

GW i `ghfU» Yb `]b `B F K . ; `UXVYW_ž'6c h h f c d
i b X `; Y`gYb_]fW X Yb `V`Y]V Yb `Ui » Yb `j c f

J YfÒZZYbh]W X h `8]YbghU[ž'&\$"\$, "&\$&('\$+.(, `b`XYi hgW X Yb
GhÅXhYb` \Uh`XYf`GW i `ghUfh`b]W X h`bi f`6YXYi hi b[`Z0f`X]Y
GW Ø`Yfž`gcbXYfb`Ui W X`Z0f`X]Y`J Yf`Y\fgg]hi Uh]cb`]b`XYb
J]YfhY`bž]b`XYbYb`GW i `Yb`]Y[Yb`"K Å\fybX`Y]b][Y`GhÅXhY`]b
BcfXf\Y]b!K YghZU`Yb`VYfY]hg`GW i `ghfU» Yb`Y]b[YZ0\fh
\UVYbž`gYmYb`; `UXVYW_ž'6c h h f c d`i b X`; Y`gYb_]fW X Yb
a ca YbhUb`b]W X h`Ui Z`X]YgYg`A cXY`""GhUhhXYggYb` \UVYb
X]YgY`GhÅXhYU`hYfbUh]j Y`@0gi b[Yb`ni f`F`YXi n]Yfi b[`XYg`

J YfÒZZYbh]W X h `8]YbghU[ž'&\$"\$, "&\$&('\$+.(,

b`XYi hgW X Yb`GhÅXhYb` \Uh`XYf`GW i `ghUfh`b]W X h`bi f`6YXYi hi b[`Z0f
X]Y`GW Ø`Yfž`gcbXYfb`Ui W X`Z0f`X]Y`J Yf`Y\fgg]hi Uh]cb`]b`XYb
J]YfhY`bž]b`XYbYb`GW i `Yb`]Y[Yb`"K Å\fybX`Y]b][Y`GhÅXhY`]b
BcfXf\Y]b!K YghZU`Yb`VYfY]hg`GW i `ghfU» Yb`Y]b[YZ0\fh`\UVYbž
gYmYb`; `UXVYW_ž'6c h h f c d`i b X`; Y`gYb_]fW X Yb`a ca YbhUb`b]W X h
Ui Z`X]YgYg`A cXY`""GhUhhXYggYb` \UVYb`X]YgY`GhÅXhYU`hYfbUh]j Y
@0gi b[Yb`ni f`F`YXi n]Yfi b[`XYg`J Yf`Y\fgUi Z`ca a Ybg`i a
GW i `Yb`\Yfi a `Ybhk]W`Y`h"

b`6c h h f c d`nY][h]g]W X ž`XUgg`X]Y`gc [YbUbbhYb`<c`!`i b X`6f]b[ncbYb
j cb`XYb`9`hYfb`[i h`Ub[Ybca a Yb`k YfXYb`"8]YgY`gdYn]Y`Yb
6YfY]W X Y`Ub`Z0bZ`6c h h f c dYf`GW i `Yb`Yf`Ui VYb`Yg`9`hYfbž]\fY
?]bXYf`gW X bY`Y]b!`i b X`Ui gni `UXYbž`c`bY`XUVY]`XYb`J Yf`Y\f
ni gÅm`]W X`ni `VY`UghYb`"8]Y`GhUXh`d`Ubh`gc [Ufž`nk Y]`k Y]hYfY`X]YgYf
NcbYb`Y]bni f]W X hYbž`i a `X]Y`9ZZ]n]Ybn`i b X`G]W X Yf\Y]h`Z0f`X]Y
?]bXYf`ni `Yf\0\Yb"

J Yf`Y\fgd`fcV`Ya Y`i b X`@0gi b [Yb

8]Y`G]hi Uh]cb`]b` ; Y`gYb_]fWXYb`]gh`YXcW`Yhk Ug`_ca d`]n]YfhYf" `9]b
GhUXhgd fYWX Yf` [UV`Ubž`XUgg`Yg`Ub`bchk YbX][Yb`5i`gk Y]WZ`WXYb
ZØf`X]Y`9`hYfb`a Ub[Y`Y" `C`bY`Ui`gfY]WXYbXY`5`hYfbUh]j Yb`k`ØfXY
XUg`J Yf`_Y`fgW`Ucg`YX][`]W`Ub`UbXYfY`GhY`Yb`j Yf`U[Yfh`ghUhh
[Y`Øgh`k YfXYb" `8 Yf`9]bgUhn`j cb`GW`i`ghfU» Ybž`VY]`XYbYb`ni
VYgh]a a hYb`NY]hYb`XYf`J Yf`_Y`f`_ca d`Yhh[YgdYffh`k]fXž`ghY`h
XU`Yf`b]W`h`ni`f`8 YVUhY" `8]Y`GhUXh`g]Y`h`g]W`]b`XYf
J YfUbhk`cfhi`b[ž`i`a ZUggYbXY`j Yf`_Y`fgfYWX`h]WXY`i`bX
j Yf`_Y`fgd`UbYf]gWXY`5gdY`_hY`ni`VYfØW`g]W`h][Ybž`k Ug`X]Y
I a`gYhni`b[`ni`g`Åh`]WXYf`A U» bU`a Yb`_ca d`]n]Yfh`a`UWX`h"

≠b` ; `UXVYW`_ [UV`Yg`VYfY]hg`Y]bYb`HYgh`Ui`Z`a`]h`Y]bYf`nY]h]W`
VY[fYb`nhYb`GhU» YbgdYffi`b[`j`cf`XYf`A`cgU]_gW`i`Y" `8 Ug`9f[YVb]g
X]YgYf`HYghd`UgY`ghY`h`YXcW`bcW`Ui`gž`k Yg`U`V`U`_hi`Y" `Y]bY
_cb`_fYhYb`GW`f]hhY`ni`f`9]bZØ`fi`b[`j`cb`GW`i`ghfU» Yb
i`bhYfbca`a Yb`k`YfXYb" `8]Y`<`YfUi`gZcfXYfi`b[`]b` ; `UXVYW`_]gh`Ygž
Y]bY`[YY][bYhY`@Øgi`b[`ni`Z]bXYbž`X]Y`gck`c`G]WXYf`Y]h`U`g`Ui`W`
DfU`_h]_UV]`]h`Åh`ZØf`X]Y`9`hYfb`V]YhYh"

5i`gg]W`hYb`ZØf`X]Y`Ni`_i`b`Zh

=a` `<]bV`]W`_`Ui`ZX]Y`VYj`cfghY`YbXYb`GW`i`ghUfh`k]fX`]b
; Y`gYb_]fWXYb`Y]bY`j Yfgh`Å`_hY`?`cbhfc`Y`XYf`DUf`_j YfVchY`j`cf
GW`i`Yb`Ub[Y`_ØbX][h" `8]Yg`_ØbbhY`XUni`VY]hfU[Ybž`X]Y
J Yf`_Y`fgg]hi`Uh]cb`j`cf`XYb`GW`i`Yb`ni`j`YfVYggYfbž`Ui`W`k`Ybb`Y]b
ØVYf[fY]ZYbXYg`?`cbnYdh`bcW`ZY`h" `8]Y`GhUXh`c`Zž`Xi`fW`X]YgY
A U» bU`a Yb`XYb`9`hYfb`ni`g][bU`]g]YfYbž`XUgg`X]Y`GW`UZZ]`b[
g]WXYfYf`J Yf`_Y`fgVYX]b[i`b[Yb`ZØf`X]Y`GW`Ø`Yf]bbYb`i`bX`GW`Ø`Yf
cVYfghY`Df]cf]h`Åh`Uh"

8]Y`8]g`_i`gg]cb`ØVYf`GW`i`ghfU» Yb`]b`X]YgYb`Gh`X`hYb`k]fZi`Ui`W`
VYXYi`hYbXY` :`fU[Yb`ØVYf`[Ygi`bXY`GW`i`k`Y[Y`i`bX`X]Y`G]WXYf`Y]h
XYf`?`]bXYf`Ui`Z`K`Å`fYbX`UbXYfY`Gh`X`hY`a`]h`X]YgYf`≠b]h]Uh]j`Y
:`cfhgW`f]hhY`a`UWX`Ybž`ghY`Yb`Y]b][Y`?`ca`a`i`bYb`j`cf`XYf
<`YfUi`gZcfXYfi`b[ž`[YY][bYhY`@Øgi`b[Yb`ni`Z]bXYbž`X]Y`b]W`h`bi`f
YZZ`_h]j`ž`gcbXYfb`Ui`W`Ui`ZX]Y`gdYn]Z]gWXYb` ; Y[YVYb`Y]hYb`j`cf
Cfh`UV[Ygh]a`a`h]g]bX" `8 Yf`GW`i`ghUfh]gh`gca`]h`b]W`h`bi`f`XYf
6Y[]bb`Y]bYg`bYi`Yb`GW`i`U`fYgž`gcbXYfb`Ui`W`Y]b`HYgh`ZØf`X]Y

J Yf_Y\fg_cbnYdhY`]b`j` YfgW\jYXYbYb`GhAXhYb"

8Yf`i`a`[`Ub[`a`]h`GW`i`j`Yf_Y`f`nY][`h`z`XUgg`Yg`b]W\h`]a`a`Yf`
Y]bZUW\Y`@Ogi`b[`Yb`[`]Vh" `ϕ`XYb`GhAXhYb`z`X]Y`GW`i`ghfU»Yb`
UV`Y`b`Yb`z`]gh`Y]bY`J`Y`n`U`U`b` ,`VYf`Y[`i`b[`Yb`b`c`h`k`Yb`X][`z`i`a` `XUg`
N]Y`X`Yf`J`Yf_Y`f`gg]W\Yf`Y]h`ni` `YffY]W\Yb" `8`Ug`:`Y`Y`X`V`U`W`_`j`c`b`
9`h`Y`f`b`i`b`X`@`Y`f`Y`f`b`_`O`b`b`h`Y`X`U`V`Y]`Y]b`Y`k`Y`f`h`j`c`Y`F`Y`g`g`c`i`f`W`
X`U`f`g`h`Y`Y`b`z`i`a` `]`Y`a`Y]b`g`U`a` `a`]h`X`Y`b`J`Yf_Y`f`g`d`U`b`Y`f`b`c`d`h]a`U`Y`
F`U`a`Y`b`V`Y`X]b[`i`b[`Yb`ni` `g`W\`U`Z`Y`b" `6`Y`c`V`U`W`h`Y`b`k`]f`z`k`]Y`g]W\`X]Y`
A`U»`b`U`a`Y`b`]b`b`Y`f`U`V`X`Y`f`_`c`a` `a`Y`b`X`Y`b`A`c`b`U`h`Y`Y`b`h`k`]W`_`Y`b`
k`Y`f`X`Y`b`i`b`X`c`V`b`Y`i`Y`?`c`b`n`Y`d`h`Y`]b`g`@`Y`V`Y`b`[`Y`f`i`Z`Y`b`k`Y`f`X`Y`b`z`i`a`
X]Y`G]W\`Y`f`Y]h`Z`O`f`i`b`g`Y`f`Y`?`]b`X`Y`f`ni` `Y`f`\`O`Y`b"

J Yf`O`Z`Y`b`h]W\`h`8]Y`b`g`h`U[`z`&`\$`"\$,`"&`\$`&(``\$`+`.(` ,`

9]b][`Y`GhAXhY`f]W\`h`Y`b`ni`a` `GW`i` `gh`U`f`h`g`c[`Y`b`U`b`b`h`Y`G`W`i` `gh`f`U»`Y`b`
Y]b` `X`c`f`h`X`O`f`Z`Y`b`a`c`f[`Y`b`g`i`b`X`b`U`W`a` `]h`h`U[`g`_`Y]b`Y`5`i`h`c`g`
f`Y]b`Z`U`\`f`Y`b" `ϕ` ;` `U`X`V`Y`W`_`z`6`c`h`h`f`c`d`i`b`X` ;`Y`g`Y`b`_]f`W\`Y`b`]g`h`X`U`g`
A`c`X`Y`""`a` `A`c`a`Y`b`h`ni`a` `]b`X`Y`g`h`_`Y]b`H`\`Y`a`U"

|` `@`h`n`j`c`b`G`h`U`Y[`a`U`b`b`#`:`I`B`?`9`:`c`h`c`G`Y`f`j`]W`g`

- <c`!`i`b`X`6`f]b[`!`N`c`b`Y`b`]b`6`c`h`h`f`c`d`\`U`V`Y`b`g]W\`V`Y`k`A`\`f`h`
- GW`i` `gh`f`U»Y`b`V`Y`b`O`h][`Y`b`5`i`g`k`Y]W\`Z`A`W`Y`b`Z`O`f`5`i`h`c`g`

9]b][`Y`GhAXhY`]b`B`F`K` `f]W\`h`Y`b`ni`a` `GW`i` `gh`U`f`h`a`c`f[`Y`b`
g`c[`Y`b`U`b`b`h`Y`G`W`i` `gh`f`U»Y`b`Y]b` `X`c`f`h`X`O`f`Z`Y`b`a`c`f[`Y`b`g`i`b`X`
b`U`W`a` `]h`h`U[`g`_`Y]b`Y`5`i`h`c`g`f`Y]b`Z`U`\`f`Y`b" `6`Y]i`b`g`]b` ;` `U`X`V`Y`W`_`z`
6`c`h`h`f`c`d`i`b`X` ;`Y`g`Y`b`_]f`W\`Y`b`]g`h`X`U`g`A`c`X`Y`""`a` `A`c`a`Y`b`h`ni`a` `]b`X`Y`g`h`
_`Y]b`H`\`Y`a`U"

ϕ`6`c`h`h`f`c`d`\`A`h`g]W\`X`U`g`J`Yf_Y`f`g`W\`U`c`g`X`i`f`W` `9`h`Y`f`b`h`U`l`]g`U`i`h`
Y]b`Y`f`G`h`U`X`h`g`d`f`Y`W\`Y`f]b`a`Y]g`h`]b` ;`f`Y`b`n`Y`b` `i`b`h`Y`f`U`b`X`Y`f`Y`a` `A`h`h`Y`b`
g]W\`X]Y`<c`!`i`b`X`6`f]b[`n`c`b`Y`b`V`Y`k`A`\`f`h" `5`b`Z`O`b`Z`G`W`i` `Y`b`k`i`f`X`Y`b`
g`d`Y`n]Y`Y`6`Y`f`Y]W\`Y`Y]b[`Y`f]W\`h`Y`h`z`]b`X`Y`b`Y`b`9`h`Y`f`b`]f`Y`?`]b`X`Y`f`
f`U`i`g`U`g`g`Y`b`i`b`X`k`]Y`X`Y`f`Y]b`g`U`a` `a`Y`b`_`O`b`b`Y`b" `N`k`Y`]k`Y]h`Y`f`Y`<c`!
i`b`X`6`f]b[`n`c`b`Y`b`U`b`6`c`h`h`f`c`d`Y`f`G`W`i` `Y`b`k`Y`f`X`Y`b`[`Y`f`U`X`Y`[`Y`d`U`b`h" `ϕ`
 ;` `U`X`V`Y`W`_`k`i`f`X`Y`Y]b`Y`n`Y]h]W\`V`Y[`f`Y`b`n`h`Y`G`h`f`U»Y`b`g`d`Y`f`f`i`b[`

gWxcba U`j cf'XYf'A cgU]_gWxi `Y'[YhYghYh' `X]Y'[YbUi Y
5i gk Yfhi b[`ghY\h'UVYf'bcWx `Ui g"

8]Y`6YXYi hi b[`j cb`GWxi `ghfU» Yb`ZØf`X]Y G]Wx Yf\Y]h

GWxi `ghfU» Yb`k i fXYb`]bg`@YVYb`[Yfi ZYbž'i a `X]Y`G]WxYf\Y]h'XYf
?]bXYf`Ui ZXYa `GWxi `k Y[`ni `Yf\Ø\Yb" `8Yf': i » [Åb[Yf!`i bX
: U\ffUXj Yf_Y\`f`k]fX`[YZØfXYfhž`k Å\`fYbX`[`Y]Wx nY]h][`XYf
5i hcj Yf_Y\`f`]b`XYb`i ba]hY`VUFYb`GWxi `VYfY]WxYb`fYXi n]Yfh`k]fX"
@Ui h`Y]bYf`Ghi X]Y`XYg`8Yi hgWxYb`J Yf_Y\`fgg]WxYf\Y]hgfUhYg`fBJ F Ł
g]bX`j]Y`Y`i bZÅ`Y`a]h'?]bXYfb`]a `GhfU» Ybj Yf_Y\`f`X]fY`_h`]b`XYf
BÅ\Y`j cb`GWxi `Yb`ni `j YfnY]WxYb`" `8U\Yf`]gh`Yg`Yb hgWxY]XYbXž
A U» bU\`a Yb`ni `Yf[fY]ZYbž`X]Y`XUg`F]g]_c`j Yff]b[Yfb`i bX`Y]bY
g]WxYfY`5b`_i bZi`XYf`GWØ`Yf`[Yk Å\`f`Y]ghYb" `8]Y`9]bZØ\`fi b[`j cb
GWxi `ghfU» Yb`_Ubb`Ui Wx`VYXYi hYbž`XUgg`X]Y`@`Zhe`i U`]hÅh`]b`XYf
I a [YVi b[`XYf`GWxi `Yb`j YfVYggYfh`k]fXž`XU`k Yb][Yf': U\fnYi [Y
GWxUXghcZY`Ui gghc» Yb"

⊖ j]Y`Yb`GhÅXhYbž`]b`XYbYb`GWxi `ghfU» Yb`VYfY]hg`]a`d`Ya Yb]Yfh
k i fXYbž`nY][Yb`GhUh]gh]_Yb`Y]bY`d`c`g]h]j Y`9b`hk]W`_i b[`]\`bg]Wx`h`]Wx
XYf`i bZU`n`U\`Yb" `6Y]gd]Y`gk Y]gY`gUb`_X]Y`5bn`U\`XYf
J Yf_Y\`fgi bZÅ`Y`]b`GWxi `ncbYb`j cb`&\$%, `V]g`&\$&&`i a `V]g`ni `` \$
i `]b`GhÅXhYb`k]Y`A ØbWxYb`i bX`<Ua Vi f[" `8]YgY`NU\`Yb
i b`hYfghfY]WxYb`X]Y`d`chYbn]Y`Yb`J`cfhY]`Y`Y]bYf`gc`WxYb
A U» bU\`a Yb"

< YfUi gZcfXYfi b[Yb`i bX`K]XYfghÅbXY

Hfchn`XYf`J`cfhY]`Yž`X]Y`GWxi `ghfU» Yb`V]YhYb`_ØbbYbž`ghY\Yb
GhÅXhY`k]Y`; Y`gYb_]fWxYb`j cf`<YfUi gZcfXYfi b[Yb" `8Yf`A Ub[Y`Ub
5i gk Y]WxZÅWxYb`ghY`h`Y]b`nYbhfU`Yg`DfcV`Ya `XUfž`XUg`X]Y
I a gYhni b[`YfgWx`k Yfh" `9]bY`i a [Y\YbXY`J Yf`U[Yfi b[`XYg
J Yf_Y\`fg`_ØbbhY`ni`f`, VYf`Ughi b[`i a `]Y[YbXYf`GhfU» Yb`ZØ\`fYb
i bX`gca]h`bYi Y`DfcV`Ya Y`gWxUZYb" `8]Y`8]g`_i gg]cb`ØVYf
GWxi `ghfU» Yb`]gh`XU\Yf`c`Zij`cb`6YXYb`_Yb`[YdfÅ[hž`XUgg`X]Y
A U» bU\`a Y`b]Wx`h`[i`h`Xi`fWx`XUWx`higY]b`_ØbbhY`i bX`X]Y

VYhfcZZYbYb'5bk c\bYf'a Ò[`]WYfk Y]gY'i bhYf'XYb'J YfÅbXYfi b[Yb
`Y]XYb"

9]bY'I a ZfU[Y'XYF'GhUXh; Y`gYb_]fWYb`UhhY'[YnY][hžXUgg'j]Y`Y
9`hYfb'VYgcf[h'ØVYf'X]Y'9ffY]WVUf_Y]h'j cb'GWXi `Yb'g]bXž'gc`hYb
GWXi `ghfU»Yb'Y]b[YZØ\fh'k YfXYb"9]bY'6U`UbW'ink]gWYb'XYf
G]WYf\Y]h'XYf'?]bXYf'i bX'XYf'A cV]`hÅh'XYf': Ua]]Yb'ni `Z]bXYbž
V`Y]Vh'Y]bY'[fc»Y'<YfUi gZcfXYfi b[`ZØf'X]Y'GhUXhj Yfk U`hi b["

8YhU]`g

6Ygi WYb'G]Y'i bg'Ui Z.'b!U["XY