

A UWX hgd ]Y`. 'Gc `UXYb 'G]Y' Æ fY `; UX[ Yhg ]b  
ZfY]Yf`K ]`XVU\ b`Ui Z

Ni `k ]ggYbž`k ]Y`a Ub`gY]bY`; UX[ Yhg ]b`XYf`K ]`Xb]g`Ui ZÀXhž  
\_ÒbbhY`Y]bY`: fU[ Y`XYg`, VYf`YVYbg`gY]b`cXYf  
fk U\fgWXY]b`]WYfŁ`i a `@Ub[ Yk Y]`Y`Ub`Y]bYa `fY[ bYf]gWXYb  
HU[ `ni `j Yfa Y]XYbž`XYb`a Ub`i bhYf`Y]bYf`D`UbY`j YfVf]b[ h  
GY]Yb`k ]f`Y`\f`]W`. `GY`Vgh`k Ybb`G]Y`Y]b`< UfXWŁ`fY!  
, VYf`YVYbg\_ØbghYf`g]bXž`fY]W`h`Y]b`?ca`dUgg`i bX`Y]bY  
? UfhY`Y]bZUW`b]W`h`a Y`\f`Ui g``C`V`G]Y` Æ fY`F`ci hY`a ]h`Y]bYf  
K UbXYf!5dd`j YfZc`[ Ybž` Æ fY`Dcg]h]cb`dYf`; DG`hf]Ub[ i `]YfYb  
cXYf` Æ fYb`@]YVYb`a ]hhY]`Ybž`XUgg`G]Y`]b`G]W`Yf`\Y]h`g]bXž  
5VYb`hYi`fYf`j Yf`UggYb`\Yi`hni`hU[ Y`gY`hYb`XUg`<Ui`g`c`\bY  
a]bXYghYbg`Y]b`Y`Y`\_hfc`b]gW`Yg`; YfÀh" K À`fYbX`a Y]bYf  
`YhnhYb`K UbXYfi`b[ `Ybh`Ub[ `XYg`Gci`h\`K Ygh`7cUgh`DUh\  
j Yfgcf[ hY`a ]W`a Y]b`Ga Ufhd`\cbY`a ]h`i bhYf`\U`hi`b[  
/ Ua`d^Y``d/

Ni `k ]ggYbž`k ]Y`a Ub`gY]bY`; UX[ Yhg ]b`XYf`K ]`Xb]g`Ui ZÀXhž`\_ÒbbhY  
Y]bY`: fU[ Y`XYg`, VYf`YVYbg`gY]b`cXYf`fk U\fgWXY]b`]WYfŁ`i a  
@Ub[ Yk Y]`Y`Ub`Y]bYa `fY[ bYf]gWXYb`HU[ `ni `j Yfa Y]XYbž`XYb`a Ub  
i bhYf`Y]bYf`D`UbY`j YfVf]b[ h

GY]Yb`k ]f`Y`\f`]W`. `GY`Vgh`k Ybb`G]Y`Y]b`< UfXWŁ`fY!  
, VYf`YVYbg\_ØbghYf`g]bXž`fY]W`h`Y]b`?ca`dUgg`i bX`Y]bY`? UfhY  
Y]bZUW`b]W`h`a Y`\f`Ui g``C`V`G]Y` Æ fY`F`ci hY`a ]h`Y]bYf`K UbXYf!5dd  
j YfZc`[ Ybž` Æ fY`Dcg]h]cb`dYf`; DG`hf]Ub[ i `]YfYb`cXYf` Æ fYb`@]YVYb  
a ]hhY]`Ybž`XUgg`G]Y`]b`G]W`Yf`\Y]h`g]bXž`5VYb`hYi`fYf`j Yf`UggYb  
\Yi`hni`hU[ Y`gY`hYb`XUg`<Ui`g`c`\bY`a ]bXYghYbg`Y]b`Y`Y`\_hfc`b]gW`Yg  
; YfÀh"

K À`fYbX`a Y]bYf`YhnhYb`K UbXYfi`b[ `Ybh`Ub[ `XYg`Gci`h\`K Ygh  
7cUgh`DUh\  
j Yfgcf[ hY`a ]W`a Y]b`Ga Ufhd`\cbY`a ]h`i bhYf`\U`hi`b[ `]b

: cfa 'j cb '@YgYa UhYf]U`i bX`A i g]\_žK Y[ VYgWfY]Vi b[ Yb`ni  
ÒZYbh]WYb`9]bf]W`hi b[ Yb`i bX`7Ua d]b[ d`ÀhYbžNi [ !`i bX  
6i gZ\fd`ÀbYbžXYf`A Ò[ `]W\_X]hž`a Y]bY`K UbXYfi b[ `ni `j YfZc`[ Ybž  
i bX`XYf` : fY]\Y]h`ni `Zchc[ fUZ]YfYb`K ]`Y`i bX`j cf`U`Ya `Y]bY  
A Ò[ `]W\_X]hž`? ]U`Ua `9bXY`XYg`HU[ Yg`Ubni fi ZYb`i bX`a Y]bYb  
5i ZYbh\U`hgcfh`ni `a Y`XYb"

⇒W`k Uf`\_Ui a `j cb`XYf`K Y`h`UV[ YgW`b]hhYb`i bX`\`ÀhY`XUg`U`Yg  
bUhØf`]W`Ui W`c`bY`Ga Ufhd`cbY`gW`UZYb`\_ÒbbYbž`UVYf`Yg`\Uh  
XUg`@YVYb`Ui Z`YXYb` : U`Y]bZUW`Yf`[ Ya UW`h`5`Ygž`k Ug`]W`hi b  
a i gghY`ži a `U`X]YgY`⇒Zcfa Uh]cbYb`[ f]ZZYfY]h`ni `UVYbž`k Uf  
g]W`Yfni ghY`Ybž`XUgg`a Y]b`Ga Ufhd`cbY`Ui Z[ Y`UXYb`k Uf"

⇒a ` : c`[ YbXYb`k YfZY`]W`Y]bYb`6`]W`\_XUfUi Zž`k ]Y`G]Y`⇒fY` : YfÀhY`]b  
XYf`K ]`Xb]g`Ui ZUXYb`\_ÒbbYbž`i bX`XYW`Y`U`Yg`UVž`j cb`Y]bYa  
`Y]W`hYb`7Ua d]b[ Ui gZi [ `V]g`ni `Y]bYf`HfUbgUh`Ubh]\_fY]gY"

## A ]b]!@UXY[ YfÀhY

DfY]g.`UV`%) `~

6Y`]HU[ YgUi gZØ[ Yb`]gh`XYf`Y]bZUW`ghY`K Y[ ži a `g]W`Yfni ghY`Ybž  
XUgg`G]Y`gW`bY`ž`Y]bZUW`i bX`Y]W`h`ni [ `Àb[ `]W`g]bXž`Y]b`A ]b]!  
@UXY[ YfÀh`a ]h`ni ZØ`fYb`"Bcfa U`Yfk Y]gY`Yhk U`gc`[ fc»`k ]Y`Y]b  
@]ddYbgh]Zž`g]bX`A ]b]!@UXY[ YfÀhY`Y]W`h`f+) , ) [ Łž`\_Y]b`i bX  
\UVYb`[ Ybi [ `9bYf[ ]Yž`i a `Y]b`Ga Ufhd`cbY`cXYf`Y]bYb`9!FYUXYf  
Ui Zni `UXYb`"G]Y`k YfXYb`gW`bY`ØVYf`i G6`Ui Z[ Y`UXYbž`gcXUgg`g]Y  
Ybhk YXYf`Ub`Y]bYb`8Yg`\_hcd!D7ž`@Udhcd`cXYf`Y]bY`GhYW`XcgY  
Ub[ YgW`cggYb`k YfXYb`\_ÒbbYb"

`U`h1 `k ]Y!a Ub!]`fY![ UX[ Yhg!]b]XYf!k ]`Xb]g!Ui Z`Xh!% 2

A ]b]!@UXY[ YfÀhY`g]bX`Ui W`Y]b`]XYU`Yf`6Y[ `Y]hYf`ZØf`6i g!`i bX  
6U`bZU`fhYb`cXYf` : `Ø[ Y`"? ]U`i bX`]W` \UVYb`VY]XY`Y]bYb`A G7!  
Dck Yfgh]W`\_`b`i bgYfYb`HU[ Ygfi W`g`ÀW`Ybž`k Ybb`k ]f`fY]gYb`"K ]f  
VYj cfni [ Yb`XYb`Dck Yf`Gh]W`\_`[ Y[ YbØVYf`i bgYfYa `U`hYb`5b`\_Yf  
5ghfc`a ]b]ž`XU`Yf`Y]bY`@98!5bnY][ Y`\Uhž`X]Y`Ubny][ hž`k ]Y`j ]Y`  
@UXi b[ `bcW`j cf`\UbXYb`]gh"

# A cV]`Y`Gc`Uf`Dck YfVUb\_g

DfY]g. `UV`(\$`~`

: Øf`Àb[ YfY`F Y]gYb`k ]Y`Y]bYb`a Y\fhÀ[ ][ Yb`7Ua`d]b[ !HfY`\_]gh`XUg  
bÀW`ghY`c[ ]gW`Y`@UXY[ YfÀh`Y]bY`a`cV]`Y`Gc`Uf!Dck YfVUb`\_"`8]YgY  
g]bX`]a`a`Yf`bcW`"Y]W`h`f%\*\$`\$`&\$`[ Ł`i`bX`]b`XYf`F Y[ Y`Y`hk`U`gc  
[ fc»`k ]Y`Y]b`Ga`Ufhd`cbYž`UVYf`j ]Y`gY]h[ Yf`U`g`Y]bY`A`]b]!  
Dck YfVUb\_ž`XU`g]Y`I`J!GhfU`Y`b`ni`a`5i`ZUXYb`UbghY`"Y`j`cb  
BYhnghfca`c`XYf`Y]bYa`Ub`XYfYb`; YfÀh`j`Yfk`Yb`XYb"

6Y]`ghUf`\_Yf`X]fY`\_hYf`GcbbYbY]bghfU`i`b[ `gc`hY`Y]bY`[ i`hY`a`cV]`Y`  
Gc`Uf!Dck YfVUb`\_`Ga`Ufhd`cbYž`9!F`Y`UXYf`c`XYf`8][ ]hU`\_Ua`YfU  
bU`Y`ni`nY]h[ `Y]W`a`]h`Y]bYa`BYh`n`U`bgW`i`gg`j`c`gh`À`b`X][ `Ui`Z`UXYb  
\_`Ò`b`Yb`"6Y]`[ Yf]b[ YfYf`GcbbYbY]bghfU`i`b[ `Y]ZYfb`g]Y`Y]bY  
\_`cbghU`bhY`Gc`UfYf`U`hi`b[ g`UXi`b[ `Y]bi`[ ž`i`a`À`b`Yb`XYb  
k ]W`h][ Yb`5bfi`Z`ni`Ø`V`Y`fa`]h`Y`b`c`XYf`]a`B`chZU`"À`fY`Dcg]h]cb`ni  
`c`\_U`]g]YfYb"

5V[ YgY`Y`b`j`cb`XYf`Gc`UfYbYf[ ]Y`j`YfZØ[ Yb`g]Y`Ø`V`Y`f`a`Y`f`Y`f`Y`  
@UXY`Z`b`\_h]cbYbž`Y]bgW`"Y]»`]W`B`Y`h`n`ž`5i`hc`UXY[ YfÀ`h`c`XYf`I`G6ž  
k`Ug`V`Y`X`Y`i`h`Y`ž`X`U`gg`g]Y`Ui`W`X`U`bb`U`g`F`Y`g`Y`f`j`Y`V`U`b`\_`ZØ`f`h`f`U`[`V`U`f`Y`b`  
Ghfca`Z`b[ ]YfYb`\_`Ò`b`Ybž`k`Y`bb`\_Y]bY`GcbbY`]b`XYf`B`À`Y`]gh"

`U`h1`k`]Y!`a`Ub!]`fY![`UX[`Yhg!]b!`h`Y!`k`]X!`Ui`Z`À`X`h!`&`2`

À`W`"UVY`\_Øfn`]W`Y]bY`k`UggYfX]W`hY`a`cV]`Y`Gc`UfVUb`\_j`cb`A`G7  
[ Y`\_Ui`Z`ž`i`a`Y]b`:`f`Y`Y`c`UXYf!A`c`XY`"ni`Y`fg`Y`h`n`Y`b`ž`X`U`g`]b`XYf`Y`f`gh`Y`b  
K`c`W`Y`X`Y`g`:`Y`V`f`U`i`W`g`U`i`g`Z]Y`"8]YgYa`g`W`Y]b`h`Y`g`X`Y`i`h`]W`V`Y`gg`Y`f`  
ni`[ Y`Y`b`"À`W`"UVY`Y`g`Y`X`Y`b`HU[ `Ui`Z`a`Y]bYf`Y`h`h`Y`b`K`Ub`XYfi`b[  
Xi`f`W`7`c`fbk`U`"V`Y`bi`h`h`i`b`X`Z`Y`gh[ Y`ghY`"h`ž`X`U`gg`Y`g`Ua`V`Y`gh`Y`b  
Z`b`\_h]cb]Yf`h`ž`k`Y`bb`]W`Y`g`h`U[ gØ`V`Y`f`U`i`Z`XYf`J`c`f`XY`f`g`Y]hY`a`Y]b`Y`g  
F`i`W`g`U`W`g`"UVY`i`b`X`gc`j`]Y`GcbbY`k`]Y`a`Ò[ `]W`U`i`Z`g`U`i`[ Y`"À`W`  
k`Ø`f`X`Y`Y`g`X`U`bb`U`b`Y]bYf`G`h`Y`W`X`c`g`Y`U`i`Z`Y]bYa`7`Ua`d]b[ d`U`h`n`  
U`i`Z`UXYb"

: U`hVUfY`Gc`UfdUbY`!@UXY[ YfÀhY

DfY]g. 'UV') \$`

: Øf`Y]bY`\_cbh]bi ]Yf`]WXY`bYhni bUV\Àb[ ] [ Y`hfU[ VUfY  
Ghfca j Yfgcf[ i b[ `]gh`Y]b`ZU`hVUfYg`Gc`Ufa cXi `X]Y`VYghY`C dh]cb"  
G]Y`Y][ bYb`g]WY`[ i h`ZØf`GY[ Y`hØfbgž`7Ua`d]b[ `!`i bX`HfY`\_\_]b[ `!  
9l dYX]h]cbYb`i bX`@Ub[ nY]hfY]gYb`k ]Y`K`c\ba`cV]!`cXYf  
` VYf`UbXfY]gYb"

: U`hVUfY`Gc`Ufa cXi `Y`UXYb`[ fØ»YfY`; YfÀhY`k ]Y`HUV`Yhg`i bX  
@Udhcdg`Ui Zi bX`\_ØbbYb`a Y`fYfY`\_Y]bYfY`; YfÀhY`[ `Y]WYnY]h][  
Ui ZUXYb`"G]Y`g]bX`bUhØf`]WY`gWYk YfYf`f) \$\$[ `Ui Zk`ÀfhgŁi`bX  
[ fØ»Yfž`j cf`U`Ya` ]a`Ui g[ Ync[ YbYb`Ni ghUbXž`ZU`hYb`g]WY`UVYf`Ui Z  
Yhk U`A U[ Un]b[ fØ»Y`ni gUa`a`Yb"

?]U`i bX`]WY`d`UbYb`i bgYfY`bÀWYghY`[ fc»Y`F`Y]gY` `gYWYg`A`cbUhY  
Xi fWY`GØX!`i bX`C`ghUZF]\_Už`Y]bgWY`]Y»`]WY`A`UXU[ Ug\_Uf`i bX  
A`cgUa`V]\_` `i bX`\UVYb`XU\Yf`]b`Y]b`ZU`hVUfYg`%&!K`!  
Gc`Uf`UXY[ YfÀh`a` ]h`nk`Y]`DUbY`g`]bj`Ygh]Yfh` `WY`V]b`a` ]f`b]WY`h  
g]WY`Yfž`cV`Yg`i bVYX]b[ h`bchk`YbX][ `]ghž`k`Ybb`a` Ub`VYXYb`\_hž`XUgg  
`Ja`Yg`F`YXXYb`Yhk`Ug`Y`b`]WY`Yg`Ua` `Dc`Uf`\_fY]g`j`Yfk`YbXYhž`UVYf  
k`]f`a` ØggYb`Y]bYb`6`c[ `VYhfY]VYb`°

`U`h1` `k ]Y!a` Ub!]`fY![ UX[ Yhg!]b!h\Y!k ]`X!Ui Z`Xh!(`2

## Dck YfVUb\_g

DfY]g. 'UV') \$`

Dck YfVUb\_g`X]YbYb`ni`a`GdY]WYfb`j`cb`9bYf[ ]Yž`i`a` `Y]bY  
ni`j`Yf`Àgg][ Y`9bYf[ ]YfYgYfj`Y`VYfY]hni`ghY`Ybž`a` ]h`XYf`a` Y`fYfY  
; YfÀhY`[ `Y]WYnY]h][ `] [ Y`UXYb`k`YfXYb`\_ØbbYb`"G]Y`g]bX`VY]`k`Y]hYa  
X]Y`ni`j`Yf`Àgg][ ghYb`i`bX`j` ]Y`gY]h][ ghYb`i`bX`]YZYfb`X]Y`gh`Àf`\_ghYb  
GhfØa`i`b[ Yb`"G]Y`g]bX`YXcWY`Ui`WY`X]Y`gWYk`YfghY`Dck`Yf!`@Øgi`b[ `]  
U`Yg`j`cb`&+`\$`[ `V]g`(`\_[ `°

Dck YfVUb\_g`g]bX`]XYU`ž`Y[ U`cV`G]Y`X]Y`?`]bXYf`Ui`Z`Y]bYa  
7Ua`d]b[ Ui`gZi[ `]a` ]h`XYf`:`Ua` ]`Y`i`bhYf`U`hYb`cXYf``ÀfY`Y]bn][ Y  
J`YfV]bXi`b[ `ni`f`N]j` ]`]gUh]cb`a` ]h`Ghfca` `j`Yfgcf[ Ybž`k`À`fYbX`G]Y

X]Y`K ØghY` ; cV]`Xi fW\ei YfYb" `G]Y`\_ÖbbYb`g]W`ZØf`fcVi ghYž  
k UggYfX]W\hY`Ga Ufhd\cbY!@UXYa cXY`Y`k ]Y`X]YgYg`5ei U`HfY`\_  
cXYf`<cW\`Y]ghi b[ ga cXY`Y`YbhgW\Y]XYbž`X]Y`@Y]W\hZi [ nYi [ Y  
ghUfhYb`\_ÖbbYb`

`U`h1 k ]Y!a Ub!]`fY![ UX[ Yhg!]b!XYf!k ]`Xb]g!Ui Z`AXh!) 2

G]Y`\_ÖbbYb`ZUgh`U`Yg`a ]h`Ghfca` `Ui ZUXYbž`Y]bgW\`Y»` `]W  
Gc`Uf[ Yf`ÄhYž`5i hc!`i bX`K c\ba cV]`VUhhYf]Yb`gck ]Y`BYhnghfca ž  
i bX`VY`U`hYb`]`fY`@Y]ghi b[ `ØVYf`A cbUHY`

8 UfØVYf`\]bUi g`\_ÖbbYb`g]Y`ZUgh`YXYg`; Yf`Äh`Ui ZUXYbž  
Y]bgW\`Y»` `]W`@Udhcdgž`HUV`Yhg`i bX`Ga Ufhd\cbYgž`i bX`X]Y`<][` \!  
9bX!A cXY`Y`\_ÖbbYb`gc[ Uf`A cXY`Zi [ nYi [ Yž`8fc\`bYbž  
?Ø\`gW`f`Äb`\_Y`i bX`i: YfbgY`Yf`Ui ZUXYb`

`U`h1 k ]Y!a Ub!]`fY![ UX[ Yhg!]b!h\Y!k ]`X!Ui Z`AXh!\* 2

## 5`hYfbUh]j Yb`ni f`Gc`UfYbYf[ ]Y

9g[ ]Vh`5`hYfbUh]j Yb`ni` f`Gc`UfYbYf[ ]Y`i bX`Dck YfVUb\_gž`UVYf`X]Y  
a Y]ghYb`g]bX`b]W\h`gc`V]`][` cXYf`ni j Yf`Ägg][` "<]Yf`]gh`Y]bY  
5i gk U\`Y]b][` Yf`U`hYfbUh]j Yf`C dh]cbYb`

K UggYf. `a m 7`Dck Yf`HfY`\_\_`6fYbbghcZznY`Yb!@UXY[ Yf`Äh`DfY]g.  
&\$`\$`I`G!8c`Uf`8 Ug`]gh`Y]b`]bbcj Uh]j Yg`8Yg][` b`XYg`gW\k YX]gW\Yb  
I bhYfbY`a Ybg`a m 7ž`XUg`]a`K YgYbh]W\Yb`a ]h`Y]bYa`9gg`ÖZZY`  
K UggYf`i bX`Y]bYf`Df]gY`GU`n`Ui g\_ca`a`h`

`U`h1 k ]Y!a Ub!]`fY![ Yf`ÄhY!]a`!k ]`Xk UggYf!Ui Z`AXh 2

K ]bX. `<M`a ]b]`K ]bXhi fV]bYDfY]g. `) `~ 8]YgYg  
a ]\_fck ]bXVYhf]YVYbY`; Yf`Äh`j cb`<M`a ]b]`g]Y`h`]XYU`Ui g`ZØf  
GY[ Y`fY]gYb`cXYf`K cW\YbYbXYb`]b`GW\ch`h`UbX`

`U`h1 k ]Y!a Ub!]`fY![ UX[ Yhg!]b!XYf!k ]`Xb]g!Ui Z`AXh!%% 2

<UbX. `5a Yf]\_Ub]gW\Yg`F chYg`?fYi n`i: F L' `<UbX\_i fVY`DfY]g. `) `) `~

8]Y'<UbX\_i fVY`XYg'F chYb'?fYi nYg[ ]Vh'Yg'gW\cb'gY]h  
>J\fnY\bhYbž'UVYf'k ]Y'XUg'U'hY'Gdf]W\k cfh'gU[ h' K Ybb'Yg'b]W\h  
\_Udi hh']ghž'fYdUf]YfY'Yg'b]W\h"

`U`h1 k ]Y!a Ub!]`fY![ UX[ Yhg!]b!XYf!k ]`Xb]g!Ui Z`AXh!- 2

7Ua d]b[ \_cW\Yf.'6]c@]hY'K ccX'6i fb]b[ `7Ua dghcj Y'DfY]g.'%&\$`~  
8]YgYf'6]c@]hY!<c`nVfYbbYfž'XYf'Ui W`U'g'@UXY[ Yf`h'X]Ybž'gh  
]XYU`Z0f'7Ua dYf"

`U`h1 k ]Y!a Ub!]`fY![ UX[ Yhg!]b!XYf!k ]`Xb]g!Ui Z`AXh!%& 2

Dck Yf'; i a a ]gh]YZY`. `C fUb[ Y'; ch'K ]bX'Dck Yf'; i a a ]gh]YZY'DfY]g.  
H67=]gh'X]Y'K Y'h'VYfY]h'Z0f'h\Yfa cY'Y\_hf]gW\Y'; i a a ]gh]YZY`3

`U`h1 k ]Y!a Ub!]`fY![ UX[ Yhg!]b!XYf!k ]`Xb]g!Ui Z`AXh!%\$ 2

@Y]hV]'X.'8fYUa gh]a Y

6Ygi W\Yb'G]Y'i bg'Ui Z.'Y]bY!fY]gY"XY

8YhU]`g