fYU`]hm'cZ'mcih\'Yb[U[YaYbh']b'Wf]aY'UbX h\Y'Wcaaib]hmg'fc`Y']b'UXXfYgg]b['h\YgY']ggiYgž']h'VYWcaYg WYUf'h\Uh'ibXYfghUbX]b['h\Y'fcch'WUigYg'WUb'`YUX'hc'acfY YZZYWh]jY'gc`ih]cbg"'9jYfmcbY'\Ug'U'dUfh'hc'd`Um']b'ghYYf]b['cif mcih\'hckUfX'U'Vf][\hYfžgUZYf'ZihifY"

H\]gʻ]bW]XYbhʻgYfj YgʻUgʻUʻghUf_ʻfYa]bXYfʻh\Uhʻmci h\!fY`UhYX]ggi YgʻYI hYbXʻk Y```VYmcbXʻh\YʻWcbZ]bYgʻcZʻUʻg]b[`YʻWf]a Y"ʻ=h i bXYfgWcfYgʻh\Yʻi f[YbhʻbYYXʻZcfʻWca a i b]hmʻYb[U[Ya YbhʻUbX gi ddcfhʻgmghYa gʻZcW gYXʻcbʻdfYj Ybh]cbʻUbXʻ]bhYfj Ybh]cb"'9ZZcfhg gi W. ʻUgʻh\YʻCZZ]WYʻcZʻDfYj Ybh]cbʻGYfj]WYgžʻk \]W\ʻdfcj]XYg j c`i bhUfmʻdfc[fUa gʻhcʻ\Y`dʻ_YYd'mci h\gʻUk UmʻZfca ʻWf]a YžʻUfY Wfi W]U``Ugʻh\YmʻU]a ʻhcʻYb\UbWYʻdi V`]WgUZYhmʻk \]`YʻZcghYf]b[dcg]h]j YʻXYj Y`cda Ybhgʻ]bʻUh!f]g_'mci h\"

5 '7 U``'hc '5 Wh]c b

%ž\$\$\$ža cfY'h\Ub'g][b]Z]WUbh`m`gi fdUgg]b['h\Y'ghUhY'Uj YfU[Y'cZ &%") 'dYf'%ž\$\$\$"'H\]g'hfci V`]b['XUhU'g]hi UhYg'5`UW\i U'7ci bhm`]b h\Y'h\]fX'ei Ufh]`Y'Ua cb[': `cf]XU'Wci bh]Yg'Zcf'mci h\`UffYghgž a YUb]b['fci [\`m`\U`Z'cZ'h\Y'Wci bh]Yg'\Uj Y'VYhhYf'ci hWca Yg'Zcf mci b['fYg]XYbhg"'H\Y'Wcbh]bi YX'f]gY'cZ'gi W\`fUhYg'ghfYggYg'h\Y bYYX'Zcf']a dUWhZi ``]bhYfj Ybh]cb'ghfUhY[]Yg'hc'W' fV'XY`]bei YbWn UbX'dfca chY'U'gUZYf'Wca a i b]hm'Zcf'Vch\'mci h\g'UbX'h\Y'[YbYfU` di V`]Wž'Ug']bX]WUhYX'Vm'h\Y': `cf]XU'<YU`h\`7\Ufhg"</pre>