

B Yi Y`K Y[Y`]b`GUW\ gYb!5b\ U`h. ' \$
Ub[Y\YbXY`@Y\ fYf`ghUfhYb`]bbcj Uh]j Yg
5i gV]`Xi b[ga cXY`

GUW\ gYb!5b\ U`hghUfhYh`Y]b`bYi Yg`@Y\ fUa hgghi X]i a`]b
A U[XYVi f[. ' \$`Ghi X]YfYbXY`j YfV]bXYb`H\Ycf]Y`a`]h
GW\i`dfUI]gž`i a`XYa`@Y\ fYfa Ub[Y`ni`VY[Y[bYb`

⇒b`GUW\ gYb!5b\ U`h`k]fX`XYa`U`_i hYb`@Y\ fYfa Ub[Y`a`]h
]bbcj Uh]j Yb`5i gV]`Xi b[ga cXY`Yb`VY[Y[bYh`5a`&\$`5i [i gh
&\$&(`UVYb`Ub`XYf`i`b]j Yfg]h`h`A U[XYVi f[. ' \$`Ghi X]YfYbXY`]fY
]bX]j]Xi Y`Yb`j Yfhf`A[Y`i`bhYfnY]W\ bYhž`X]Y`HY`]Y]bYg`bYi Ufh][Yb
@Y\ fUa hgghi X]Yb[Ub[g`g]bX`8]YgY`A U» bU\`a`Y`]gh`b]W\h`bi`f`Y]b
GW\ f]h`i]b`F]W\h`i`b[`Y]bYf`bUW\`U`h][Yb`@Ogi`b[`XYg
@Y\ fYfa Ub[Y`gž`gcbXYfb`Ui`W\`Y]b`j Yfgi`W\ž`X]Y`E`i`U`]h`h`XYf
5i gV]`Xi b[`XYf`ni`_ØbZh][Yb`@Y\ f`f`ÄZhY`ni`j YfVYggYfb`

8]Y`gdYn]Y``_c`bn]d]YfhY`5i gV]`Xi b[`VY[]bbh`VYfY]hg`k`Ä`fYbX`XYg
6UW\Y`cfghi X]i a`g`a`]h`Y]bYf`DfUI]gcf]Ybh]Yfi`b[ž`X]Y`Y]bn][Ufh][`]b
8Yi hgW\`UbX`]gh`8]Y`Ub[Y\YbXYb`@Y\ f`f`ÄZhYž`X]Y`g]W\`Ui`Z
GY`_i`bXUf`gW\i`Yb`j`cfVYfY]hYbž`gc`Yb`]f`h`YcfYh]gW\Yg`K`]ggYb`UV
XYa`Xf]hYb`GYa`YghYf`X]fY`_h]b`XYb`GW\i`Yb`Ub`k`YbXYbž`]bXYa
g]Y`Y]bY`Yb[Y`j`YfV]bXi`b[`nk`]gW\Yb`Ghi X]i a`i`bX`DfUI]g
\YfghY`Yb`8]Yg`[YgW\]Y\hž`]bXYa`g]Y`Y]bYb`HU[`dfc`K`cW\Y`]b
Y]bYf`GW\i`Y`\cgd]h]YfYb`i`bX`gca`]h`k`Yfhj`c`Y`9fZU\fi`b[Yb`]a
l`bhYff]W\h`gUa`a`Y`b`

⇒bbcj Uh]j Y`5i gV]`Xi b[gghfi`_hi`fYb

8]YgYg`A`cXY`ghY`h`g]W\Yfž`XUgg`X]Y`Ghi X]YfYbXYb`b]W\h`bi`f`X]Y
b`ch`k`YbX][Yb`?`Yb`b`hb]ggY`Yfk`YfVYbž`gcbXYfb`Ui`W\`X]Y`F`Y`U`]h`h`
XYg`GW\i`U`hU[g`_Yb`b`Yb`Yfb`Yb`8`Yf`, VYf[Ub[`j`ca`Ghi X]i a`]b

XYb`@Y\FYfVYfi Z`k`jFX`gca`j]h`Z]Y»YbX`[`YghU`hYh`"B`UW`XYa`"X]Y
Ghi`X]YfYbXYb`j]\fYb`6UW`Y`cfUVgW`i`gg`YffY]W`h`\UVYbž`Zc`[`h`Y]b
A`UghYfghi`X]i`a`ž`]b`XYa`"g]Y`Y][`Ybgh`A`bX][`i`bhYff]W`hYb`i`bX`]\fY
: `A`][`_Y]hYb`k`Y]hYf`j`Yfh]YZYb`_`ObbYb`"

8]Y`?`ca`V]bUh]cb`XYf`:`A`W`Yf`]gh`YVYbZU`g`bYi`Ufh][`.:`Øf`X]Y
9fghZ`A`W`Yf`8Yi`hgW`i`bX`A`Uh\Ya`Uh]_`k`i`fXYb`VYfY]hg`k`Y]h`ØVYf
X]Y`<`A`ZhY`XYf`D`A`hnY`j`Yf[`YVYb`" `@Ui`h`XYa`"6]`Xi`b[`ga`]b]ghYf]i`a`]b
A`U[`XYVi`f[`\`Uh`XUg`@UjX`GUW`gYb!5b`U`h`%*`Ni`gU[`Yb`ZØf`XUg
: `UW`8Yi`hgW`i`bX`%(`Ni`gU[`Yb`ZØf`A`Uh\Ya`Uh]_`YfhY]`h`"8]Y
?`ca`V]bUh]cbga`Ò[`\`W`_Y]hYb`g]bX`j`]Y`Z`A`h][`/`gc`_`Ubb`8Yi`hgW
VY]gd]Y`gk`Y]gY`a`]h`9h\]_ž`HYW`b]_`cXYf`7\Ya`]Y`j`YfVi`bXYb
k`YfXYbž`k`A`fYbX`A`Uh\Ya`Uh]_`a`]h`D`mg]_ž`HYW`b]_`cXYf`7\Ya`]Y
_`ca`V]b]Yfh`k`jFX`"

9]b`"Ub`[`Zf]gh][`Yf`D`Ub

9]b`VYgcbXYfg`k`]W`h][`Yf`5gdY`_`h`X]YgYg`5i`gV]`Xi`b[`ga`cXY`g`]gh
X]Y`j`YfdZ]W`hi`b[`XYf`Ghi`X]YfYbXYbž`bUW`j]\fYa`"Ghi`X]i`a`ZØf
a`]bXYghYbg`ZØbZ`š]\fY`]b`GUW`gYb!5b`U`h`ni`i`bhYff]W`hYb`"8]YgY
A`U»`bU`a`Y`]gh`b]W`h`bi`f`XUfUi`Z`Ui`g[`Y`Y[`hž`XYb`i`ba`]hY`VUfYb
@Y\FYfa`Ub[`Y`ni`VY`_`Aa`dZYb`/g]Y`n]Y`h`Ui`W`XUfUi`Z`UVž`X]Y
`Ub[`Zf]gh][`Y`j`Yfgcf[`i`b[`j`cb`GW`i`Yb`]b`XYf`FY[`]cb`a`]h
ei`U`]Zn]YfhYa`"@Y`fdYfgcbU`ni`g]W`Yfb`"

8`Ug`A`]b]ghYf]i`a`ZØf`6]`Xi`b[`GUW`gYb!5b`U`h`VYhc`b`h`X]Y
B`chk`YbX][`_Y]h`gc`W`Yf`Dfc`Y`_`hYž`i`a`XUg`6]`Xi`b[`ggmghYa`]b`XYf
FY[`]cb`ni`gh`A`f`_`Yb`"8]Yg`_`Ubb`U`g`_`UfY`FYU`_`h]cb`Ui`Z`XYb
XYi`hgW`UbXk`Y]hYb`HfYbX`Ub[`YgY\Yb`k`YfXYbž`XYf`nY][`hž`XUgg
j`]Y`Y`6i`bXYg`A`bXYf`GW`k`]Yf][`_Y]hYb`\UVYbž`Ui`gfY]W`YbX`@Y\FYf
Ui`gni`V]`XYb`i`bX`ni`\`U`hYb`"8i`fW`XYb`ZfØ`Yb`i`bX`]bhYbg]j`Yb
?`cbhU`_`h`a`]h`XYb`GW`i`Yb`k`jFX`XYb`Ghi`X]YfYbXYb`b]W`h`bi`f`X]Y
A`Ò[`\`W`_Y]h[`Y[`YVYbž`g]W`]b`Y]bYa`fYU`Yb`i`a`ZY`X`ni`VYk`A`fYbž
gc`bXYfb`Ui`W`Y]bY`6]bXi`b[`Ub`X]Y`FY[`]cb`ni`Yb`hk`]W`_`Y`b`"

8]Y`<`YfUi`gZcfXYfi`b[`Ybž`X]Y`a`]h`XYa`"@Y\FYfa`Ub[`Y`j`YfVi`bXYb
g]bXž`g]bX`U`gc`j`]Y`gW`]W`h][`"8Yf`5bgUhn`]b`GUW`gYb!5b`U`h
_`ObbhY`U`g`A`cXY`ZØf`UbXYfY`6i`bXYg`A`bXYf`X]YbYbž`X]Y`A`b`]W`Y`Y

DfcV`Ya Y`YfZU`fYb" `bXYa `a Ub`ni `ØbZh][Y`@Y`f`f`ÄZhY`VYfY]hg
k `Ä`fYbX`j`\fYf`Ghi X]YbnY]h`b`GW`i` `Yb`]bhY[f]Yfhž`cZ`h`a Ubž`b]W`h
bi f`XUg`b`hYfYggY`Ub`XYa `6Yfi Z`ni `ZØfXYfbž`gcbXYfb`Ui W`X]Y
5hhfU`hj]h`Ä`h`XYg`@Y`fYfVYfi Zg`ni `ghY][Yfb"

@Y`fYfV]`Xi b[`]a `K UbXY`

A]h`XYf`9]bZØ`fi b[`X]YgYg`A cXY`g`nY][h`GUW`gYb!5b`U`hž`XUgg`Yg
VYfY]h`]ghž`X]Y`hfUX]h]cbY`Y`b`K Y[Y`XYf`@Y`fYfV]`Xi b[`ni
`]\bhYfZfU[Yb`i bX`bYi YžZYI]V`Y`K Y[Y`ni `[Y`Yb" `b`XYf`Yi h][Yb
NY]hž`b`XYf`6]`Xi b[`]a a Yf`XmbUa]gW`Yf`i bX`j]Y`gY]h][Yf`k]fXž`]gh
gc`W`Y]b`GW`f]hh`b`chk YbX][ž`i a `a]h`XYb`5bZc`fXYfi b[Yb`Ub`Y]bY
a cXYfbY`GW`i `Y`GW`f]hh`ni `U`hYb"

8 i fW`X]YgY`GhfUH] [Yb`_ØbbhY`Yg`GUW`gYb!5b`U`h`[Y`]b[Ybž`Y]b
ghUV]`YfYg`@Y`f`_ØfdYfUb[YV`ch`ni `gW`UZZYb`i bX`X]Y`E`i`U`]h`Ä`h`XYf
6]`Xi b[`bUW`U`h][`ni `j YfVYggYfb" `8Yf`c`_i`g`Ui`Z`dfU`h]gW`Yg
@YfbYb`j`cb`6Y[]bb`Ub`i bX`X]Y`J`YfdZ]W`hi b[`ni f`Ub[Zf]gh][Yb
HÄ]h[_Y]h]b`XYf`F`Y[]cb`g]bX`nYbhfU`Y`9`Ya YbhYž`X]Y`X]Y
@Y`fYfV]`Xi b[`]b`GUW`gYb!5b`U`h]b`Y]bY`bYi Y`Y`fU`ZØ`fYb
_ØbbYb"

8 Yf`@Y`fYfa Ub[Y`]b`GUW`gYb!5b`U`h`

8 Yf`@Y`fYfa Ub[Y`]gh`b]W`h`bi f`Y]b`DfcV`Ya `]b`GUW`gYb!5b`U`hž
gcbXYfb`VYhf]Zh]j]Y`Y`6i bXYg`ÄbXYf" `b`GUW`gYb!5b`U`h]gh`X]Y
G]hi`Uh]cb`VYgcbXYfg`_f]h]gW`ž`XU`XUg`@JbX`]b`XYb`Y`hnhYb`Ä`fYb
a]h`Y]bYa `g][b]Z]_UbhYb`F`ØW_[Ub[`Ub`@Y`f`f`ÄZhYb`_cbZfc`bh]Yfh
k`Uf" `@Ui`h`XYa `6]`Xi b[ga]b]ghYf]i a `GUW`gYb!5b`U`h[UV`Yg]a
Ä`f`&\$&`Yhk`U`%", \$\$`i bVYgYhnhY`@Y`fYfghY`Ybž`k`cVY]j`cf`U`Ya
]b`ÄbX`]W`Yb`F`Y[]cbYb`i bX`]b`gdYn]Y`Yb`i`ÄW`Yfb`k`]Y
A`Uh`Ya`Uh]_`i bX`BUhi`fk`]ggYbgW`UZhYb`X]Y`BUW`ZfU[Y`VYgcbXYfg
`cW`]gh`8]Yg`_ØbbhY`ni`Y]bYa`F`ØW_[Ub[`XYf`6]`Xi b[gei`U`]h`Ä`h
ZØ`fYbž`XU`GW`i`Yb`c`Zh`b]W`h`X]Y`YfZc`fXYf`]W`Y`9i`dYfh]gY`V]YhYb
_ØbbYb"

8 Ug`@JbX`fYU[]Yfh`b]W`h`bi f`a]h]bbc]Uh]j`Yb
5i`gV]`Xi b[ga cXY`Ybž`gcbXYfb`Ui W`a]h]j`YfgW`]YXYbYb

5bfY]ngmghYa Ybži a '† b[Y'@Y\FYf']b'XYb'6Yfi Z'ni 'n]Y\Yb'i bX'g]Y
]b'GUWgYb!5b\U'hini '\U'hYb"8Uni '[Y\ÖfYb'i bhYf'UbXYfYa
Z]bUbn]Y''Y': ÖfXYfdfc[fUa a Yž'Gh]dYbX]Yb'i bX'Y]bY'I bhYfghØhni b[
VY]'XYf'K c\bi b[ggi WXY"

GWXi `]gWXY'FU\ a YbVYX]b[i b[Yb'i bX
< YfUi gZcfXYfi b[Yb

9]b'k Y]hYfYf'5gdY_hž'XYf'ni a '@Y\FYfa Ub[Y''VY]hfÄ[hž'g]bX'X]Y
i bhYfgW]YX'W]WYb'GWi `Zcfa Yb'i bX'XUg'6]Xi b[ggmghYa 'b
GUWgYb!5b\U'h"ä 'J Yf['Y]W'ni 'UbXYfYb'6i bXYg'ÄbXYfb'[]Vh'Yg
\Yf'Y]bY'J]Y'nU\`j cb'GWi `Zcfa Ybž'XUfi bhYf'; fi bXgW'i `Ybž
GY_i bXUfgW'i `Yb'i bX'; ma bUg]Yb"ŸXY'X]YgYf'GWi `UfhYb'Vf]b[h
i bhYfgW]YX'W]WY'5bZcfXYfi b[Yb'i bX'< YfUi gZcfXYfi b[Yb'a]h
g]W'"

Ni XYa '[]Vh'Yg'Y]bYb'\c\Yb'5bhY]'Ub'GWØ'Yfb'a]h
A][fUh]cbg\]bhYf[fi bXž'k Ug'ni gÄh'W]WY'?ca dYhYbnYb'j cb
'@Y\F_fÄZhYb'YfZcfXYfh"J]Y'Y'@Y\FYf'g]bX'cZ'h'b]W'h'Ui gfY]WYbX'Ui Z
X]Y'\YhYfc[YbY'GWØ'YfgW]UZh'j cfVYfY]hYhž'k Ug'XUg'@Y\Fi a ZY'X
ni gÄh'W]WY'VY'UghYh"@Ui h'Y]bYf'Ghi X]Y'XYg'ægh]hi hg'ZØf
K Y]hYfV]Xi b['b'XYf'6]Xi b['fDÄXU[c[]gWYg'@UbXYg]bgh]hi h
GUWgYb!5b\U'h'VYb'Öh][Yb'Yhk U'() i 'XYf'@Y\F_fÄZhY'gdYn]Z]gWY
GWi 'i b[Ybži a 'XYb'6YXØfZb]ggYb'X]YgYf'GWØ'Yf[fi ddY'[YfYW'h
ni 'k YfXYb"

@Ub[Zf]gh][Y'DYfgdY_h]j Yb'i bX'GhfUHY[]Yb

8]Y'A U» bU\ a Yb'XYg'@UbXYg\Ui g\U'hg' 'I bhYff]W'hga]b]ghYf]i a g
VY]b\U'hYb'Ui W'Ub[Zf]gh][Y'GhfUHY[]Ybži a 'XUg'6]X'XYf
'@Y\FYfUi gV]'Xi b['bUW\U'h]['ni 'j YfVYggYfb"8Uni '[Y\Öfh'Ui W
X]Y'j YfghÄ_fh'Ni gUa a YbUfVY]h'nk]gWYb'I b]j Yfg]hÄhYb'i bX
GWi `Yb"8]Y'I b]j Yfg]hÄhYb'gc`Yb'b]W'h'bi f'5i gV]'Xi b[gghÄhYb
gY]bž'gcbXYfb'Ui W'U'g'DUfhhYf'Z b[]YfYbž'X]Y'U_h]j 'Ub'XYf
'; YghU'hi b['j cb'@Y\Fd`ÄbYb'i bX': cfhV]'Xi b[gUb[YVchYb'VYhY']][h
g]bX'"

⊕'GUWgYb!5b\U'hghfYVhia Ub'Ubž'Xi fW'X]YgY'A U» bU\ a Yb'b]W h
bi f'X]Y'5bnU\`XYf'@Y\ f_ fÀZhY'ni`Yf\Ò\Ybž'gcbXYfb'Ui W'XYfYb
ZUW`]WY'i bX'dÀXU[c[]gWXY'E i U`Z]_Uh]cb'ni`j YfVYggYfb"
8UXi fW`_ÒbbhY'b]W h'bi f'X]Y'5bnU\`Ub'@Y\ fYfb'Yf\Ò\h'k YfXYbž
gcbXYfb'Ui W'X]Y'5hfU_hj]hÀh'XYg'@Y\ fYfVYfi Zg'[YghY][Yfh
k YfXYbž'k Ug`Ub[Zf]gh][`ni`Y]bYf'ghUV]YfYb'@Y\ fYfg]hi Uh]cb
ZØ\ fYb`_ÒbbhY`"

Ni gÀhn`]W'k]fX'Ui Z'X]Y'6YXYi hi b[]j cb': cfh'i bX
K Y]hYfV]'Xi b[Yb'ZØf'VYghY\YbXY'@Y\ f_ fÀZhY'\]b[Yk]YgYb"'@Ui h
Y]bYf'i bhYfgi W'i b['XYf'8Yi hgWYb'; YgY`gW UZh'ZØf
9fn]Y\i b[gk]ggYbgW UZhYb'bY\ a Yb'YXcW'bi f' \$i`XYf
@Y\ f_ fÀZhY'fY[Y'a À»][`Ub'X]YgYb'K Y]hYfV]'Xi b[gUb[YVchYb'hY]'ž
k Ug'Ui ZY]b'k Y]hYfYg'ghfi`_hi fY`Yg'DfcV`Ya`'\]bk Y]gh`"

J Yf`]b_hY'E i Y`Y.`X d U`B U W X f]W h Y b

8 Y h U]`g

6 Y gi W X Y b`G]Y`i bg'Ui Z.`b!U["XY