

GWk Y]hYf'HYWk bc`c [ ]Yg. 'Gh)``Y[ i b[ 'XYg  
K Yf\_g']b'A U]bn'i bX'bYi Y'9]bgdUfi b[ Yb

GWk Y]hYf'HYWk bc`c [ ]Yg'd`Ubh'X]Y'GW`Y»i b[ 'XYg'K Yf\_g'ZØf  
DA A 5!D`UhhYb']b'A U]bnž'i a `?cghYb'ni 'gYb\_Yb'i bX'X]Y  
K YhhVYk YfVgZÅ\][ \_Y]h'ni 'j YfVYggYfb"

GWk Y]hYf'HYWk bc`c [ ]Ygž'Y]b'i bhYfbY\ a Yb'a ]h'G]hni]b  
GhY]b\Ui gYb']b'XYf'GWk Y]nž'\Uh'Y]bY'VYXYi hYbXY'9bhgWk Y]Xi b[  
[ YhfcZZYbž'X]Y'XUg'K Yf\_]b'A U]bn'ghUf\_'VYY]bZi ggYb'k ]fX"8Yf  
; YgWÅZhgVYfY]Wk'' 5'7ca d'cg]hYgž'gdYn]U`g]Yfh'Ui Z  
J YfVi bXk Yf\_ghc ZZ'ž'd`Ubhž'X]Y'DfcXi \_h]cbgghÅhhY'ZØf'Yi hfi X]YfhY  
DA A 5!D`UhhYb']b'A U]bn'V]g'ni a `9bXY'XYg'Å\ fYg'ni 'gW`Y]»Yb"  
8]YgYg'J cf\UVYb'k ]fX'j cb'Y]bYf'FY]\Y'Z]bUbn]Y`Yf', VYfY[ i b[ Yb  
i bX'<YfUi gZcfXYfi b[ Yb']a `Ni `]YZYfa Uf\_h'[ Yhf]YVYb"

8Yf'; fi bX'ZØf'X]YgY'GW`Y»i b[ ']gh'X]Y'j YfÅbXYfhY'A Uf\_hg]hi Uh]cb  
ZØf'A A 5ž'Y]bYa 'k ]Wk h[ Yb'5i g[ Ub[ ggghc ZZ'ZØf'X]Y'<YfghY`i b[ 'j cb  
DA A 5!D`UhhYb"' Æ'XYf'J Yf[ Ub[ Yb\Y]h'k Uf'X]Y  
9][ Ybdc`ma Yf]gUh]cb'j cb'A A 5'Ua 'A U]bnYf'GhUbXcfh'fYb'UUVY"  
8cW'Ui Z[ fi bX'bYi Yf'6YX]b[ i b[ Yb'Ui ZXYb'Ni `]YZYfa Åf\_hyb  
g]Y\h'GWk Y]hYf'\_Y]bY'bUWk\U'h][ Y'Ni \_i bZi'ZØf'X]YgY'DfcXi \_h]cb"  
8]Y'k ]fhgWk UZi]Wk Yb'<YfUi gZcfXYfi b[ Yb']b'9i fcd'Ui bX'5g]Yb  
\UVYb'ni XYa `XUni `[ YZØ\fhž'XUgg'X]Y'I a gÅhY']b'ZUgh'U`Yb  
; YgWÅZhgVYfY]Wk Yb'XYg'i bhYfbY\ a Ybg'fØW\_`Åi Z[ 'g]bX"

: ]bUbn]Y`Y'5i gk ]f\_i b[ Yb'i bX  
9]bgdUfi b[ Yb

8]Y'GW`Y»i b[ 'XYg'A U]bnYf'K Yf\_Yg'k ]fX'j cfUi gg]Wk h]Wk  
Y]ba U][ Y'?cghYb'j cb'V]g'ni '&\$'A ]`]cbYb'GWk Y]nYf': fUb\_Yb  
fYbhgdf]Wk h'Yhk U`&%A ]`]cbYb'9i fcŁj Yfi fgUWk Yb"8Yb'bcWk'g]bX

X]Y`Ub[ Zf]gh][ Yb`9]bgdUfi b[ Yb`ZØf`XUg`l bhYfbY\ a Yb`b]W\h`Ui » Yf  
5W\h`ni ``UggYb``5V`&\$&) `d`Ubh`GW\k Y]hYf`Y]bY`Ä`f`]W\Y  
FYXi n]Yfi b[ `XYf`cdYfUh]j Yb`?cghYb`i a `&\$`A `]`cbYb`GW\k Y]nYf  
: fUb`Yb``8]Yg`]gh`Y]b`ghfUhY[ ]gW\Yf`GW\f]hh`i a `X]Y  
K YhhVYk YfVgZÄ`][ \_Y]h`XYg`l bhYfbY\ a Ybg`]b`Y]bYa `gW\k ]Yf][ Yb  
A Uf`hi a ZY`X`ni `j YfVYggYfb"

⇒ YfghYb`<U`V`U`f`&\$&( `\_cbbhY`` 5`7ca`dcg]hYg`VYfY]hg`Y]bY  
GhY][ Yfi b[ `XYf`DfcZ]hUV`]hÄ`h`j YfnY]W\ bYb`ž`hfc`h`Y]bYg`F ØW\_[ Ub[ g  
]a `l a`gUhn``8]Yg`\_ØbbhY`XUfUi Z`]bXYi hYb`ž`XUgg`X]Y  
j`cf\Yf[ Y\YbXYb`GdUfa U»bU\ a Yb`VYfY]hg`K ]f`i b[ `nY][ Yb`  
⇒gVYgcbXYfY`]b`B`cfXUa`Yf]\_U`j YfnY]W\ bYh`XUg`l bhYfbY\ a Yb`Y]b  
K UW\ghi a`ž`XUg`Ui ZY]bY`dcg]h]j Y`9b`hk ]W`i b[ `]a  
5fW\]hY`\_hi f[ YgW\Ä`Z`h`ni fØW`ni ZØ\ fYb`]gh`ž`k Ä`fYbX`X]Y`G]h`Uh]cb`]b  
9i fcdU`i bX`5g]Yb`Y\Yf`bY[ Uh]j `V`Y]Vh"

## A Uf`hYb`hk ]W`i b[ `i bX`Ni `i bZhgUi gg]W\ hYb

8]Y`GW`Y]Y»i b[ `XYg`K Yf`Yg`]b`A U]bn`fYZY`\_h]Yfh`b]W\h`bi f`]bhYfbY  
<YfUi gZc`fXYfi b[ Yb`ž`gcbXYfb`Ui W\`Yi hYfbY`A Uf`hVYX]b[ i b[ Yb`ž  
X]Y`Y]bYb`k ]W\h][ Yb`9]bZi`gg`Ui Z`X]Y`9b`hgW\Y]Xi b[ gZ]bXi b[  
\UVYb``l bhYfbY\ a Yb`]a `J YfVi bXk Yf`ghc`ZgY`\_hcf`ghY\Yb`i bhYf  
8fi W`ž`g]W\`Ub`gW\ bY``Ä`bXYfbXY`A Äf`hY`Ubni`dUggYb``8]Y  
GW`Y]Y»i b[ `\_ØbbhY`Ui W\`U`g`HY`]Y]bYf`[ fØ»YfYb`?c`bgc`X]Yfi b[  
]bbYf\U`V`XYf`6fUbW\Y`Ub[ YgY\Yb`k YfXYb`ž`]b`XYf`9Z]n]Ybn`i bX  
?cghYb`\_cb`hfc``Y]a a Yf`nYbhfU`YfY`H\Ya Yb`k YfXYb"

K Ä`fYbX`DA A 5!D`UhhYb`k Y]hYf\]b`]a `DfcXi`\_hdcfhZc`]c`j`cb  
GW\k Y]hYf`V`Y]VYb`ž`k ]fX`X]Y`DfcXi`\_h]cb`bi b`ghfUZZYf`cf[ Ub]g]Yfh`  
8]Y`5bdUggi b[ Yb`]b`XYf`DfcXi`\_h]cb`ggghfUhY[ ]Y`g]bX`b`chk YbX][ ž  
i a `Ui Z`X]Y`a Uf`hVYX]b[ hYb`F ØW\_[ Äb[ Y`ni`fYU[ ]YfYb`i bX`i a`]b  
Y]bYa`ni bY\ a YbX`k YhhVYk YfVg]bhYbg]j Yb`l a ZY`X`ni `VYghY\Yb`  
8]Y`⇒j Ygh]h]cbYb`]b`UbXYfY`F Y[ ]cbYb`k ]Y`B`cfXUa`Yf]\_U`ž`k`c`Y]b  
K UW\ghi a`ni`VYc`VUW\hYb`]gh`ž`\_ØbbhYb`Y]b`<]bk Y]g`XUfUi Z`gY]b`ž  
XUgg`XUg`l bhYfbY\ a Yb`gY]bY`F Yggci fW`b`ghfUhY[ ]gW\`i a`U[ Yfb  
a`ØW\hY"

⇒5bVYhfUW\hXYf`U`hi Y`Yb`A Uf`hYb`hk ]W`i b[ Yb`i bX`XYf

VYj cfghY\YbXYb`GW\`jY» i b[ `XYg`A U]bnYf`K Yf\_Yg`ghY\h`GW`k Y]hYf  
HYW`bc`c[ ]Yg`j cf`Y]bYf`YbhgW`Y]XYbXYb`D\UgY`gY]bYf  
I bhYfbY\`a Ybg[ YgW`]W`hY`"8 Ug`i bhYfbY\`a Yb`a i gg`bi b`fUgW`  
YbhgW`Y]XYb`ž`k ]Y`Yg`g]W`Ua` VYghYb`d`cg]h]cb]Yfh`ž`i a` `X]Y  
<YfUi gZcfXYfi b[ Yb`ni`a` Y]ghYfb`i bX`[ `Y]W`nY]h][ `d`fcZ]hUVY`ni  
V`Y]VYb`"

8 ]Y `b`ÀW`ghYb`GW`f]hhY`ZØf`GW`k Y]hYf  
HYW`bc`c[ ]Yg`

⊕`XYb`\_ca`a YbXYb`A`cbUhYb`k ]fX`X]Y`5i Za` Yf\_gUa` \_Y]h`Ui Z`X]Y  
I a`gYhni b[ `XYf`[ Yd`UbhYb`A`U» bU\`a Yb`[ Yf]W`hY`h`gY]b`"8 ]Y  
GW`]Y» i b[ `XYg`K Yf\_Yg`]b`A`U]bn`]gh`b]W`h`bi`f`Y]b`VYXYi`hYbXYf  
GW`f]h`ZØf`X]Y`]bhYfbY`I a`ghfi`\_hi`f]Yfi b[ `XYg`I bhYfbY\`a Ybg`ž  
gcbXYfb`Yg`k ]fX`Ui W`]bhYfYggUb`h`gY]b`ni`VYcVUW`hYb`ž`k ]Y`g]W`  
X]Yg`Ui Z`X]Y`A`Uf`\_hd`cg]h]cb`j`cb`GW`k Y]hYf`]a`i[ `cVU`Yb  
K`YhhVYk`YfVgi`a`ZY`X`Ui`gk ]f\_Yb`k ]fX`"8 ]Y` :`À\][`\_Y]h`XYg  
I bhYfbY\`a Ybg`ž`g]W`gW`bY``UbdUggYb`ni`\_`ØbbYb`ž`k ]fX  
YbhgW`Y]XYb`X`XUZØf`gY]b`ž`k ]Y`[ i`h`Yg`X]Y`<YfUi gZcfXYfi b[ Yb`ž`X]Y  
j`cf`\`a` ``]Y[ Yb`ž`a` Y]ghYfb`\_`Ubb`"

5 bU`mgY`XYf`U`\_hi`Y``Yb`k ]fhgW`UZh`]W`Yb  
<YfUi gZcfXYfi b[ Yb`

8 ]Y`k ]fhgW`UZh`]W`Yb`F`U\`a YbVYX]b[ i b[ Yb`ž`X]Y`GW`k Y]hYf  
HYW`bc`c[ ]Yg`XYfnY]h`Yf`YVh`ž`g]b`X`b]W`h`]gc`]Yfh`ž`gcbXYfb`gd]Y[ Y`b  
VfY]hYfY`HfYbXg`]b`XYf`[ `cVU`Yb`K ]fhgW`UZh`k ]XYf`"8 ]Y  
Ub\`U`hYbXYb`I`bg]W`Yf\`Y]hYb`Xi`fW`[ Yc`d`c`]h]gW`Y`GdUbbi b[ Yb`ž  
@]YZf`\_Y`hYbi`bhYfVfYW`i b[ Yb`i`bX`ghY][ YbXY`F`c`\ghcZ`d`fY]gY  
VY`UghYb`j ]Y`Y`I bhYfbY\`a Yb`ž]bgVYgcbXYfY`]b`XYf  
: Yfh][ i b[ g]bXi`ghf]Y`"8 ]YgY` :`U`\_hc`fYb`\UVYb`X]Y  
DfcXi`\_h]cbg`\_cghYb`Yf\`Ø`h`i`bX`XUg`; YgW`À`Zhgi`a`ZY`X`YfgW`k`Yfh`ž  
k`Ug`g]W`X]fY`\_h`Ui`Z`X]Y`DfcZ]hUV`]h`h`h`Ui`gk ]f`\_h`"

9]b`k Y]hYfYf`k ]W`h][ Yf`5gdY`\_h]gh`X]Y`J`Yf`À`bXYfi b[ `XYg`A`Uf`\_hYg  
ZØf`J`YfVi`bXk`Yf`\_ghcZY`"8 ]Y`B`UW`ZfU[ Y`b`UW`DA`A`5!D`UhYb`]gh`Ui`Z  
Y]b`bYi`Yg`B]j ]YUi`[ Ygi`b`\_Yb`ž`XU`U`hYfbUh]j`Y`A`UhYf]U`]Yb`i`bX`

HYW\bc`c[ ]Yb`ni bY\`a YbX`VY`]YVhYf`k YfXYb" J ]Y`Yb  
I bhYfbY\`a Yb`ZÀ`h`Yg`gW\k Yfž`g]W\`Ub[ Yg]W\hg`X]YgYf  
J YfÀbXYfi b[ Yb`Ubni dUggYbž`i bX`gc`Yf[ ]Vh`g]W\`Y]b`K Yhh`Ui Zž`i a  
X]Y`ϕbcj Uh]cbgZÀ\][ \_Y]h`ni `Yf\`Ò\Yb`i bX`[ `Y]W\`nY]h][ `X]Y`?cghYb  
ni `gYb`\_Yb"

## F Y [ ]c b U`Y `A Uf\_hhfYb Xg

ϕ`9i fcdU`nY][ Yb`i bhYfbY\`a Yb`k ]Y` 5`7ca dcg]hYg`Y]bY  
fØW`Ài Z][ Y`i a gUhnYb`k ]W`i b[ `]b`a Y\`fYfYb  
; YgW\`ÀZh`gVYfY]W\Yb"8 ]Yg`k ]fX`ni a `HY]`Xi fW\`Y]bY`ghU[ b]YfYbXY  
B UW\`ZfU[ Y`i bX`Y]bYb`j YfgW\`ÀfZhYb`K YhhVYk YfV`j Yfi fgUW\`h`a  
; Y[ YbgUhn`XUni `Uh`BcfXUa Yf]\_U`ghUV]Y`Ni k ÀW\`gY`j YfnY]W\`bYhž  
k Ug`Ui ZY]b`fcVi ghYg`5fW\`hY`\_hi f[ YgW\`ÀZh`\]bk Y]gh"8 ]YgY  
i bhYfgW\`YX`]W\Yb`9b`k ]W`i b[ Yb`]b`j YfgW\`YXYbYb`F Y[ ]cbYb  
YfZcfXYfb`j cb`i bhYfbY\`a Yb`ghfUhY [ ]gW\`Y`5bdUggi b[ Ybž`i a `]b  
XYb`^k Y"][ Yb`A Àf\_hYb`k YhhVYk YfVgZÀ\][ `ni `V`Y]VYb"

8 Yf`K Y[ ž`XYb" 5`7ca dcg]hYg`Y]bgW\`À[ hž]gh`Y]b`6Y]gd]Y`ZØf`Y]bY  
?ca V]bUh]cb`Ui g`?cghYbfYXi \_]cb`i bX`A Uf\_h`cbgc`X]Yfi b[ ž`i a  
X]Y`Ub[ Zf]gh][ Y`K YhhVYk YfVgZÀ\][ \_Y]h`g]W\Yfni ghY`Yb"9]b  
gc`W\Yg`Jcf[ Y\`Yb`\_ÒbbhY`]b`XYb`\_ca a YbXYb`ϕ\`fYb`Ui W\`  
UbXYfYb`i bhYfbY\`a Yb`U`g`A cXY`X]YbYbž`i a `YfZc`[ fY]W\`Ui Z`X]Y  
g]W\`j YfÀbXYfbXYb`A Uf\_hVYX]b[ i b[ Yb`ni `fYU[ ]YfYb"

: ]bUbn]Y`Y`5i gk ]f`\_i b[ Yb`XYf

I bhYfbY\`a Yb`gghfUhY [ ]Yb

8]Y`9bhgW\Y]Xi b[ ž`XUg`K Yf`\_]b`A U]bn`gh]`ni `Y[ Ybž`k ]fX`U`g`HY]`  
Y]bYf`[ fØ»YfYb`GhfUhY [ ]Y`j YfghUbXYbž`X]Y`Z]bUbn]Y`Y`6Y`Ughi b[ Yb  
a ]hhY`Zf]gh][ `ni `fYXi n]YfYb`i bX`XYb` : c`\_i g`Ui Z`dfcZ]hUV`YfY  
; YgW\`ÀZh`gVYfY]W\Y`ni `f]W\`hYb"CVk c`\`X]Y`GW\`Y»i b[ `a ]h  
Y]ba U`][ Yb`?cghYb`j cb`V]g`ni `&\$`A ]c`7< : `j YfVi bXYb`]ghž`fYW\`bYh  
GW\`k Y]hYf`HYW\bc`c[ ]Yg`XUa ]hž`XUgg`X]Y`À\`f`]W\Yb`cdYfUh]j Yb  
?cghYb`UV`&\$&) `i a `&\$`A ]c`7< : `g]b`\_Yb`k YfXYb"HUhgÀW\`]W\`nY][ [ h  
X]YgYf`GW\`f]hh`Y]bYb`dfcU`\_hj Yb`5bgUhn`ni f`G]W\YfghY`i b[ `XYf  
Z]bUbn]Y`Yb` ; Ygi bX`Y]h`XYg`I bhYfbY\`a Ybg`]b`Y]bYa  
\`YfUi gZcfXYfbXYb`k ]fhgW\`UZh]W\Yb`i a ZY`X"

8]Y`V]g\Yf][ Yb`GdUfa U» bU\`a Yb`\UVYb`VYfY]hg`ni `Y]bYf  
GhY][ Yfi b[ `XYf`DfcZ]hUV]`hÅh`ja `YfghYb`<U`V`U\`f`&\$&(`[ YZØ\fhž  
k Ug`XUfUi Z`\]bXYi hYhž`XUgg`X]Y`GhfUHY[ ]Y`XYf`?cghYb`cbhfc``Y  
YfghY`dcg]hj Y`9f[ YVb]ggY`nY][ h``8]YgY`9bhk ]W`i b[ `\_ÖbbhY`ZØf  
≠j YghcfYb`j cb`≠hYfYggY`gY]bž`X]Y`Ui Z`bUW\`U`h][ Y  
K UW`ghi a gghfUHY[ ]Yb`UW`hYb`"K Ybb`k Y]hYfY`A U» bU\`a Yb  
YfZc`[ fY]W`i a [ YgYhnh`k YfXYbž`\_ÖbbhY`X]Yg`XUg`J YfhfUi Yb`XYf  
≠j YghcfYb`ghÅf`Yb`i bX`X]Y`A Uf`hdcg]h]cb`j cb`GW`k Y]hYf  
HYW`bc`c[ ]Yg`ZYgh][ Yb`"

: Øf`k Y]hYf[ Y\YbXY`≠Zcfa Uh]cbYb`ni `XYb`k ]fhgW`UZ]W`Yb  
FU\`a YbVYX]b[ i b[ Yb`i bX`XYfYb`5i gk ]f`i b[ Yb`Ui Z  
I bhYfbY\`a Ybž`VYgi W`Yb`G]Y`V]hY`XUg`6i bXYgUa h`ZØf  
GhUh]gh]\_ "

8YhU]`g

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