## @cWU``@Y[]g`Uhcf`A Ubbm`5VUfWU`7\Uf[YX 5a]X`8caYgh]W8]gdi hY`7f]g]g

JW\_gcb'7cibhm'@Y[]g`Uhcf'AUbbm'5VUfWU'ZUWYg'XcaYgh]W VUhhYfm'WXUf[Yg'Ua]X'ZUa]`m'X]gdihYgž'k]h\`\]g'gcb'fYWYbh`m ZcibX'gUZY"



G\Uk bYYž? UbgUgž1 b]hYX GhUhYg11H\Y1fYWbh`Y[U``hfci V`Yg gi ffci bX]b[`\$JW\_gcb7ci bhm`@Y[]g`UhcfA Ubbm`5VUfWU`\Uj Y``YZh a Ubm`]b`h\Y1Wca a i b]hm`Vch\`WcbWYfbYX1UbX1Wi f]ci g"`5VUfWU ZUWYg1gYf]ci g1WLUf[Yg1]b`fY`Uh]cb1hc1Xca Ygh]Wj]c`YbWY1UbX1h\Y k Y``!VY]b[`cZ`\]g1hk c!mYUf!c`X1gcb" BYk g1Zfca **Bcfh\YUgh`BYk g** fYdcfhg1h\Uh15VUfWU1k Ug1Wf]a ]bU``m1WLUf[YX1]b'?UbgUg17]hm A i b]W]dU``7ci fh1Zcf1j]c`Uh]b[`U1dfchYWh]cb1cfXYf"15XX]h]cbU``mž\Y ]g1ZUW]b[`a]gXYa YUbcf1WLUf[Yg1]b1%\bgcb17ci bhm1Zcf1Xca Ygh]W

G\UkbYY'dc`]WY'WcbZ]faYX'h\Uh'Vch\'5VUfWU'UbX'\]g'gcb'kYfY ZcibX'gUZY'UZhYf'U'Vf]YZ'dYf]cX'cZ'WcbWYfb'k\Yb'h\Ym'kYfY fYdcfhYX'a]gg]b['Vm'5VUfWUg'k]ZY'cb'AUm'&, "'G\Y']bX]WUhYX'h\Uh

6UW\_'Uh'h\Y``cWU```YjY`ž'UW\_gcb'7ci bhm'@Y[]g`Uhi fY'7\U]fa Ub 8 UF cb A W YY \Ug UW\_bck YX [YX 5 VUfW g UffYghž Ya d \Ug]n]b[ h\Y`bYYX`Zcf`XiY`dfcWYgg"`=bhYfYgh]b[`mž`h\Y`Wcibhmg`W\UfhYf XcYgʻbchʻdfcj]XYʻWYUfʻdYbU`h]YgʻZcfʻY`YWhYXʻcZZ]W]U`gʻWcbj]WhYXʻcZ

dgmWkc`c[mž'UbX'diV`]W\YU`h\"

 $H Y 'g h U ' V U 'Y [ V 'W U 'Y [ V 'W U 'Y [ V 'W U 'Y ] [ \ g' ] [ \ hg' U ]$ gcVYf]b[ fYU`]hm]b h\YI b]hYXGhUhYgfY[UfX]b[ Xca Yqh]W j]c`YbWY"'5g`cih`]bYX'Vm`fYgYUfWX'W]hYX'Vm`F78J.7D7žXcaYgh]W j]c`YbWY`Wcbh]biYq`hc`UZZYWh`a]``]cbg`cZ`ZUa]`]Yg`YUWX`mYUfž`k]h\ g][b]Z]WUbh`]a d`]WUh]cbg`Zcf`WX]`XfYb`]bj c`j YX"`Gi WX`]ggi Yg`YI hYbX VYmcbX]bX]j]XiU`WUgYgž]adUWh]b[`WX]`XdfchYWh]cbžWiqhcXmž UbX'gi ddcfh'gmghYa g"'=h']g'YggYbh]U``hc'fYWc[b]nY'h\Uh ibXYfqhUbX]b[ 'Xca Ygh]Wj ]c`YbW' ]q'U'a i`h]!ZUWYhYX ]qgi Y'h\Uh fYei ]fYg`]bdi h`Zfca `j Uf]ci g`Z]Y`Xg`]bWi X]b[ `gcW]U``k cf\_ž

## 6fcUXYf =a d`]WUh]cbg cZ 8ca Ygh]WJ ]c`YbWY

H\Y`bYIh`Wcifh`XUhY`Zcf`5VUfWU`]q`qYh`Zcf`≯`m`-`Uh`%.'\$`d"a "ž k \ ]W\ `k ]```hU\_Y`d`UWY`j ]U`j ]XYc`WcbZYfYbWY"`=b`fYqdcbqY`hc`h\Y g]hi Uh]cbž<sup>·</sup>5VUfWU<sup>·</sup>\Ug<sup>·</sup>YI dfYggYX<sup>·</sup>\]g<sup>·</sup>`cj Y<sup>·</sup>Zcf<sup>·</sup>\]g<sup>·</sup>W\]`XfYbž<sup>·</sup>\cd]b[ Zcf'U'ei ]W\_'fYgc`i h]cb'hc'h\YgY'hfci V`]b['a UhhYfg"

⊕ 'U'Wci fh'UddYUfUbWY 'fYdcfhYX'Vm'? G < 6 ž'5 VUfWU'd YUXYX bch</p> [i]`hm`hc`h\Y`Wcibh`cZ`XcaYgh]WVUhhYfm"`5WWcfX]b[`hc`h\Y  $W_{U} = W_{U}^{T} = U_{V}^{T} = U_{V}^{T$ cb'AUm'&-ž'Ub']bW]XYbh'\]g'UhhcfbYmg'WU]a'UfcgY'Zfca'U'X]gdi hY cjYfWX]XWjqhcXmžh\ci[\`h\Ym`]bq]qhh\Y`]bWJXYbhX]Xbch VYWca Y'd\mg]WU`"5Zi fh\YfWca d`]WUh]cb``]Yg`]b5VUfWU g j]c`Uh]cb`cZ`U`dfchYWh]cb`cfXYfž`k \]W\`a UbXUhYg`\Y`fYZfU]b`Zfca fYhi fb]b[ 'h\Y]f'W\]`X'hc'\]g'k ]ZY"'H\]g']ggi Y'k ]``'VY'UXXfYggYX']b'U W]j]``\YUf]b[ 'qW\YXi `YX'Zcf'A cbXUm"

## 8 Y h U g c Z h Y 7 V Uf [ Y g

h\Y]f`qcb`\Uq`q]bWY`VYYb`fYhi fbYX`hc`\Yf`WUfY"`5VUfWU`k Uq Vcc\_YX`]bhc Wci bhm 'U]`Vi hei ]W\_`mfY`YUgYX`cb`U`` %ž) \$\$ dYfgcbU`fYWc[b]nUbWY'VcbX"

U`Wf]a Yž`Wcbh]bi ]b[`hc`fU]gY`ei Ygh]cbg`UVci h`UVWci bhUV]`]hm`UbX [cj YfbUbWY`]b`h\Y`ZUWY`cZ`gi W\`gYf]ci g`U``Y[Uh]cbg"

5g'h\Y`Y[U``dfcWYYX]b[g'i bZc`Xž'h\Y`Wca a i b]hm'k UhW\Yg'WcgY`m" K]h\`h\Y`bYI h'Wci fh`XUhY`fUd]X`m'UddfcUW\]b[ž'h\Y`ci hWca Y`cZ h\]g`WUgY`Wci `X`\Uj Y``Ugh]b[`]a d`]WUh]cbg`Zcf`5VUfWUž`\]g`ZUa]`mž UbX`h\Y`\$JW\_gcb`7ci bhm`@Y[]g`Uhi fY`Ug`U`k \c`Y"

8 Y hU]`g	
Cfh	G\Uk bYYž?UbgUgžI b]hYX`GhUhYg
EiY``Yb	• bcfh\YUghbYkg"bYh
	• k k k "_g\V"₩ca
	• fWXjWdW/cf[

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