9]bVfi W\ 'VY]'8]U_cb]Y'BYi VfUbXYbVi f[.
Dc`nY]'gi W\ h'NYi [Yb

9]bVfi W\ 'VY]'XYf'8]U_cb]Y'BYi VfUbXYbVi f[. 'HÄhyf'ghY\`Yb
; Y`X'Ui g'?UggY"Dc`nY]'gi W\ h'NYi [Ybž'i a 'XYb': U`
Ui Zhi _`ÄfYb"

⊕`XYf'5Xc`d\!?'c`d]b[ !GhfU»Y'j]b'BYi VfUbXYbVi f[ 'gh`Y]b
j Yf\YYfYbXYf'9]bVfi W\]b`X]Y`FÄi a `]W\ \_Y]hYb`XYf'8]U_cb]Y
ZYgh[YghY`h'k cfXYb"'5a `A cbhU[a cf[Yb`VYa Yf\_hYb`A]hUfVY]hYfž
XUgg'9]bVfYW\Yf'[Yk U`hgUa `]b`XUg'; YVÄi XY`Y]b[YXfi b[Yb
k UfYb"'8Yf'9]bVfi W\ `U'h`b]W\ h'bi f`Z]bUbn]Y`Yž'gcbXYfb`Ui W\
Ya ch]cbU`Y`GW\ÄXYb` \]bhYf`UggYbž`XYbb`X]Y'8]U_cb]Y`YfZØ`h`Y]bY
k]W\h[Y`gcn]U`Y': i b_h]cb`]b`XYf`GhUXh"

8]Y`HÄhyf`\UhhYb`Y]bY': YbghYfgW\Y]VY`Y]b[YgW\`U[ Ybž'i a `Ni [Ub[
ni `Y]bYa `J Yf_Ui ZgfUi a `ni `Yf\U`hYb"@Ui h'5b[ UVYb`XYf`Dc`nY]
k i fXYb`a Y\YfYf`\i bXYfh'9i fc`Ui g`XYf`FY[]ghf]Yf_UggY
Ybhk YbXYh"'9]b`J cfZU``X]YgYf'5fh'gh`b]W\ h'bi f`Y]b`Z]bUbn]Y`Yf
J Yf'i ghž'gcbXYfb`Ui W\ `Y]b`GW\`U[` [ Y[ Yb`X]Y`⊕hY[f]hÄhXYf
C f[Ub]gUh]cbž`X]Y`g]W\ `ZØf`VYXØfZh][Y`A YbgW\Yb`Y]bgYhnh"
9]bVfYW\Yb`]b`gc`W\Y`9]b]W\hi b[Yb`fi Zhj ]Y`Y': fU[Yb`\]bg]W\h]W\
XYf`G]W\Yf\Y]hi bX`XYg`GW\i hnYg`gcn]U`Yf'8 ]YbghY`\Yfj cf"

8 YhU]`g`ni a `J cfZU``

8Yf'9]bVfi W\ `YfY][ bYhY`g]W\ `k Ä\YfYbX`Y]bYg`\_`Uf`XYZ]b]YfhYb
NY]hfUi a g`nk ]gW\Yb': fY]hU[ bUW\ a ]hU[ `i a `%)'l \f`i bX
A cbhU[a cf[Yb`i a `*.' \$'l \f"'8]Y`Dc`nY]\`Uh`VYfY]hg'9fa]hhi b[Yb
Y]b[Y`Y]hYhž`X]Y`i bhYf`XYa `J cfk i fZ`XYg`VYgcbXYfg`gW\k YfYb
8]YVghU\`g'[ YZØ\fh`k YfXYb"'Gc`W\Y`5bgW\`Ä[ Y`Ui Z`Uf]hUh]j Y
9]b]W\hi b[Yb`\UVYb`b]W\h'bi f`fYW\h]W\Yž'gcbXYfb`Ui W\ `gcn]U`Y

⇒ a d`\_]Uh]cbYbž'XU'g]Y'XUg'J YfhfUi Yb']b'gc`WXY'C f[Ub]gUh]cbYb
YfgWØhYfb' _ØbbYb"

8]Y'Dc`]nY]' \Uh'X]Y'6Yj Ø`_Yfi b['i a 'A]h\]'ZY'[YVYhYb" :XYfž'XYf
a Ø[`]WXYfk Y]gY']b'X]YgYa 'NY]hfUi a 'Yhk Ug'l b[ Yk Ø\ b`]WXYg]a
6YfY]WXYf'8]U_cb]Y!K Yf_ghÅhY'VYa Yf_h'\Uhž'k]fX'Ub[Y\U'hYbž
g]WXY'ibhYf'XYf'HY'YZcbbi a a Yf'\$' -) ') , &) &&('ni 'a Y'XYb"'8]Yg
nY][hž'k]Y'k]WXYh]['X]Y'Ni gUa a YbUfVY]h'nk]gWXYb'XYf'Dc`]nY]'i bX
XYb'6Øf[Yfb']ghž'i a 'J YfVfYWXYb'Ui Zni _`ÅfYb'i bX'ni _ØbZh]['ni
j Yf\]bXYfb"

G]WXYf\Y]hgVYXYb_Yb' i bX'[YgY`gWXYUZh`]WXY
J YfUbhk c fhi b[

8Yf'J c fZU`Vf]b[h'Ui WXY' fØ» YfY': fU[Yb'ni f'G]WXYf\Y]hj cb
gcn]U'Yb'9]bf]WXYhi b[Yb'Ui Z'K Å\ fYbX'XYf'[YgY`gWXYUZh]WXY'8fi W
Ui Zgc`WXY'C f[ Ub]gUh]cbYb'k ÅWghž'a i gg[ `Y]WXYnY]h]['Ui W
g]WXYf[YghY`h'k YfXYbž'XUgg'XYfYb'F Åi a `]WXY_Y]hYb'[YgWØhnh
g]bX"'8]Yg' _ØbbhY'VYXYi hYbž'XUgg'G]WXYf\Y]hg]bj Ygh]h]cbYb']b
: cfa 'j cb'VYggYfYb'GWXY`ØggYfb'cXYf'5`Ufa Ub`U[Yb'bc hk YbX][
k YfXYb"

6YgcbXYfg']b'XYf'U_hi Y`Yb'NY]hž']b'XYf'gcn]U'Y': YfYWXYh][_Y]hi bX
<]'ZY'ZØf'VYXØfZh][Y'DYfgcbYb']a ' : c_i g'XYf'8]g_i gg]cb'ghY\Ybž']gh
Yg'i a gc'k]WXYh][Yfž'XUgg'gc`WXY'9]bf]WXYhi b[Yb'i b[YghØf'h'UfVY]hYb
_ØbbYb" :XYf'8]YVghU\`Yb_hj cb'X]YgYf'k]WXYh][Yb'5i Z[UVY'UV
i bX'gWXYk ÅWXYh'X]Y'6Ya Ø\i b[Yb'XYf'Yb][Ybž'X]Y'g]WXY'hÅ[`]WXY'ZØf
UbXYfY'Y]bgYhnYb"'8]Y'8]U_cb]Y'i bX'Å\ b`]WXY'C f[Ub]gUh]cbYb
g]bX'c Zh'X]Y'YfghY'5b'Ui ZghY`Y'ZØf'A YbgWXYbž'X]Y']b'B ch'g]bXž'i bX
gc`hYb'j c f' ? f]a ]bU`]hÅh[YgWXYh'k YfXYb"

8Yf'9]bVfi WXY']b'XYf'8]U_cb]Y'BYi VfUbXYbVi f[`]gh'\_Y]b']gc`]YfhYf
: U`"' : b j]Y'Yb'GhÅXhYb'g]bX'_Uf]hUh]j Y'9]bf]WXYhi b[Yb']a a Yf
\Åi Z][Yf'N]Y'gWXY]VYb'j cb'? f]a]bY`Yb"'8 Ug'k YW_h
VYgcf[b]gYffY[YbXY': YXUb_Yb'ØVYf'X]Y'G]WXYf\Y]hj cb'gcn]U'Yb
Dfc'Y_hYbž'X]Y'XUfUi Z'Ub[Yk]YgYb'g]bXž'XUgg']\fY'F Yggci fW'b
i b[YgWXYa Å'Yfh'ni f'J YfZØ[i b['ghY\Ybž'i a ']\fYf'k]WXYh][Yb'5fVY]h
bUWXY[Y\Yb'ni _ØbbYb"

8]Y`Dc`nY]XfÅb[h`XUfUi Z`XUgg`X]Y`2 ZYbh]W_X]h]b`X]YgYf
5b[Y`Y[ Yb\Y]h`Ui Za Yf_gUa `V`Y]Vh`i bX`a Ò[`]W\_X`<]bk Y]gY`ni f
5i Z_`Àfi b[ `XYg`J YfVfYW\_XYbg`\Yf[]Vh`5i W`]b`XYb`gcn]U`Yb
A YX]Yb`k ]fX`i a `I bhYfghØhni b[ [ YVYhYb`"8Yf`5ddY``Ub`X]Y
; Ya Y]bgW_XUZh]gh`\_Uf. GW\_XØhYb`k]f`ni gUa a Yb`X]Y
9]bf]W_X hi b[YbžX]Y`i bg`U``Yb`ni [ i hY`ca a Yb`"

9]b`5i Zfi Z`ni f`K UW_X gUa _Y]h

8]YgYf`J cfZU``gc``hY`Y]b`K YW_fi ZUb`U``Y`gY]bžXUgg`XYf`GW_Xi hn
i bgYfYf`gcn]U`Yb`bgh]hi h]cbYb`j cb [fØ» hYf`6YXYi hi b[ `]gh`"8]Y
8]U_cb]Y`\Uh`b]W_Xh`bi f`X]Y`5i Z[ UVYž`A YbgW_XYb`]b`Bch`ni `Y`ZYbž
gcbXYfb`Ui W\_Xž`Y]bY`dcg]h]j Y`; Ya Y]bgW_XUZh`ni `ZØfXYfb`"≠fY
N]Y`ghfYV][ \_Y]hi bX`CdZYfb`]gh`VYk i bXYfbgk Yfhž`i bX`g]Y
j YfX]YbYb`i bgYfYb`GW_Xi hni bX`i bgYfY`I bhYfghØhni b["

Bi b`V`Y]Vh`ni `cZYbžXUgg`X]Y`Dc`nY]`nY]hbU\`XYb`cXYf`X]Y`HÅhYf
Z]bXYb`\_Ubbž`i a `Y]b`; YZØ\`XYf`G]W_XYf\Y]h`ni fØW`ni [YVYb`"
; `Y]W\_XnY]h][ `]gh`YXYf`9]bnY`bY`[YZfU[hž`k UW\_XgUa `ni `gY]b`i bX
<]ZY`ni `Y]ghYbž`k Ybb`Yg`i a `XYb`GW\_Xi hni bgYfY`gcn]U`Yb
9]bf]W_X hi b[Yb`[ Y`h`"8Ybb`YhnhYbX`]W\_X`g]bX`g]Y`Y]b`; fi bXdZY`Yf
i bgYfYf`; YgY``gW_XUZh`"

I fgUW_X Yb`ZØf`9]b VfØW_X Y`]b`gcn]U`Y

9]bf]W_X hi b[Yb

9]bVfØW_X Y`]b`gcn]U`Y`9]bf]W_X hi b[Yb`k ]Y`X]Y`8]U_cb]Y
BYi VfUbXYbVi f[`nY][ Yb`cZh`X]Y`Z]bUbn]Y``Yb`i bX`gcn]U`Yb
<YfUi gZcfXYfi b[Yb`Ui Z`XYbYb`j ]Y`Y`Cf[Ub]gUh]cbYb
[Y[YbØVYfghY\Yb`"Gc`W_XY`9]bf]W\_X hi b[ Yb`g]bX`\Ài Z][ `Ui ZGdYbXYb
Ub[Yk]YgYb`i bX`\UVYb`a Y]gh`VY[fYbnhY`A ]hhY`ZØf
G]W_XYf\Y]hga U» bU\`a Yb`"b`Y]bYf`NY]hž`]b`XYf`X]Y`gcn]U`Yb`8]YbghY
Ui Z[fi bX`XYf`ghY][YbXYb`@VYbg\U`hi b[g_cgYb`i bX`XYf
U``[Ya Y]bYb`k ]fhgW\_XUZh]W\_XYb`I bg]W_XYf\Y]h`i bhYf`8fi W`_ghY\Ybž
ghY][h`XUg`F]g]_c`ZØf`_f]a]bY``Y`5\_h]j ]hÅhYb`"

8]Y`9fY][ b]ggY`]b`BYi VfUbXYbVi f[ `g]bX`b]W\_Xh]gc`]Yfh`Y`b`]W_XY

JcfZÀ`Y`j]b`UbXYfYb`GhÀXhYb`VY`Y[Ybž`XUgg`gc]U`Y`9]bf]W\hi b[Yb
ni bY\ a YbX`N]Y`Y`j`cb`9]bVfYW\Yfb`g]bX"@Ui h`XYf`À\`f`]W\Yb
?f]a]bU`ghUh]gh]\_`XYf`Dc`nY]`k`YfXYb`ja`8i fW\gW\ b]hh`Yhk U`&\$`i
U`Yf`9]bVfØW\Y`j]b`gc]U`Yb`9]bf]W\hi b[Yb`i bX`Cf[Ub]gUh]cbYb
j`YfØVh"8]YgY`NU\`Yb`j`YfXYi`h`]W\Ybž`XUgg`Yg`Y]bYf`j`YfghÀf`hYb
5i Za Yf_gUa`\_Y]h`VYXUfZ`i`a`XYfUfh][ Y`?f]a]bU`]hÀ`h`ni`VY`\_Àa`dZYb
i bX`X]Y`G]W\Yf\Y]h`XYf`VYhfYi`hYb`DYfgcbYb`gck`jY`XYf`A`hUfVY]hYf
ni`[ Yk`À\`f`Y]ghYb"

F YU_h]cbYb`XYf`; Ya Y]bXY

8]Y`FYU\_h]cbYb`Ui`ZXYb`9]bVfi`W\`j]b`X]Y`8]U`_cb]Y
BYi VfUbXYbVi f[`g]bX`j]b`XYf`; Ya Y]bXY`Ui`h`J]Y`Y`5bk`c\`bYf`i`bX
l`bhYfghØ`hnYf`nY][ Yb`g]W\`VYgcf[ h`ØVYf`X]Y`G]W\Yf\Y]h`gc`W\Yf
9]bf]W\hi b[Yb"8]Y`8]U`_cb]Y`gY`Vgh`\Uh`VYfY]hg`Y]b`GhUhYa`Ybh
j`YfØZYb`h]W\hž`j]b`XYa`g]Y`j`\fY`8Ub`\_VUf`_Y]h`ZØf`X]Y`i`bhYfghØ`hni`b[
XYf`Dc`nY]`i`bX`XYf`; Ya Y]bXY`ni`a`5i`gXfi`W`_Vf]b[hi`bX
[`Y]W\`nY]h][`VYhcbhž`XUgg`gc`W\Y`JcfZÀ`Y`XUg`J`Yf`hf`Ui`Yb`j]b`gc]U`Y`
8]YbghY`[ YZÀ\`fXYb`_ØbbYb"

⊕`UbXYfYb`: À`Yb`j`cb`9]bVfØW\Yb`j]b`À\`b`]W\Y`9]bf]W\hi b[Yb
ki fXYb`cZha`U`g`⊕]h]Uh]j`Yb`[Y[fØbXYhž`i`a`XUg
G]W\Yf\Y]hgVYk`i`ggghY]b`j]b`XYf`; Ya Y]bXY`ni`ghÀf`_Yb" `Gc`W\Y
A`U`»`bU\`a`Yb`_ØbbYb`j`cb`XYf`⊕ghU`Uh]cb`VYggYfYf`6Y`Yi`W\hi`b[
Ub`[ YZÀ\`fXYhYb`C`fhYb`V]g`ni`f`l`a`gYhni`b[ `j`cb
BUW`VUfgW`UZh`gk`UW`Yb`fY]W\Yb"8]Y`6YXYi`hi`b[ `XYf
; Ya Y]bgW`UZh`ni`f`Df`Aj`Ybh]cb`gc`W\Yf`HUhYb`k`j]fX`ni`bY\`a`YbX
VYhcbhž`XU`g]Y`b]W\`h`bi`f`X]Y`G]W\Yf\Y]h`Yf\`Ø\`hž`gcbXYfb`Ui`W\`XUg
Ni`gUa`a`Yb[ Y\`Øf][`\_Y]hg[ YZØ\`ghÀf`_h"

?f]a]bU`ghUh]gh]\_Yb`j]b`8Yi`hgW\`UbX

8]Y`G]W\Yf\Y]hg`U[Y`ZØf`gc]U`Y`9]bf]W\hi b[Yb`j]b`8Yi`hgW\`UbX
YfZcfXYfh`Y]bYb`k`Y]hYfYb`6`]W`_Ui`Z`X]Y`U`_hi`Y`Yb
?f]a]bU`ghUh]gh]\_Yb"@Ui h`XYb`GhUh]gh]\_Yb`XYg
6i bXYg`\_f]a ]bU`Ua`hYg`f6?5Ł[UV`Yg]a``⋈\`f`&\$&&`Yhk`U`, (`\$\$\$
9]bVfØW\Y`j]b`K`c\`b\`Ài`gYf`i`bX`UbXYfY`; YV`Ài`XYž`k`Ug`Y]bYa
5bgh]Y[`j`cb`\*`ž`i`i`ja`J`Yf[ `Y]W\`ni`a`Jcf`U\`f`Yb`hgd]f]W\`h"8]YgY

NU\`Yb'gd]Y[ Y`b`b]W h'bi f`X]Y`Ni bU\`a Y`XYf`9]bVfØWY`]b`XYb
df]j UhYb`GY`hc`f`k]XYfž`gcbXYfb`Ui W`X]Y`DfcV`Ya Yž`X]Y`gcn]U`Y
9]bf]W h`i b[ Yb`i bX`[ Ya Y]bbØm][ Y`C f[Ub]gUh]cbYb`Yf`YVYb"

9]bVfØWY`]b`XYfUfh][Yb`9]bf]W h`i b[Yb`\UVYb`b]W h'bi f
a UhYf]Y``Y`5i gk ]f`_i b[Ybž`gcbXYfb`VYY]bZi ggYb`Ui W`XUg
a YbgW`]W Y`K c`\Yf[ Y\Ybž`]bgVYgcbXYfY`]b`XYb
8]Ybgh`Y]ghi b[ Ybž`X]Y`g]Y`UbV]YhYb"8]Y`DfÅj Ybh]cbggfhUhY[]Yb
g]bX`XU\Yf`Y]b`<Ui dhZc`_i g`ZØf`; Ya Y]bXYb`i bX
G]W Yf\Y]hgVY\`ØfXYbž`i a`ni`_ØbZh][Y`J cfZÅ``Y`ni`j Yfa Y]XYb`i bX
XUg`J YfhfUi Yb`]b`gcn]U`Y`8]YbghY`ni`ghÅf`_Yb"

8YhU]`g

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