

K c`ZgVi f[ `ØVYfghY\h'Dc\_U`!< ØfXY.  
%. \$!G]Y[ `[ Y[ Yb`a i h][ Y`? cV`YbnYf

8Yf`J Z@K c`ZgVi f[ `VYg]Y[ h`Hi G`?cV`Ybn`]a `8: 6!Dc\_U`a ]h  
%. \$`i bX`n]Y\h`]b`X]Y`nk Y]hY`Fi bXY`Y]b``K ]a a Yf`hf]Zhi`ZfØ`"

⇒ a `8: 6!Dc\_U``\Uh`XYf`J Z@K c`ZgVi f[ `gY]bY`DZ]W`hUi Z[ UVY  
YfZc`[ fY]W`Yf`YX][ h``5a `A cbhU[ UVYbX`hfUh`XYf`i » VU``!  
6i bXYg`][ ]gh[ Y[ Yb`Hi G`?cV`Ybn`Ub`i bX`[ Yk Ubb`a ]h%. \$``8 Ug  
YbhgW`Y]XYbXY`Hcf`Z]Y``]b`XYf`%) ``A ]bi hYž`U`g`DUhf]W`\_K ]a a Yf`]a  
GhUX]cb`C VYfk Yfh`XYb`6U``]a `BYhn`i bhYfvfUW`hY``Fi bX`,`\$\$\$  
Ni gW`Ui Yf`j YfZc`[ hYb`XUg`; YgW`Y\Yb`i bX`Yf`YVhYb`Y]b`Gd]Y`ž`XUg  
ZØf`X]Y`B]YXYfgUW`gYb`Yhnh]W`\_b]W`hini a `; `UbngHØW`\_k i fXY"

J cb`6Y[ ]bb`Ub`ØVYfbU\`a Yb`X]Y`K c`ZgVi f[ Yf`XUg`?ca`a UbXc`i bX  
XfÅb[ hYb`XYb`; Y[ bYf`]b`X]Y`8YZYbg]j Y``8Yf`C VYf`][ ]ghž`XYf`]b`XYf  
j Yf[ Ub[ YbYb`GU]gcb`XYb`F\Y]b`UbX!Dc\_U``[ Yk ]bbYb`\_cbbhYž  
\UhY`GW`k ]Yf][ \_Y]hYbž`g]W`\_Ui g`XYf`i a \_`Ua`a Yfi b[ `ni `VYZfY]Yb`  
G]Y`ghUbXYb`ni `6Y[ ]bb`a ]h`Y]bYf`ghUf`\_XYZYbg]j Yb`5i ZghY``i b[  
i bX`j Yfgi W`hYbž`XYa `8fi W`\_ghUbXni \U`hYb``K ]a a Yfg`ZfØ`Yg`Hcf  
ghY``h`X]Y`K Y]W`Yb`ZØf`K c`Z[ Ub[ `K c`ZgVi f[ `Ui ZXYb  
K Y]hYf`\_ca`a Yb`]a `Dc\_U`"

? cV`Ybn`V`Y]Vh`hUdZYfž`K c`ZgVi f[ `Z]bXYh  
b]W`h`]bg`Gd]Y`

CVk c`\`X]Y`K c`ZgVi f[ Yf`XUg`Gd]Y``Xca ]b]YfhYbž`ZY`\`hY`Yg`]\bYb  
Ub`8i fW`gW`\_U[ g\_fUZh`i bX`?fYUh]j ]hÅh`]a `5i ZVUi gd]Y``B UW`XYa  
: Øfi b[ ghfYZZf`gW`]Yb`Yg`gcž`U`g`cV`g]Y`Yg`Yhk Ug`fi \][ Yf  
Ub[ Y\Yb``UggYb`k c``hYb```X]YgYf`D\UgY`XYg`Gd]Y`g`\_cbbhY`g]W`  
X]Y`?cV`YbnYf`A UbbgW`UZh`Yhk Ug`ghUV]`]g]YfYbž`V`]YV`YXcW`  
[ YZÅ`f`]W`\_i bX`j Yfgi W`hYž`]\fY`: Ubg`a ]h`Y]XYbgW`UZh`]W`Ya `Gd]Y`

ni `VY[ Y]ghYfb"J]Y`Y`5b\Åb[ Yf`XYg`Hi G`?cV`Ybn`Yfa i bhYfhYb`XUg  
HYUa ``Ui hghUf`\_i bX`\]Y`hYb`X]Y`<cZZbi b[ `Ui ZY]bY`K YbXY`Ua  
@YVYb"

8]Y`nk Y]hY`<U`VnY]h`VY[ Ubb`a` ]h`Y]bYa` `YbYf[ ]gW`Yb`5i Zhf]hh`XYf  
<Ui g\YffYbž`X]Y`YbX`]W`cZZYbg]j Yf`U[ ]YfYb`k c``hYb"5i W`k Ybb  
g]Y`bi f`Y]bYa` `Hcf`\]bhYf\Yf\]b`\_hYbž`V`]YV`X]Y`A UbbgW`UZh  
i a ghf]hhYb`i bX`[ UV`]f`6YghYgž`i a` `XYb`i: Uj cf]hYb`ni` `ØVYf`]ghYb"  
8cW`hfchn`XYg`9b[ U[ Ya` Ybhg`XYf`?cV`YbnYfž`X]Y`bUW` ``Ub[ Yf  
5Vgh]bYbn`]a` `Dc`\_U`k` ]YXYf`Ui ZXYa` `D`Uhn`ghUbXYbž`\_cbbhY  
K`c`ZgVi f[ `X]Y`?cbhfc``Y`fY`Uh]j` `gW`bY``ni` fØW`[ Yk` ]bbYb"8]Y  
B]YXYfgUW`gYb`gW`UZhYb`Yg`YXcW`b]W`hž`k`Y]hYfY`\_`UfY  
HcfW`UbW`b`ni` `\_fY]YfYbž`k` Ug`Ui Z]\fY`a` Ub[ Y`bXY`DfÅn]g]cb`i` bX  
XYb`ZY`YbXYb`Ni` [ `ni`a` `Hcf`ni` fØW`ni` ZØ`fYb`]gh"

Hfchn`XYf`, VYf`Y[ Yb\Y]h`nY][` hYb`X]Y`K`c`ZgVi f[ Yf`A`Yf`\_a` U`Y`Y]bYf  
i b]bgd]f]YfhYb`@Y]ghi b[ ``5i W`X]Y`9]bk`YW`g`i` b[ `j`cb`H]U[ c`Hca` Ug  
ZØf`æbUg`K` ]bX`VfUW`hY`\_Y]bY`Zf]gW`Yb`æ`di` `gY"8Yf`6U`k`i`fXY  
cZhc`bY`nØbXYbXY`æYb`b`i` bX`\Yf`[ Ygd]Y`hž`i` bX`X]Y`5Vk`Y`f  
j`cb`?cV`Ybn`\]Y`h`XYb`8fi`W`\_V]g`ni`f`+-`"A` ]bi`hY`ghUbX"æ`X]YgYf  
YbhgW`Y]XYbXYb`D`UgY`Yf\]Y`hYb`X]Y`?cV`YbnYf`Y]bY`fchY`?UfhY  
Ui`Z[ fi`bX`Y]bYg`i: ci`gd]Y`g`j`cb`M]g]b`MJa` Ubž`k` Ug`X]Y`7\UbW`b`ZØf  
Y]b`7ca` YVUW`\_ghUf`\_j` YfgW`YW`hYfhY"

æ`XYf`9bXd`UgY`XYg`Gd]Y`g`k`Uf`XYf`J`Z@K`c`ZgVi f[ `k`Y]hYf\]b  
b]W`h]b`XYf`@U[ Yž`XYb`6U``n]Y`ghfYV][` `ni` `j`Yfk`UbXY`b`i` bX`a`i` gghY  
g]W`X`Ua` ]h`ni`Zf]YXYb`[ YVYbž`XUg`Gd]Y`a` ]h`bi`f`Y]bYa` `HfYZZYf  
J`c`fgd`fi`b[ `ØVYf`X]Y`NY]h`ni` `Vf]b[ Yb"8]Y`?cV`YbnYf`V`]YVYb`]a  
;`fc»`Yb`i`bX`;`Ubnyb`[ YZ`Å`f]W`ž`\_cbbhYb`YXcW`\_Y]bY`\_`UfYb  
7\UbW`b`a` Y`f`\YfUi`ggd]Y`Ybž`VYj`cf`XUg`GW`i`ggg][`bU`YfhØbhY"

## 9]b`b`c`hk`Y`b`X][`Y`f`G]Y`[

8Yf`G]Y`[ `]a` `Dc`\_U``]gh`ZØf`K`c`ZgVi f[ `c`\bY`Nk`Y]ZY`Y]b`k` ]W`h][`Yf  
GW`f]h"8Ug`9ffY]W`Yb`XYf`b`ÅW`ghYb`F`i`bXY`a`ch]j` ]Yfh`XUg`HYUa`ž  
Ui`W`k`Ybb`X]Y`5fh`i`bX`K`Y]gYž`k` ]Y`X]YgYf`9fZc`[ `ni`ghUbXY`\_Ua`ž  
b]W`h`ZØf`i`b[ YhY`hY`i: fYi`XY`gc`f[ hY"8Yf`J`Z@a`i`gg`g]W`]b`XYb  
\_ca`a`YbXYb`Gd]Y`Yb`XYi`h]W`ghY][`Yfbž`i`a` `]b`\Ø`YfYb

K YhhVYk YfVYb`VYghY\Yb`ni`\_ÖbbYb"8]Y` : Ubg`i bX`X]Y  
J YfUbhk cfh`j]WYb` \c ZZYb`Ui Z`a Y`f`? fYUh]j`h`Ä`h`i bX`Y]b`VYggYfYg  
Ni gUa` a Ybgd]Y`i]b`XYb`b`ÄW`ghYb`6Y[ Y[ bi b[ Yb`ž`i a`g]W`XUg  
J YfhfUi Yb`XYf`5b`Äb[ Yf`ni fØW`ni [ Yk`]bbYb`"

≠bg[ YgUa` h`V`Y]Vh`XYf`8: 6!Dc`\_U`Y]b`VYXYi hYbXYf`K YhhVYk YfVž  
XYf`ZØf`U`Y`hY]`bY`a` YbXYb`HYUa` g`Y]bY`[ Yk`]ggY`9`fY`a` ]h`g]W`  
Vf]b[ hž`[ YfUXY`ZØf`X]Y`hcd!VYgYhnhYb`?`i`Vg``: Øf`X]Y`?cV`YbnYf  
V`Y]Vh`XYf`5i`Zhf]hh`[ Y[ Yb`Y]bYb`6i`bXYg`][ ]ghYb`]b`9f]bbYfi b[ ž  
k`Ä`fYbX`K`c`ZgVi f[ `Y]bYb`k`Y]hYfYb`GW`f]hh`Ui ZXYa` `K`Y[ `ni`f  
H]hY`j`YfhY]X][ i b[ `]a`8: 6!Dc`\_U`[ Ya` UW`h`U`h"9]bgW`fÄb`\_i b[ Yb`]b  
XYf`Gd]Y`k`Y]gY`i bX`X]Y`B`chk`YbX][ \_Y]hž`XUg`Y][ YbY`Gd]Y`ni  
j`YfVYggYfb`ž`ghY\Yb`Y`X`c`W`Y]bXYi h][ `Ui`Z`XYf`5[ YbXU`"

8]Y`6YXYi hi b[ `XYg`8: 6!Dc`\_U`g`ZØf`XYb`J`Z@  
K`c`ZgVi f[

8Yf`8: 6!Dc`\_U`ghY`h`ZØf`j`]Y`Y` : i » VU`j`YfY]bY`]b`8Yi hgW`U`bX`Y]bY  
dfYgh][ YhfÄW`h][ Y`i`bX`c`Zh`Z]bUbn]Y`Y`A`Ö[ `]W`\_Y]h`XUfž`g]W`ØVYf  
X]Y`6i`bXYg`][ U`\]bUi`g`]b`XYf`2`ZZYbh]W`\_Y]h`ni`dfÄgYbh]YfYb``: Øf  
XYb`J`Z@`K`c`ZgVi f[ `U`h`X]YgYf`K`YhhVYk YfV`VYgcbXYfY`6YXYi hi b[ ž  
XU`XYf`J`YfY]b`&\$%)`XYb`Dc`\_U`[ Yk`]bbYb`\_cbbhY"8Yf`9fZc`[ `]a  
Dc`\_U`k`]f`\_h`g]W`dcg]h]j` `Ui`Z`X]Y`A`cfU`XYf`A`UbbgW`U`Zhi`bX`X]Y  
l`bhYfghØhni b[ `Xi`fW`X]Y` : Ubg`Ui`g`Y`XYg`X`f`ghfYVYb`X]Y  
K`c`ZgVi f[ Yf`XU`b`UW`ž`Y]bY`[ i`hY`@Y]ghi b[ `]a`Dc`\_U`ni`nY][ Yb`ž`i`a  
gck`c`\`X]Y`7`i`V`\]ghcf]Y`ni`k`ØfX][ Yb`U`g`Ui`W`i`a`XUg`; YZØ`\`XYg  
9fZc`[ gž`XUg`a`]h`XYa`Dc`\_U`g]Y[ `j`YfVi`bXYb`]ghž`ni`fØW`ni`\`c`Yb`"

9]b`k`Y]hYfYf`5gdY`\_h`]gh`X]Y`A`Ö[ `]W`\_Y]hž`g]W`[ Y[ Yb`j`YfgW`]YXYbY  
HYUa` g`Ui`g`i`bhYfgW`]YX`]W`Yb`@][ Yb`ni`a`YggYb"8]Yg`Vf]b[ h`b]W`h  
bi`f`X]Y`7`\U`b`W`Ui`Z`gdcfh]W`Yb`9fZc`[ `a`]h`g]W`ž`gcbXYfb`Ui`W`X]Y  
; Y`Y[ Yb`\Y]hž`9fZU`fi b[ Yb`ni`gUa` a`Y`b`ž`X]Y`]b`XYf`6i`bXYg`][ U  
bØh`n]W`gY]b`\_ÖbbYb" < ]ghcf]gW`[ YgY\Yb`\U`h`XYf`Dc`\_U`\`Ä`i`Z][  
, VYffUgW`i b[ Yb`i`bX`GYbgUh]cbYb`\Yfj`cf[ YVfUW`hž`k`Ug`XUg  
Hi`fb]Yf`VYgcbXYfg`Ui`ZfY[ YbX`a`UW`h`"

5`\_`hi`Y``Y`GhUh]gh]\_Yb`i`bX`@Y]ghi b[ gXUhYb

ϕ·XYf'U\_hi Y`Yb'GU]gcb`nY)[ h'XYf'J Z@K c`ZgVi f[ '[ Ya ]gWk hY  
9f[ YVb]ggY`j b'XYf'6i bXYg`][ U"6Y]'Y]bYa`6`]W\_`Ui Z'X]Y`GhUh]gh]\_Yb  
XYf'6i bXYg`][ U'&\$&' #&\$&( 'k ]fX'XYi h]Wk ž'XUgg'XYf'7`i V`g]Wk`j b  
XYf'cVYfYb`HUVY`Yb\`À`ZhY`VYk Y[ h"ϕ·XYf'YfghYb`<`À`ZhY`XYf  
GU]gcb`\_cbbhY`XYf'J Z@Y]b][ Y`VYa Yf\_Ybgk YfhY`G]Y[ Y`Yff]b[ Ybž  
X]Y`]\fY`GhAf\_Yb`ja`5b[ f]ZZi bX`j b'XYf'8YZYbg]j Y`nY][ Yb" `a`8: 6!  
Dc\_U`V`Y]Vh`YXcWk`XYf': c\_i g`XUfUi Zž'b]Wk h'bi f`X]Y`E i U`]Z\_Uh]cb  
ni f`b`ÀWk ghYb`F i bXY`ni`YffY]Wk Ybž`gcbXYfb`Ui Wk`XYb`H]hY`ni  
j YfhY]X][ Yb"

9]b`VYa Yf\_Ybgk YfhYg`GhUh]gh]\_i a`Ui g`XYf'j Yf[ Ub[ YbYb'GU]gcb  
nY)[ hž'XUgg`K c`ZgVi f[ 'a ]h'Y]bYf'6U`VYg]hnfUhY`j cb`ØVYf') ( 'i`ni  
XYb`HYUa g'a ]h'Y]bYa`Xca ]bUbhYb`Gd]Y`gh]'[ Y\`ØfhY"8]YgY  
GhUh]gh]\_Yb`j YfXYi h]Wk Ybž`k ]Y`k ]Wk h][ '6U`\_cbhfc`Y`i bX  
Gd]Y`[ YghU`hi b[ 'ZØf'XYb`J Z@g]bX"8YbbcWk`k Uf`XYf'Dc\_U`g]Y[  
&\$%)`Y]b`9f[ YVb]g`j cb`WYj YfYa`Gd]Y`i bX`XYf': À\][ \_Y]hž'Ui Wk`j b  
8fi W\_g]hi Uh]cbYb`YZZY\_h]j`ni`U[ ]YfYb"

## < YfUi gZc fXYfi b[ Yb`XYf`A Ub bgWk UZh

9]bY`<YfUi gZc fXYfi b[ 'ZØf'XYb`J Z@K c`ZgVi f[ 'VYghY`h'XUf]bž  
k À\`fYbX`XYf`[ YgUa hYb'GU]gcb`Y]bY`\_cbghUbhY`@Y]ghi b[ `ni  
nY][ Yb"8 Ug': Y\`Yb`j cb`?fYUh]j ]h`h'j b`Gd]Y`Ybž`k ]Y`Yg`[ Y[ Yb`Hi G  
?cV`Ybn`ni`VYcVUWk hYb`k Ufž`\_ØbbhY`g]Wk`Ub[ Zf]gh][ 'U`g  
dfcV`Ya Uh]gWk`Yfk Y]gYb" HfU]bYf'i bX`GhUZZ`ghY`Yb`j cf`XYf  
5i Z[ UVYž`j bX]j ]Xi Y`Y`GhAf\_Yb`XYf`Gd]Y`Yf`ni`ZØfXYfb`i bX  
[ `Y]Wk nY]h][ `X]Y`HYUa XmbUa ]\_`ni`j YfVYggYfb" Gd]Y`Yf`k ]Y`DUhf]W\_  
K ]a`a`Yfž`XYggYb`Hcf`ja`Dc\_U`gd]Y`Yb`hgWk Y]XYbX`k Ufž`a`ØggYb  
k Y]hYf\]b`Ui ZY]bYa` \c`Yb`B]j YUi`gd]Y`Ybž`i a`X]Y`A Ub bgWk UZh]b  
Yb`hgWk Y]XYbXYb`A ca`Yb`hYb`ni`i`bhYfghØhnYb"

8]Y`J Yf`Yhni b[ gUbZÀ`][ \_Y]h`k ]Wk h][ Yf`Gd]Y`Yf`\_Ubb`YVYbZU`g`Y]b  
\_f]h]gWk Yg`H\Ya U`XUfghY`Yb" HYUa gž`X]Y`Ui Z`Y]bY`\_Y]bY  
?UXYfVfY]hY`Ub[ Yk ]YgYb`g]bXž`Ui ZYb`; YZU`fž`j b`D\UgYb`j cb  
J Yf`Yhni b[ Yb`j b`]\fYf`@Y]ghi b[ gZÀ\][ \_Y]h`ghUf`\_Y]bni VfYWk Yb"  
9i dYfhYb`VYZØfk cfhYb`XU\`Yf`Y]bY`[ i hY`Gd]Y`YffchUh]cbž`i a`X]Y  
: ]hbYgg`i bX`: f]gWk Y`XYf`A Ub bgWk UZh`ØVYf`X]Y`[ YgUa hY`GU]gcb  
\]bk Y[ `ni`[ Yk À\`f`Y]ghYb"

8YhU]g

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