

< Y` ]\_cdhYfj Yfgcf[ i b[ 'ZØf'6Yf[ \ØhhY ' ]a  
B Uh]cbU`dUf\_ '6YfW\ hYg[ UXYb

8]Y'6Yf[ \ØhhY 'K Uhna Ubb\Ui g'k ]fX'k Y[ Yb'Y]bYf'XYZY\_hYb  
A UhYf]U`gY]'VU\b'j cfØVYf[ Y\YbX'a ]h'<i VgW\ fUi VYfb  
j Yfgcf[ h"

⇒a 'B Uh]cbU`dUf\_ '6YfW\ hYg[ UXYb' [ ]Vh'Yg'XYfnY]h'GW\ k ]Yf][ \_Y]hYb  
a ]h'XYf'VY']YVhYb'6Yf[ \ØhhY 'K Uhna Ubb\Ui g"5i Z[ fi bX'Y]bYg  
8YZY\_hg'Ub'XYf'A UhYf]U`gY]'VU\b'a ØggYb'X]Y '@]YZYfi b[ Yb'Ub'X]Y  
6Yf[ \ØhhY 'j cfYfgh'dYf'<Y` ]\_cdhYf'YfZc`[ Yb"Gc`W\Y  
<YfUi gZcfXYfi b[ Yb'g]bX' ]b'XYb'\cW\ [ Y'Y[ YbYb'; YV]YhYb'b]W\ h  
i b[ Yk Ò\b`]W\ ž'XcW\ 'X]Y [ YbUi Y'G]hi Uh]cb'XYf'K Uhna Ubb\Ui g  
\Uh'VYgcbXYfY'5i Za Yf\_gUa \_Y]h'Ui Zg]W\ '[ Ync[ Yb"

8]Y'GY\_h]cbž'X]Y'ZØf'XUg'K Uhna Ubb\Ui g'ni ghÅbX][ ' ]ghž'd`Ubhž'g]W\  
a ]h'UbXYfYb'<ØhhYb'i bX' ]\fYb'Yk Y'] [ Yb'GY\_h]cbYb  
Ui gni hUi gW\Yb"N]Y` ]gh'Ygž'X]Y'NU\`XYf'<i VgW\ fUi VYfZØ[ Y' ]b  
X]YgYb'gYbg]V'Yb'B Uhi ffUi a 'Ui ZY]b'A ]b]a i a 'ni 'fYXi n]YfYb"  
K ]f'a ÒW\ hYb'YXYb'a Ò[ `]W\Yb'GW\ f]h'i bhYfbY\ a Ybž'i a 'X]Y  
5i gk ]f\_i b[ Yb'Ui Z'X]Y'B Uhi f' [ Yf]b[ 'ni '\U'hYb ž'Yf\_`ÀfhY'Y]b  
GdfYW\Yf'XYf'GY\_h]cbž'<Yff'6`cW`"8Yf'9]bgUhn'j cb'<Y` ]\_cdhYfb  
Vf]b[ h'YXcW\ 'ni gÅhn`]W\Y'?cghYb'a ]h'g]W\ ž'X]Y'X]Y'GY\_h]cb'hfU[ Yb  
a i gg"

5\_hi Y`Y'< YfUi gZcfXYfi b[ Yb'XYf'6Yf[ \ØhhY

8]Y'9bhgW\Y]Xi b[ ž'X]Y'6Yf[ \ØhhY'dYf'<Y` ]\_cdhYf'ni 'j Yfgcf[ Ybž']gh  
b]W\ h'Y]W\ h'[ YZU`Yb'"8]Y'A UhYf]U`gY]'VU\b' ]gh'Y]bY'k ]W\ h][ Y  
HfUbgdcfhj YfV]bXi b[ ž'X]Y'i bhYf'bcfa U'Yb'l a ghÅbXYb'XYb  
K UfYb!'i bX'A UhYf]U'VYXUfZ'XYf'<ØhhY'g]W\Yfh'"8]Y'l fgUW\Yb'ZØf  
XYb'8YZY\_h'k i fXYb'bcW\ 'b]W\ h'VY\_Ubbh'[ Y[ YVYbž'i bX'Ui W\ 'X]Y

NY]hgdUbbY`Z0f`X]Y`YfZcfXYf`]WXYb`F`YdUfUhi`fYb`]ghi`b`\_Uf`"8]Yg  
k`]fZi`:`fU[`Yb`Ui`Z`k`]Y`X]Y`6Yf[`\0hhY`]b`XYf`b`ÅW`ghYb`NY]hj`Yfgcf[`h  
k`YfXYb`\_Ubb`i`bX`cV`X]Y`;`ÅghY`k`Y]hYf\`]b`k`]Y`[`Yk`c`b`h  
Ya`dZUb[`Yb`k`YfXYb`\_0bbYb`"

⇒`5bVYhfUW`h`XYf`VYgcbXYfYb`@U[`Y`XYf`6Yf[`\0hhY`ž`X]Y`c`Zi`U`g  
N]Y`Z0f`K`UbXYfYf`i`bX`B`Uhi`f`]YV\`UVYf`[`]`hž`\_0bbhY`XYf`XYZY`\_hY  
Ni`[`Ub[`\_`Ub[`Zf]gh][`Y`5i`gk`]f`\_i`b[`Yb`Ui`Z`XYb`6Yhf]YV`i`bX`X]Y  
6Ygi`W`YfnU\`Yb`\`UVYb`"A`Y`fYfY`5bZfU[`Yb`VYn0[`]W`XYf  
²`Zbi`b[`gnY]hYb`i`bX`XYf`J`YfZ0[`VUf`\_Y]hj`cb`l`bhYf`0bZnYb  
YffY]WXYb`X]Y`GY`\_h]cb`k`0WXYb`h]W`"9g`\`YffgW`h`X]Y`6YZ0fW`hi`b[`ž  
XUgg`Y]bY`\_`Åb[`YfY`G`W`\_Y`»`i`b[`XYf`6Yf[`ghU]cb`Z0f`j`]Y`Y`Y]b  
[`fc`»`Yg`9bh[`Y[`Yb`\_ca`a`Yb`VYXYi`hYhž`XU`K`UbXYfYf`X]Y  
K`Uhna`Ubb`\`Ui`g`U`g`F`0W`\_ni`[`gc`fh`g`W`Å`hnYb`"

:`]b`Ubn]Y`Y`i`b`X`0`\_`c`c`[`]g`W`Y``,`VYf`Y`[`i`b[`Yb`

K`]Y`Yfk`Å`\`bhž`k`]fX`X]Y`l`a`ghY`i`b[`]Ui`Z`<`i`VgW`fUi`VYf`]YZYfi`b[`Yb  
X]Y`?`cghYb`XYi`h]W`Yf`\`0`Yb`"8]Yg`]gh`b]W`h`bi`f`Y]bY`Z]bUbn]Y`Y`Y  
6Y`Ughi`b[`]Z0f`X]Y`GY`\_h]cb`ž`gcbXYfb`\_0bbhY`Ui`W`5i`gk`]f`\_i`b[`Yb  
Ui`Z`X]Y`DfY]gdc`]h]\_`XYf`6Yf[`\0hhY`\`UVYb`" <`]bg]W`h]W`XYf  
Yl`hfYa`ghYb`<`0`Yb`U[`Yb`i`bX`XYf`Y]b[`YgW`f`Åb`\_hYb`A`0[`]W`\_Y]hYb  
ni`f`J`Yfgcf[`i`b[`]g]bX`gc`W`Y`ni`g`Å`h`]WXYb`5i`g[`UVYb`\_f]h]gW`"K`]f  
a`0ggYb`U`X]YgY`Z]bUbn]Y`Yb`5gdY`\_hY`]a`5i`[`Y`VY`\`U`hYb`ž  
]bgVYgcbXYfY`k`Ybb`k`]f`X]Y`DfY]gY`Z0f`i`bgYfY`;`ÅghY`UbdUggYb  
a`0ggYb`ž`Z0[`hY`6`c`W`\_`\]bni`"

<]bni`\_`ca`a`hž`XUgg`X]Y`J`Yfk`YbXi`b[`]j`cb`<`Y`]c`d`hYfb`]b`Y]bYa  
B`Uh]cb`U`d`Uf`\_`Ui`W`0`\_`c`c`[`]g`W`Y`6YXYb`\_Yb`Ui`Z`k`]fZi`@`ZhZU`\`fh  
j`Yfi`fgUW`h`@`Å`fa`i`bX`\_Ubb`H]YfY`]b`]Y`fYf`b`Uh0f`]WXYb`l`a`[`YVi`b[  
gh0fYb`"8Yf`G`W`i`hn`XYf`H]Yfk`Y`h]gh`Y]b`nYb`hf`U`Yg`5b`]Y[`Yb`]a  
B`Uh]cb`U`d`Uf`\_`ž`gc`XUgg`X]Y`GY`\_h]cb`VYghfYVh]ghž`X]Y`5bnU`\`XYf  
:`0[`Y`gc`[`Yf]b[`]k`]Y`a`0[`]W`ni`\`U`hYb`"

Hf`c`hn`XYf`G`W`k`]Yf][`\_Y]hYb`V`Y]V`h`X]Y`<`c`Zbi`b[`ž`XUgg`V`U`X`Y]bY  
@0gi`b[`]Y`Zi`bXYb`k`]fX`"8]Y`Ni`g`Ua`a`Yb`UfVY]h`a`]h`UbXYfYb  
<0hhYbVYhfY]VYfb`\_Ubb`XUVY`\`Y`ZYb`ž`Y`ZY`\_h]j`Y`i`bX`b`UW`\`U`h][`Y  
@]YZYfghfU`hY[`]Yb`ni`Yb`hk`]W`\_Y`b`"K`]f`a`0ggYb`\_fYU]h]`k`YfXYb`ž`

a Yf\_h'6`cW\_Ub" K ]f\cZZYb`Ui ZVU`X][ Y`F YdUfUhi fYb`XYf  
GY]`VU\`bž`XUa ]h`k ]f`ni fØW`ni a `[ Yk c\`bhYb`J Yfgcf[ i b[ ga cXi g  
k YWgY`b`\_ÖbbYb"

## 9]b`6`]W\_]b`X]Y`Ni \_i bZh`XYf`K Uhna Ubb`Ui g

8]Y`G]hi Uh]cb`fi bX`i a`X]Y`K Uhna Ubb`Ui g]gh`Y]b`6Y]gd]Y`ZØf`X]Y  
<YfUi gZcfXYfi b[ Ybž`a ]h`XYbYb`6Yf[ VYk ]fhgW`UZh] b[ `\_cbZfcbh]Yfh  
]gh`8Yf`g]W`YfY`i bX`bUW`U`h][ Y`Ni [ Ub[ `ni `gc`W`Yb`<Ö`Yb`U[ Yb  
]gh`YggYbn]Y`ž`b]W`h`bi f`ZØf`X]Y`<ØhY`gY`Vghž`gcbXYfb`Ui W`ZØf`XUg  
[ YgUa hY`²`\_cgmghYa`XYg`DUf`g`K ]Y`X]Y`6Yf[ \ØhY  
K Uhna Ubb`Ui g]b`XYf`Ni \_i bZh`VY`]YZYfh`k ]fXž`\_ÖbbhY`ni a  
J cffY]hYf`ZØf`Ä`b`]W`Y`9]b]f]W`hi b[ Yb`]b`XYb`5`dYb`fY[ ]cbYb  
k YfXYb`8]Y`6U`UbW`nk ]gW`Yb`Hci f]ga i gi bX`BUhi fgW`i m`V`Y]Vh  
Y]bY`8Ui YfXYVUhhYž`X]Y`b`XYb`\_ca a YbXYb`K cW`Yb`i bX  
A cbUhYb`g]W`Yf`]W`k Y]hYf`Äi Zh"

8]Y`9bhgW`Y]Xi b[ ž`X]Y`6Yf[ \ØhY`ja`BUh]cbU`dUf`\_6YfW`hYg[ UXYb  
Xi fW`<Y`\_cdhYf`ni `j Yfgcf[ Ybž`]gh`b]W`h`bi f`Y]bY`dfU[ a Uh]gW`Y  
@Ögi b[ ž`gcbXYfb`k ]fZh`Ui W`X]j YfgY`i a k Y`hdc`]h]gW`Y`fU[ Yb`Ui Z`  
8]Y`FY[ ]cb`]gh`VY`\_Ubbh`ZØf`]fY`Ya dZ]bX`]W`Yb`²`\_cgmghYa Yž`X]Y  
Xi fW`a YbgW`]W`Y`9]b[ f]ZY`Y]W`h`VYY]bhf`ÄW`h][ h`k YfXYb  
\_ÖbbYb`9]bY`XYfUfh][ Y`HfUbgdcfha Yh\cXY`\_ÖbbhY`XYb  
BUhi fgW`i m`]b`XYf`FY[ ]cb`[ YZÄ`fXYbž`]bgVYgcbXYfY`k Ybb`g]Y  
b]W`h`a ]h`XYb`UbXYfYb`<ØhYb`]a`BUh]cbU`dUf`\_`\_ccfX]b]Yfh`k ]fX"

8]Y`GY\_h]cbž`X]Y`ZØf`X]Y`6Yf[ \ØhY`j YfUbhk cfh]W`]ghž`ghY`h`j cf  
XYf`<YfUi gZcfXYfi b[ ž`X]Y`6U`UbW`nk ]gW`Yb`XYf`B`chk YbX][ \_Y]h  
XYf`J Yfgcf[ i b[ `i bX`XYa`GW`i m`XYf`bUhØf`]W`Yb`l a [ YVi b[ `ni  
\U`hYb`8Yf`BUh]cbU`dUf`\_6YfW`hYg[ UXYb`]gh`b]W`h`bi f`Y]b  
VY`]YVhYg`N]Y`ZØf`K UbXYfYf`i bX`BUhi f`]YV`UVYfž`gcbXYfb`gd]Y`h  
Ui W`Y]bY`nYbhU`Y`Fc`Y`ZØf`XYb`9f`U`h`XYf`6]cX]j Yfg]hÄh`l a`X]Y  
5i gk ]f\_i b[ Yb`XYf`<Y`\_cdhYfZØ[ Y`ni`a ]b]a ]YfYbž`k ]fX`Y]bY`Yb[ Y  
Ni gUa a YbUfVY]h`a ]h`UbXYfYb`<ØhYbj ]YfhY`b`Ub[ YghfYVh"

## I a k Y`hdc`]h]gW`Y` , VYf`Y[ i b[ Yb

I a k Y`hdc`]h]gW`VYhfUW`hYh]gh`X]Y`G]hi Uh]cb`]b`6YfW`hYg[ UXYb

HY]`Y]bYg' [ f0» YfYb`8]g\_i fgYg'ØVYf`bUW\`U`h][ Y`DfU\_h]\_Yb`]a  
Hci f]ga i g'i bX`BUhi fgW`i hn" ð`XYb`j Yf[ Ub[ YbYb`]X\`fYb`\UVYb  
]a a Yf`a Y\`f`C f[ Ub]gUh]cbYb`i bX`6Y\`ØfXYb`VY[ cbbYbž`XYb` : c\_i g  
Ui ZXYb`0\_c`c[ ]gW`Yb` : i » UVXfi W`\_j cb`hci f]gh]gW`Yb`5\_h]j ]hAhYb  
ni ``Y[ Yb"8]Y`< YfUi gZcfXYfi b[ `VYghY\`h`XUf]bž`X]Y`c`U`Yb  
; Ya Y]bgW`UZhYb`i bX`X]Y`i a k Y`h[ `Y]W`Yfa U» Yb`ni `gW`ØhnYb"

ð`X]YgYa `?cbhYi h`\_0bbhY`Ui W`X`Y`8]g\_i gg]cb`ØVYf`U`hYfbUh]j Y  
J Yfgcf[ i b[ ga Yh\`cXYb`j cb`6YXYi hi b[ `gY]b"9g`[ ]Vh  
VY]gd]Y`gk Y]gY` , VYf`Y[ i b[ Ybž`X]Y`Bi hni b[ `j cb`@UghYbZU\`f`ÀXYfb  
cXYf`8fc\`bYb`Z0f`\_`Y]bYfY`@]YZYfi b[ Yb`ni `Yj U`i ]YfYb" `Gc`W`Y  
HYW`bc`c[ ]Yb`\_0bbhYb`Y]bY`i a k Y`hZFYi bX`]W`YfY`C dh]cb`]a  
; Y[ YbgUhn`ni `hfUX]h]cbY`Yb`<i VgW`fUi VYfZ0[ Yb`XUfghY`Yb"

## 5\_hi Y`Y`< YfUi gZcfXYfi b[ Yb`]a `BUhi fgW`i hn

8]Y`6Yf[ \`ØhhY`ghY\`h`b]W`h`U`Y`]b`]b`]fYa `5b`]Y[ Yb"8Yf  
BUh]cbU`dUf`\_`6YfW`hYg[ UXYb`\`Uh]b`XYb`YhnhYb`]X\`fYb  
j YfgW`]YXYbY`< YfUi gZcfXYfi b[ Yb`Yf`YVhž`j cb`Y]bYf`Ni bU\`a Y`XYg  
6Ygi W`YfUi Z`\_ca a Ybg`V]g`\]b`ni `XYb`5i gk ]f\_i b[ Yb`XYg  
?`]a Uk UbXY`g"9]b`6Y]gd]Y`]gh`XYf`F`ØW`[ Ub[ `XYf` ; `YhgW`Yf`]a  
6YfY]W`X`Yf`K Uhma Ubb!C ghk UbXž`XYf`Y]bYb`g][ b]Z]\_UbhYb`9]bZi gg  
Ui ZX]Y`c`U`Y` : `cfU`i bX` : Ui bU`\`Uh"

GhUh]gh]\_Yb`nY][ Ybž`XUgg`X]Y`NU\`XYf`6Ygi W`Yf`]b`XYb`YhnhYb  
]X\`fYb`ghUf`\_`Ub[ Ygh]Y[ Yb`]gh`Nk ]gW`Yb`&\$%%`i bX`&\$%-  
fY[ ]ghf]YfhY`XYf`BUh]cbU`dUf`\_`6YfW`hYg[ UXYb`Y]bYb`F`ØW`[ Ub[ `XYf`  
; `YhgW`YfZ`ÀW`Y`i a `Yhk U`% , `DfcnYbh"8]Yg`XYi hYh`XUfUi Z`\]bž  
XUgg`g]W`X`Y`\_]a Uh]gW`Yb`6YX]b[ i b[ Yb`bY[ Uh]j `Ui Z`X]Y  
bUh0f`]W`Yb`F`Yggci fW`b`Ui gk ]f`\_Ybž`X]Y`Ui W`Z0f`X]Y`i a `]Y[ YbXYb  
6Yf[ \`ØhhYb`j cb`6YXYi hi b[ `g]bX"

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