

G\]`c\ `x`]Y`hfYbbh'g]W\ j`cb`D]hh.`9]b
bYi`Yg`? Ud]hY`VY[]bbh

G\]`c\ `x`]Y!D]hž`HcW\hYf`j`cb`5b[Y`]bU`x`]Y`i`bX`6fUX`D]hž
\Uh'cZZ]n]Y`XYb`BUW`bUa`Yb`]\fYg`J`UhYfg`UV[Y`Y[h`

@cg`5b[Y`Yg` `9]b`VYa`Yf`_Ybgk`YfhYf`GW\ f]hh]b`X]Y
GY`Vghgh`ÅbX][_Y]h`G\]`c\ `Bci`j`Y`x`]Y!D]hž`X]Y`HcW\hYf`XYf
VY`_UbbhYb`GW\Ui`gd]Y`Yf`5b[Y`]bU`x`]Y`i`bX`6fUX`D]hž`\Uh`Ub
]\fYa`%,`";`YVi`fhghU[`cZZ]n]Y`XYb`BUW`bUa`Yb`]\fYg`J`UhYfg
UV[Y`Y[h`8]Yg`k`i`fXY`_Øfn`]W\ j`cb`I`G!A`YX]Yb`VYf]W\hYhž`X]Y`g]W\
Ui`ZcZZ]n]Y`Y`8c`_i`a`YbhY`VYn]Y\Yb`"8Yf`bYi`Y`i`bX`Y[U`
Y]b[YhfU[YbY`BUa`Y`XYf`↑`b[Yb`:`fUi``Ui`hYh`bi`b`gW\`]W\h`~G\]`c\
x`]Y`"8]YgY`9bhgW\Y]Xi`b[` _ØbbhY`U`g`Y]b`NY]W\Yb`ZØf`]\fY
k`UW\gYbXY`I`bUV`\Åb[][_Y]h`i`bX`DYfgØb`]W\ _Y]h`]bhYfd`fYh]Yfh
k`YfXYb`"

; YVcfYb`k`i`fXY`G\]`c\ `Ua` `&+"`A`U]`&\$*\$`]b`BUa`]V]U`"G]Y`]gh`XUg
YfghY`Y]V`]W\Y`?]bX`XYg`Y]bgh][Yb`HfUi`a`dUUfYgž`XUg`]b`XYf
I`bhYf\U`hi`b[gVfUbW\Y`i`bhYf`XYa`Gd]hnbUa`Yb`~6fUb[Y`]bU`
VY`_Ubbh`k`Uf`"G\]`c\ `Uh`bcW\`nk`Y];`YgW\k`]ghYf.`X]Y`a`]h`Yfk`Y]Y
%*!`Å\ f][Yb`Nk`]`]b[Y`J`j`]YbbY`i`bX`?bcl`ž`X]Y`YVYbZU`g`j`cb`x`]Y
i`bX`D]h'g]bX`"8UfØVYf`\]bUi`g`\Uh`D]h`X]Y`F`c`Y`XYg`J`UhYfg`ZØf
x`]Yg`UXcdh]YfhY`?]bXYf`A`UXXcl`ž`DUI`i`bX`NU\UfU`ØVYfbca`a`Yb`"

8]Y` ;` YgW\]W\ hY`XYf`9`hYfb

5b[Y`]bU`x`]Y`i`bX`6fUX`D]h[U`hYb`ØVYf`j`]Y`Y`J\`fY`U`g`XUg
i`h]a`Uh]Y` ;`Ua`ci`f!DÅfW\Yb`]b`<c`mk`ccX`" ÆfY`@]YVYg[YgW\]W\ hY
VY[Ubb`Ua`GYh`XYg`:]`a`g`~A`f`"i`bX`A`fg`"Ga`]h`"ž`k`c`g]Y`g]W\`&\$\$(
YbbYb`YfbhYb`"&\$%(`Zc`[hY`X]Y`<c`W\`nY]hž`YXcW\` \]Y`h`XUg` ;`ØW
b]W\h`Ub[Y`Ubž`i`bX`]a` `<Yfvgh`&\$%*`fY]W\hY`x`]Y`X]Y`GW\Y]Xi`b[

Y]b"G]Y'k UfZ'D]hhj cfž < UbX[fY]Z]W_]hYb' [Y[YbØVYf'\f'i bX'XYb
?]bXYfb'Ui g[YØVh'ni '\UVYb"8]YgY'J cfk ØfZY'ZØ\fhYb'ni
'Ub[Ub\U'hYbXYb'GhfY]h[_Y]hYbž'X]Y'j b'XYf'² ZZYbh'W_]h'j]Y'
5i Za Yf_gUa _Y]h'YffY[hYb"

GY]h'XYf'HfYbbi b['\Uh'g]W_]XUg'@YVYb'XYf'VY]XYb'GW\Ui gd]Y'Yf
ghUf'_[Yk UbXY'h"K Å\fybX'D]hh'g]W_]Ui Z'gY]bY':]'a _Uff]YfY'i bX
Dfc'Y_hY'_cbnYbhf]Yfh'\Uhž]gh'æ'Y]j cf'U''Ya 'ZØf'\f'\i a Ub]hÅfYg
9b[U[Ya Ybh'VY_Ubbh" ÆfY'?]bXYf'ghY\Yb'cZi]a 'A]hhY'di b_h'\fYf
5i Za Yf_gUa _Y]hž'i bX'X]Y'I a VYbYbbi b['j cb'G\]'c_'ØbbhY
gma Vc`]gW_'ZØf'XYb'K i bgW_'bUW_'Y]bYa 'Y][YbYbž'i bUV\Åb[]][Yb
@YVYb'ghY\Yb"

G\]'c\g'Y][YbY'?'Uff]YfY

æhYfYggUbhYfk Y]gY']gh'G\]'c_'VYfY]hg'gY'Vgh]b'XYf':]'a VfUbW\Y
U_h]j "'G]Y'\Uh'U'g'GmbW\fcbgdfYW\Yf]b']b'~?i b['i 'DUbXU'' "
a]h[Yk]f_h'i bX'nY][h'XUa]hž'XUgg'g]Y'a Ø['W\Yfk Y]gY'XYb'K Y[
'\fYf'9'hYfb' [Y\Yb'a ØW\hY"' Æf'9b[U[Ya Ybh]b'XYf
I bhYf\U'hi b[g]bXi ghf]Y'_ØbbhY'gck c_'Y]bY'ZUa]]ÅfY'HfUX]h]cb
U'g'Ui W_'Y]b'5i gXfi W_]'\fYf'dYfgØb`]W\Yb'æhYfYggYb'gY]b"'A]h'XYf
9bhgW\Y]Xi b[ž'XYb'BUW\ bUa Yb']\fYg'J UhYfg'UVni 'Y[Ybž'gYhnh'g]Y
Y]b'XYi h']W\Yg'NY]W\Ybž'XUgg'g]Y'g]W_'gY'Vgh'XYZ]b]YfYb'a ØW\hYž
'YbgY]hg'XYg'GW\UhYbg']\fYf'VYfØ\ a hYb'9'hYfb"

8]Y'cZZ]n]Y''Y'; YbY\ a][i b['XYg'; Yf]W\hg'_ca a h'ni 'Y]bYa
NY]hdi b_hž'Ub'XYa 'G\]'c_'b'Y]bY'bYi Y'@YVYbgd\UgY'Y]bhf]h"8]Y
fYW\h]W\Y'HfYbbi b['j cb'\fYa 'i: Ua]]YbbUa Yb'_ØbbhY'Y]bY'5fh
6YfY]i b['ZØf'g]Y'XUfghY''Yb'i bX']\f'Yfa Ø['W\Ybž'\fY'Y][YbY
ÆYbh]hÅ'h'ni 'ZYgh][Yb"'ægVYgcbXYfY']b'XYf'\Yi h][Yb'NY]hž']b'XYf
æX]j]Xi Yb'ni bY\ a YbX'XUbUW_'ghfYVYbž'g]W_'i bUV\Åb[]]['i bX
Y][YbghÅbX]['ni 'ZØ\`Ybž'YfgW\Y]bh'X]YgYf'GW\ f]hh'U'g'Y]bY''c[]gW\Y
9bhgW\Y]Xi b['ZØf'X]Y'† b[Y': fUi "

9g'V'Y]Vh'UVni k UfhYbž'k]Y'g]W_'fY?'Uff]YfY'i bX']\f'@YVYb'k Y]hYf
Ybhk]W_Y'b'k YfXYbž'bi b'k c'g]Y'g]W_'j cb'Y]bYa 'HY]''\fYf
ZUa]]ÅfYb'6]bXi b['c'g[Y'Øgh'\Uh"8]Y'G]W\hk Y]gY'Ui Z
6YfØ\ a h\Y]hYb'i bX']\fY?']bXYf'\Uh'g]W_']b'XYb''YhnhYb'æ\ fYb

j Yf`U[Yfhž'i bX`Yg`_ÖbbhY`gY]bž`XUgg`G\`]c\ž`]bXYa`g]Y`]\fYb
BUW`bUa`Yb`ÀbXYfhž`b]W`h`bi`f`]\fYf`Y][YbYb`≠Ybh]h`hž`gcbXYfb
Ui W`X`Ya`K`UbXY`b`b`XYf`²`ZZYbh]W`_Y]h`F`YW`bi`b[`hf`À[`h`

9]b`bYi`Yg`?`Ud]hY``ZØf`G\`]`c\`

8]YgY`9bhk`]W`_i`b[`nY][`h`Y]ba`U`a`Y`fž`k`]Y`k`]W`h][`Yg`ZØf`↑`b[`Y`
A`YbgW`Yb`]ghž`g]W`_gY`Vgh`ni`Z]bXYb`i`bX`9bhgW`Y]Xi`b[`Yb`ni`
hfYZZYbž`X]Y`]\fY`]bX]j`]Xi`Y`Yb`@YVYbgk`Y[`Y[`YghU`hYb`"G\`]c\`∞`Y`
`Uh`a`]h`]\fYf`B`Ua`Ybg`ÀbXYfi`b[`X`Yb`YfghYbž`UVYf`j`]Y`Y]W`h`b]W`h`
XYb`Y`hnhYb`G`W`f]h`h`]b`Y]b`bYi`Yg`?`Ud]hY``]\fYg`@YVYbg[`YgY`hnh`"≠`f`
J`UhYf`6`fUX`D]h`h`i`bX`]\fY`A`i`h`hYf`5`b[`Y`]bU`∞`]Y`k`YfXYb`g]W`Yf`]W`
a`]h`Gd`Ubbi`b[`V`Yc`VUW`hYbž`k`]Y`g]W`_]\fY`Hc`W`hYf`]b`X`Yf`K`Y`h`j`cb`
:]`a`i`bX`];`YgY`g`W`UZh`VY`U`i`dhYb`k`]fX`"

8]Y`F`c`Y`j`cb`G\`]`c\`]b`XYf`ÖZZYbh`]W`Yb` K`U`f`b`Y`a`i`b[`

G\`]c\`Bci`j`Y`∞`]Y!D]h`h`U`h`gY]h`]\fYf`;`YVi`fhj`]Y`5i`Za`Yf`_gUa`_Y]h`
Ui`Zg]W`_][`Ync[`Ybž`b]W`h`bi`f`Xi`fW`_]\fY`VYfØ`a`hYb`9`hYfbž`
gcbXYfb`Ui`W`X`i`fW`X]Y`i`bhYfgW`]YX`]W`Yb`D`U`gYb`]]\fYg`@YVYbg`
J`cb`Y]bYa`ZfØ`Yb`5`hYf`Ub`k`Uf`g]Y`HY`X`Yg`ÖZZYbh]W`Yb`
≠bhYfYggYgž`gY]Yg`Xi`fW`_]\fY`5i`Zh]h`hY`VY]fYX!WUfdYh!9j`Ybhg`c`XYf`
Xi`fW`_]:`Ua`j`]YbV]X`Yfž`X]Y`fY[`Y`a`À»][`j`cb`XYb`A`YX]Yb`
j`YfÖZZYbh]W`h`k`i`fXYb`"

8]Y`9bhgW`Y]Xi`b[`ž`XYb`B`UW`b`Ua`Yb`]\fYg`J`UhYfg`c`ZZ]n]Y`
UVni`Y[`Ybž`_ÖbbhY`U`g`Y]b`G`W`f]h`h`ni`f`GY`VghXYZ]b]h]cb`
]bhYfd`fYh]Yfh`k`YfXYb`"≠`Y]b`Yf`K`Y`hž`k`c`X]Y`≠Ybh]h`h`c`Zh`Xi`fW`X]Y`
:]`Ua`j`]Y`VYgh]a`a`h`k`]fXž`nY][`h`G\`]c\`a`]h`X]YgYf`9bhgW`Y]Xi`b[`ž`
XUgg`g]Y`]\fYb`Y][`YbYb`K`Y[`Y]bgW`U[`Yb`a`ÖW`hY`"Gc`W`Y`
9bhgW`Y]Xi`b[`Yb`g]bX`b]W`h`bi`f`]b`X`Yf`Dfca`]k`Y`h`fY`Y`j`Ubh`j`]Y`Y`
≠[`YbX`]W`Y`i`bX`↑`b[`Y`9fk`UW`gYbY`gi`W`Yb`b`UW`K`Y[`Ybž`]\fY`
Y][`YbY`≠Ybh]h`h`ni`Z]bXYb`i`bX`g]W`_j`cb`XYb`9fk`Ufhi`b[`Yb`]\fYf`
:]`Ua`j`]Y`ni`X]ghUbn]YfYb`"

:`Ua`j`]`ÀfY`8`mb`Ua`]_`i`bX`]`\fY`gc`n]U`Yb`

⇒ a d`]_Uh]c bYb

8]Y`ZUa]`]ÅfY`G]hi Uh]cb`j`cb`G\`]c\`]gh`Xi fW\`X]Y`ÒZZYb`h`]W\Y
HfYb`bi b[]\`fYf`9`hYfb`[YdfÅ[h`5b[Y`]bU`æ`]Y`i bX`6fUX`D]hh`k UfYb
b]W\h`bi f`Y]b`VYfØ\`a`hYg`DUUfž`gcbXYfb`Ui W\`U`_hj`Y`A`]h[YghU`hYf
]\`fYf`?`]bXYfYfn]Y\`i b[``B UW\`XYf`GW\Y]Xi b[]a` `]λ\`f`&\$%*`k Uf`X]Y
[YgUa`hY`:`Ua`]`Y`]b`Y]bYb`Ub[k`]Yf][Yb`F`YW\hgghfY]h`j`Yfk`]W`_Y`hž
XYf`nU\`fY]W\Y`5gdY`_hY`XYg`Gcf[YfYW\hgž`XYf`:`]bUb`nYb`i`bX`XYg
]bb][Yb`:`Ua`]`Yb`YVYbg`VYhfUZ`8]YgY`8mbUa`]_`_`Öbb`hY`XUg
<YfUb`k UW\gYb`j`cb`G\`]c\`i`bX`]\`fYb`:`YgW\k`]ghYfb`ghUf`_
VYY]bZi`ggh`\UVYb`"

Ni`gÅh`]W\`]gh`VY`_Ub`b`hž`XUgg`5b[Y`]bU`æ`]Y`g]W\`ghUf`_`ZØf`gc`n]U`Y
i`bX`\`i`a`Ub]hÅfY`6Y`Ub[Y`Yb[U[]Yfh` `Æf`9]bZi`gg`_`Öbb`hY`g]W\`Ui`Z
X]Y`K`YfhY`Ui`gk`]f`_Yb`ž`X]Y`G\`]c\`i`bX`]\`fY`:`YgW\k`]ghYf
ØVYfbY\`a`Yb``8]YgY`ZUa]`]ÅfY`DfÅ[i`b[]_`Öbb`hY`ni`Y]bYa`5bhf]YV
ZØf`gc`n]U`Y`J`YfUb`hk`cf`hi`b[]i`bX`Y]b`6Yk`i`gghgY]b`ZØf`X]Y`K`Y`hi`a
g]Y`\`Yfi`a`ZØ\`fYb`"

F`Y`Y`j`Ub`hY`GhUh]gh]_Yb`ni`a`9]bZ`i`gg`j`c`b
Dfca`]bYb`hYb`Ui`Z`ž`[`YbX`]W\Y

8]Y`5i`gk`]f`_i`b[Yb`j`cb`Dfca`]bYb`hYb`Ui`Z`ž`[`YbX`]W\Y`g]bX`[`i`h
Xc`_i`a`Ybh]Yfh`"@Ui`h`Y]bYf`Ghi`X]Y`XYg`DYk`F`YgYUfW\`7Yb`hYfg
\UVYb`*`&`i` `XYf`HYbU[Yf`Ub[Y[YVYb`ž`XUgg`g]Y`g]W\`j`c`b
Dfca`]bYb`hYb`]bgd]f]YfYb`UggYb`ž`k`Ybb`Yg`i`a`]\`fY`dYfg`Öb`]W\Y
⇒XYbh]hÅ`hi`bX`K`YfhY`[Y\`h` `b`gVYgcbXYfY`]b`Y]bYf`NY]hž`]b`XYf
gc`n]U`Y`A`YX]Yb`Y]bY`nYb`hfU`Y`F`c``Y`]a` `@VYb`↑`b[Yf`A`YbgW\Yb
gd]Y`Yb`ž`_`Öbb`Yb`dfca`]bYb`hY`:`][`i`fYb`k`]Y`G\`]c\`Y]bY`VYXYi`hYb`XY
F`c``Y`VY]`XYf`GY`Vghk`U\`fbY\`a`i`b[]\`fYf`5`hYfg[Yb`c`ggYb`gd]Y`Yb`"

8`Uf`ØVYf`\`]bUi`g`nY][`h`Y]bY`:`c`fgW\`i`b[]`j`c`b`XYf`5a`Yf]W\`b
DgmW\`c`c`[]W\`5ggcW]Uh]cb`ž`XUgg`ž`[`YbX`]W\Y`ž`X]Y`g]W\`a`]h
dfca`]bYb`hYb`DYfg`Öb`]W\`_Y]hYb`]XYbh]Z]n]YfYb`ž`Y]b`\`Ö\`YfYg`A`U»`Ub
GY`VghVYk`i`gghgY]b`i`bX`9][Yb] YfUb`hk`cf`hi`b[]Ui`Zk`Y]gYb`_`Öbb`Yb`"
8]YgY`9f[YVb]ggY`_`Öbb`Yb`]b`5bVYhfUW\`h`j`c`b`G\`]c\`g`Øb[ghYb
9bhgW\Y]Xi`b[Yb`i`bX`]\`fYf`?`Uff]YfYYb`hk`]W`_i`b[]b`XYf`"

I bhYf\U`hi b[g]bXi ghf]Y`U`g`VYXYi hYbX`VYhfUW hYh`k YfXYbž`XU`g]Y
a Ò[`]WYfk Y]gY`UbXYfY`đ [YbX`]WY`Yfa i h][Ybž`]\fY`Y][YbYb
K Y[Y`ni `Z]bXYb`i bX`g]W`j cb`[YgY`gW UZh`]WYb`Bcfa Yb`ni
`ÒgYb"

8 YhU]`g

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