

# A Y`]ggU`B UgWk Ybk Yb[ `j YfgWk ]YVh Hci fhYfa ]bY. : Ub g`VUb[ Yb`i a `? cbnYfhY

A Y`]ggU`B UgWk Ybk Yb[ `j YfgWk ]YVh`XfY]? cbnYfhY`k Y[ Yb  
: `cf]Ub`G]`VYfY]gYb"9]b`5i Zhf]hh`ZÄ`h`YfgUhn`cg`Ui g"  
J Yfgh`AbXb]g`YfVYhYb"

; fc»Y` , VYffUgWk i b[ `ZØf`X]Y: Ub g`j cb`A Y`]ggU`B UgWk Ybk Yb[ .`8]Y  
VY\_UbbhY`GWk`U[ Yf\_Øbgh`Yf]b`[ ]Vh`VY\_Ubbhž`XUgg`Y]b][ Y`]\fYf`a` ]h  
GdUbbi b[ `Yfk UfhYhYb`?cbnYfhY`j YfgWk`cVYb`k YfXYb`a` ØggYb"  
8]Yg`VYhf]Zhj`cf`U`Ya`X]Y`HYfa` ]bY`]a`C`\_hcVYfž`X]Y`bi b`]b`XYb  
A U]`&\$&) `j Yf`Y[ h`k`i`fXYb"6YgcbXYfg`Ybhh`Äi`gWk`YbX`]gh`X]Y  
B UWk`f]Wk`hž`XUgg`Y]b`5i`Zhf]hh`]b`?Uf`gfi` \Y`\_ca`d`Y`hh`Yb`hZÄ`h`"F`Ub[  
i`bX`B`Ua`Yb` \U`h`B`UgWk`Ybk`Yb[ `a` ]hh`Yfk`Y`]Y`gc`j` ]Y`ž`XUgg`Yg`g]Wk  
i`a`k`Y]h`a`Y`f` \Ub`XY`h`U`g`bi`fi`a`Y]b`d`Uuf`[`Yd`Ub`hY  
J`Yf`Ub`gh`U`hi`b[`Yb"

A Y`]ggU`B UgWk Ybk Yb[ ž`X]Y`XYfnY]h`Ui`Z`Y]b`Ya` [ fc»Yb`9fZc`[ ghf]d  
]ghž` \U`h`]b`XYb`Y`h`hYb`]U` \fYb`Xi`fWk`] \fY`Y]b[ `Äb[ ][ Yb`A`Y`c`X]Yb  
i`bX`] \fY`a` ]hfY]»Yb`XYb`DYfZc`fa` Ub`W`g`]b`^`ghYffY]Wk`i`b`X  
8Yi`hgWk`Ub`X`ZØf` : i`fc`fY`[`Y`gc`f[`h`"≠`fY`VY`j`c`f`ghY` \Yb`XY  
6Yf[`V`Ui`Y`fb`Vi`Ua`!Hci`f`gc`hY`i`fgd`fØb[`]Wk`Ui`g`%)`?`cbnYfhYb  
VY`ghY` \Yb`"Bi`b`a`ØggYb`Y`X`c`Wk`X`fY]`XUj`cb`ž`X]Y`ZØf`XYb`%+`ž`%`"  
i`bX`%-`"C`\_hcVYf`]b`?Ya`dhYb`ž`BYi`!!`a`i`bX`B`Øfb`VYf[`]Ub[`YgY`h`h  
k`UfYb`ž`j`YfgWk`cVYb`k`YfXYb`ž`k`Ä` \fYb`X`XYf`5i`Zhf]hh`]b`?Uf`gfi` \Y`Ua  
\*`"C`\_hcVYf[`]Äb`n`]Wk`Ui`g`ZÄ`h`"

< ]bhYf[ fØbXY`XYf`l`a`Vi`Wk`i`b[

@Ui`h`A`Y`]ggU`B UgWk Ybk Yb[ `g]b`X`X]Y`Y`b`XYfi`b[`Yb`]a`Hci`fb`YYd`Ub  
Ui`Z`Y]b`Y`HJ`!G` \ck`ni`fØW`ni`ZØ` \fYb`ž`X]Y`ni`f[`]Y]Wk`Yb`NY]h`k` ]Y  
Y]b][ Y`] \fYf`?cbnYfhXUhYb`ghUhhZ]b`XYh"?cb`\_fYhY`8YhU]`g`ØVYf

X]YgY`HJ!G\ck`jY»`g]Y`cZZYbž`XcW`j`j]Y`Y` : Ubg`gdY`\_i`j]YfYbž`XUgg  
Yg`g]W`i`a` `XYb` `GW`U[ YfVccca` `j`cb`i`bX`a` ]h: `cf]Ub`G]`VYfY]gYb  
`UbXY`hž`XYf`Ua` `%-`"C`\_hcVYf`j]Y`Y`ja` `9fghYb`Ui`g[ YghfU`h`k`fX"  
8]YgY`9b`h`Ø`i`b[ ` \_ÖbbhY`Y]bYb`Yb`hgW`Y]XYbXYb`9]bZi`gg`Ui`Z`X]Y  
9b`hgW`Y]Xi`b[ gZ]bXi`b[ `XYf`?Øbgh`Yf]b`[ Y`UVh`UVYbž`XU`X]Y  
HY]`bU`a`Y`Ub`Y]bYf`gc`W`dcdi`ÄfYb`J`YfUbghU`hi`b[ `gck`c`\  
a`YX]U`U`g`Ui`W`j]b`hYfa`g`c`Z`Di`V`]W]hmj`cb`J`cfhY]`j]gh"

8]Y`j`YfgW`cVYbYb`?`cbnYfhY`k`UfYb`ZØf`X]Y`?Øbgh`Yf]b`Y]bY  
k`]W`h[ Y`A`Ö[ `]W`\_Y]hž`]fY`A`i`g]\_`Y]bYa` `VfY]hYb`Di`V`\_i`a`ni  
dfÄgYb]hYfYb`"8]Y`9b`h`Äi`gW`i`b[ `]fYf` : Ubg`\_ÖbbhY`XU`Yf  
j`Yfgh`ÄbX`]W`gY]b`" `b`Y]bYf`dYfg`Öb`]W`Yb`B`UW`f]W`h`Ui`Z`b`ghU[ fUa  
VUh`g]Y`]fY`HfYi`Yb`i`a` `J`Yfgh`ÄbXb]g`ZØf`X]Y`i`b[ `ØW`\_]W`Y`G]hi`Uh]cb  
i`bX`Yf`\_ÄfY`ž`XUgg`]f`Hci`fd`Ub`Ui`Z[ fi`bX`X]YgYf`5bdUggi`b[ Yb  
bi`b`bYi`ghfi`\_hi`f]Yfh`k`YfXYb`a`i`gg`" `ÄW`\_c`ZZY`Ui`ZYi`Yf  
J`Yfgh`ÄbXb]g]i`bX`[ ZFY]`a` ]Y]W`ni`gY`\  
b`ž`ZØ[ hY`g]Y`\  
bni`i`bX  
j`Yfg]W`YfhY`]fYb` : Ubgž`XUgg`g]Y`X]Y` ; Y`Y[ Yb`Y]h`bi`hYb`k`c`hYbž  
i`a` ]fY`5i`Zh]hY`gc`fY]Vi`b[ g`cg`k`jY`a`Ö[ `]W`ni`[ YghU`hYb"

### K`Ug`VYXYi`hYh`XUg`ZØf`X]Y` : Ubg3

: Øf`H]W`\_Yh]b`UVYf`VYghY`h`X]Y`A`Ö[ `]W`\_Y]hž`]fY`H]W`\_Yhg`ZØf`X]Y  
UV[ YgU[ hYb`cXYf`j`YfgW`cVYbYb`?`cbnYfhY`]b`UbXYfY`Gh`ÄXhY  
i`a`ni`hUi`gW`Yb`cXYf`YfghUhhYb`ni`"UggYb`"9g`V`Y]Vh`UVni`k`UfhYbž  
k`]Y`j`j]Y`Y` : Ubg`g]W`ZØf`X]YgY`i`a`hUi`gW`cdh]cb`Yb`hgW`Y]XYbž`XU  
j`j]Y`Y`bU`h`Øf`]W`Ui`Z`]fY`7`Ub`W`\_`]bUfVY]hYb`a`ÖW`hYbž`X]Y  
?Øbgh`Yf]b`j]Y`ni`Yf`YVYb"

: `cf]Ub`G]`VYfY]gYbž`XYf`]b`XYf`GW`U[ Yfk`Y`h`Y]bY`b]W`h  
i`bYf`YV`]W`Y`F`c`Y`gd]Y`hž`\_ÖbbhY`Xi`fW`Y]bY`k`Y]hYfY`Ni`gU[ Y`i`bX  
gY]bY`Äi` »Yfgh`VY`]YVhY`HJ!G\ck`X]Y`5i`Za`Yf`gUa`\_Y]h`XYf` : Ubg  
j`cb`A`Y`]ggU`B`UgW`Yb`k`Yb[ `Ui`Z`g]W`n]Y`Yb`"J]Y`Y`GW`U[ YfZUbg  
g]bX`j`cb`XYa` ; YXUb`\_Yb`VY[ Y]ghYfhž`XUgg`X]Y`?Øbgh`Yf]b  
a`Ö[ `]W`Yfk`Y]gY`VU`X`]b`Y]bYf`[ fc»Yb` : YfbgY`d`fc`Xi`\_]cb`ni  
gY`Yb`gY]b`k`]fXž`gY`Vgh`k`Ybb`X]Yg`VYXYi`hYhž`XUgg`Y]b[ Y`]fYf  
@j`Y!5i`Zh]hY`]b`XYb`<]b`hYf[ fi`bX`hfYhYb`a`ØggYb"

9g`]gh`VYa`Yf`\_Ybgk`Yfhž`k`jY`X]Y`A`i`g]\_!`i`bX`i`b`hYf`U`hi`b[ g]bXi`ghf]Y

a ]hY]bUbXYf'j YfZcW hYb' ]ghi bX'k ]Y' HJ!9j Ybhg'XUg  
?cbnYfh[ YgWY\Yb'VYY]bZi ggYb' \_ÖbbYb" '8]Y': Ubg'j cb' A Y']ggU  
B UgWYbk Yb[ 'nY][ Yb'g]W'Ui Z'gcn]U'Yb' A YX]Yb'VYgcf[ h'i bX  
YbhhÄi gW h'ØVYf'X]Y' J YfgW ]YVi b[ Ybž'XYbbcW' V'Y]Vh'X]Y  
<cZbi b[ ž'XUgg'g]Y' VVYbZU`g'j cb'XYf'DfÄgYbn'XYf'? ØbghYf]b' ]b  
XYf'HJ!K Y'h'dfcZ]h]YfYb' \_ÖbbhYb"

## 8]Y'5i gk ]f\_i b[ Yb' ]b'XYf'GW`U[ Yfk Y`h

: Øf'XYb'GW`U[ YfVYfY]W' ]bg[ YgUa h'nY][ h'X]YgY'G]hi Uh]cbž'k ]Y  
k ]W h][ 'HJ!5i Zhf]hY'ZØf'X]Y' ?Uff]YfY'j cb' ?ØbghYfb'g]bX" '8]YgY  
D'UhhZcfa Yb'V]YhYb' ]W h'bi f'Y]bY' A Ö[ ' ]W \_Y]h'ni f'Dfca ch]cbž  
gcbXYfb'VYb'gcb'Y]bY'7\UbWž'XUg'Di V`\_i a'ni 'j Yf[ fÖ» Yfb" '8]Y  
K YW gY'k ]f\_i b[ Yb'nk ]gW Yb'@]j Y!5i Zhf]hYb' ]i bX  
a YX]Ybk ]f\_gUa Yb'5i Zhf]hYb'g]bX' ]b'XYf'\Yi h][ Yb'NY]h  
i bj Yfn]W hVUfž'i a' U`g'?ØbghYf'fY'Yj Ubh'ni 'V'Y]VYb"

A Y']ggU' B UgWYbk Yb[ g'K U\ž']\fY' Hci fXUhYb'ni 'j YfgW ]YVYbž' ]gh  
Y]b'ghfUhY[ ]gW Yf'GW UW ni [ ž'XYf'nY][ hž'XUgg' ]b'XYf'\Yi h][ Yb'NY]h  
Ui W'X]Y' ?fYUh]j Yb'Ub'X]Y'; Y[ VVYb\Y]hYb'XYg' A Uf\_hYg  
Ub[ YdUggh'k YfXYb'a ØggYb" '8]Y' ?ca V]bUh]cb'j cb'@]j Y!  
DYfZcfa UbW' ]i bX' A YX]YbdfÄgYbn'k ]fX'k Y]hYf\ ]b'ZØf'?ØbghYf]b  
i bX': Ubg[ 'Y]W Yfa U» Yb'j cb'6YXYi hi b[ 'gY]b"

A Y']ggU' B UgWYbk Yb[ ž[ YVcfYb' ]a' \f' %- - \$ž'\Uh'g]W' ]b'XYf  
XYi hgW Yb' ]i bX' ÖghYffY]W ]gW Yb'GW`U[ Yf'UbXgW UZh'Y]bYb  
VYa Yf\_Ybgk YfhYb'BUa Yb'[ Ya UW h' 'Äf'Gh]' ]gh[ YdfÄ[ h]j cb  
hfUX]h]cbY`Ya 'GW`U[ Yfž'\_ca V]b]Yfh'a ]h'a cXYfbYb'9]bZØggYbž  
i bX'g]Y' ]gh'VY\_Ubbh'ZØf']\fY'Ya ch]cbU'Y'5i gXfi W\_gk Y]gY" 'ÄfY  
?Uff]YfY'VY[ Ubb' ]b'XYb'ZfØ\Yb'&\$%\$Yf' \fYbž'i bX'gY]h\Yf'\Uh'g]Y  
nU\ 'fY]W Y'5'VYb'j YfÖZYbh]W hž'X]Y' ]b'XYb'7\Ufhg'[ fc» Y'9fZc`[ Y  
ZY]YfhYb" '8]YgY'9fZc`[ Y'nY][ Yb'g]W'Ui W' ]b' ]\fYa'k UW gYbXYb  
: UbVUgYž'gck c\` ]b'2 ghYffY]W 'U'g'Ui W' ]b'8Yi hgW`UbXž'k c'g]Y  
fY[ Y'a Ä»][ 'Ui gj Yf\_Ui ZhY' ?cbnYfhY'gd]Y'h'6YgcbXYfg' ]b'gcn]U'Yb  
A YX]Yb'\Uh'g]Y'Y]bYb'Yf\YV`W Yb'9]bZi ggž' ]bXYa'g]Y' ]\fY' A i g\_  
i bX'dYfgÖb' ]W Yb'; YgW ]W hYb'hY]'hž'k Ug']\f'\ ]Zhž'Y]bY'Yb[ YfY  
J YfV]bXi b[ 'ni ' ]\fYb': Ubg'Ui Zni VUi Yb"

9]b`VYa Yf\_Ybgk YfhYf'5gdY\_hj cb`A Y`]ggU`B UgWk Ybk Yb[ g  
?Uff]YfY`]gh`]\f`l a [ Ub[ `a ]h<YfUi gZcfXYfi b[ Yb" `Hfcm`< Ò\Yb`i bX  
H]YZYb`V`Y]Vh`g]Y`VY]`]\fYb` : Ubg`VY`]YVh"8]Y`U\_hi Y`Y`G]hi Uh]cb`a ]h  
XYf`J YfgWk]YVi b[ `j cb`Hci fhYfa ]bYb`Xi fWk`Y]bYb`a Ò[ `]Wk Yb  
5i Zhf]hh`VY] : `cf]Ub`G]`VYfY]gYb`]gh`b]Wk h`XUg`YfghY`A U`ž`XUgg`g]Y  
]\fY`5[ YbXU`UbdUggYb`a i gghY" `Gc`Wk Y`l a ghY`i b[ Yb`\UVYb`cZh  
k Yb][ Yf`a ]h`dYfgÒb`]Wk Yb` : fØbXYb`ni `hi b`U`g`j ]Y`a Y`f`a ]h`XYb  
5bZcfXYfi b[ Yb`XYf` : YfbgY\!`i bX`A i g]\_]bXi ghf]Y"8]YgY`8 mbUa ]\_  
j YfXYi h`]Wk h`X]Y`?ca`d`Yi ]h`h`X`Yg`9bhYfhU]ba Ybghž`k c`@]j Y!  
5i Zhf]hhY`cZh`a ]h`A YX]YbYb[ U[ Ya Ybhg`]b`?cb`\_i ffYbn`ghY\Yb"

9]bZi`gg`j`cb` : `cf]Ub`G]`VYfY]gYb`Ui`Z`X]Y  
GWk`U[ Yf]bXi`ghf]Y

: `cf]Ub`G]`VYfY]gYb`ž`VY`\_Ubbh`ZØf`gY]bY`F`c`Y`U`g`A`cXYfUhc`f`i`bX  
A`i`g]\_Yf`]a`XYi`hgWk Yb`GWk`U[ Yfž`\Uh`Y]bYb`Yf\YV`]Wk Yb`9]bZi`gg  
Ui`Z`X]Y`6fUbWk Y" `GY]bY`G\ck`g`YffY]Wk Yb`\c\Y`9]bgWk U`hei`chYb  
i`bX`V]YhYb`j`]Y`Yb`?Øbgh`Yfb`Y]bY`D`UhhZcfa`ž`i`a`g]Wk`Y]bYa  
[ fÒ»YfYb`Di`V`\_]i`a`j`cfni`ghY`Yb" `ϕ`XYf`F`Y[ Y`g]bX`5i`Zhf]hhY`VY]  
G\ck`g`k`]Y`XYa` `GWk`U[ YfVccca` `YbhgWk Y]XYbX`ZØf`X]Y  
G]Wk h`Vuf`\_Y]h`Y]bYg`?Øbgh`Yfg"8]YgY` : YfbgY\Ui`Zhf]hhY`\_ØbbYb`X]Y  
J`Yf`\_Ui`ZgnU\`Yb`j`cb`5`VYb`i`bX`X]Y`HY]`bY\`a`YfnU\`Yb`VY]  
?cbnYfhYb`a`U»[ YV`]Wk`VY]bZi`ggYbž`k`Ug`g]Wk`k`]YXYfi`a`Ui`Z`X]Y  
Hci`fbYYd`Ubi`b[ `Ui`gk`]f`\_h"

⇒a` `ϕ\`f`&\$&` `k`i`fXYb`GWk`hni`b[ Yb`ni`Zc`[ Y`a`Y`f`U`g`+\$`i` `XYf  
GWk`U[ Yf\`ØfYf`Xi`fWk` : YfbgY\dfc[ fUa`a`Y`Ui`ZbYi`Y`?Øbgh`Yf  
Ui`Za`Yf`\_gUa` "8Ug`nY][ hž`k`]Y`k`]Wk`h][ `gc`Wk`Y`J`YfUbbghU`hi`b[ Yb`ZØf  
X]Y`?Uff]YfY`Yb`hk`]W`\_i`b[ Yb`XYf`?Øbgh`Yf`g]bX" `A`Y`]ggU  
B`UgWk`Ybk`Yb[ ` \_ØbbhY`Xi`fWk`]\fYb`VY]`c`fghY\YbXYb`5i`Zhf]hh`VY]  
 : `cf]Ub`G]`VYfY]gYb`X]Y`7\UbWk`\UVYbž`]\fY`F`Y]Wk`k`Y]hY`ni  
j`Yf[ fÒ»Yfb`i`bX`a`Ò[ `]Wk`Yfk`Y]gY`bYi`Y` : Ubg`ni` `[ Yk`]bbYb"

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