

: Y`X_fYi n`]b`6]VYfUWk . l a ni [`ZØf`XYb
< cWk UggyfgWk i hn`YfZc`[fY]Wk j c``nc [Yb

9]b`9\YdUUf`Ui g`6]VYfUWk `dZY[h`gY]h`&, `ſ\fyb`Y]b
: Y`X_fYi nžXUg`bi b`bUWk `< cWk UggyfgWk i hna U» bU\ a Yb
j YfgYhnh`k i fXY"

⊕`XYf`GhUXh`6]VYfUWk `k i fXY`Y]b` \]ghcf]gWkYg: Y`X_fYi n`i a `Y]b][Y
A Yhf`j YfgYhnh`"8]YgY`A U» bU\ a Y`k Uf`bchk YbX][ž`bUWkXYa
i a ZUb[fY]WkY`< cWk UggyfgWk i hnUfVY]hYb`ja `6YfY]Wk`XYg
<U[YbVi WkYf`; fUVYbg`Xi fWk [YZØ\fh`k i fXYb"Ni j cf`ghUbX`XUg
?fYi n`]b`Y]bYf`_Y]bYb`GYb_Y`Ub`Y]bYa `@UbXk]fhgWkUZhk Y[
nk]gWkYb`6Yf[Yf\Ui gYb`i bX`K]bhYffYi hY"5b[Y\Øf][Y`XYf
_Uh\c`]gWkYb`?]fWkY`gck]Y`XUg`9\YdUUf`6YfhU`i bX`< Ubg`?]ZYf`Yž
X]Y`g]Wk`gY]h`%- - *`i a `XUg: Y`X_fYi n`_Øa a Yfbž`g]bX`]b`X]YgY
9bhgWkY]Xi b[`]bj c`j]Yfh"

8Y_Ub`GhYZUb`Fi ZgY[bYhY`j cf`k Yb][Yb`HU[Yb`XUg`?fYi n`Ub
gY]bYa `bYi Yb`GhUbXcfh`8 Ug`ZØf`X]Y`?]ZYf`Yg`VYXYi hgUa Y`?fYi n
k i fXY`%- - *`Ui Z[YghY`hž`bUWkXYa `g]Y`k Å\fybX`Y]bYf`K U`ZU\fh]b
GØXh]fc`ni `XYa `; `Ui VYb`[YZ] bXYb` \UhhYb"8]YgY`h]YZ[Y\YbXY
9fZU\fi b[` \Uhi bg`a ch]j]Yfhž`Y]b: Y`X_fYi n`ni `gh]ZhYb ž`Yf`Åi hYfh
<Ubg`?]ZYf`Y"Jcb`XYf`⇒XY`ni f`l a gYhni b[`k Uf`Yg`YXcWk`Y]b
`Ub[Yf`K Y[ž`XYf`Ui Wk`VØfc`fUh]gWkY`< ØfXYb`Y]bgWk`cgg"

8Yf`K Y[`ni a `bYi Yb`GhUbXcfh

8]Y`⇒XYž`Y]b`Y][YbYg: Y`X_fYi n`Ui Zni ghY`Ybž`hfUh]b`XYb`%- - \$Yf!
ſ\fyb`Ui Zž`bUWkXYa `?]ZYf`Yg`Y]bY`< c`nZ[i f`j cb`7\]ghi g`Ua
?fYi n`Yfk cfVYb` \UhhYb"8]YgY:][i f`]bgd]f]YfhY`X]Y`VY]XYbž`Y]bY
Y][YbYž`a Uf`UbhY`GhÅhhY`ZØf`XYb`; `Ui VYb`ni `gWkUZZYb" <]YfVY]
k Uf`Y]bY`Ni gUa a YbUfVY]h`a]h`XYf`GhUXh`6]VYfUWk `i bYf`Àgg`]Wk ž

XYbb`X]Y`5i ZghY`i b[`Y]bYg: Y`X_fYi nYg`YfZcfXYfh]b`8Yi hgW`UbX
nU`fY]WXY; YbY`a][i b[Yb" K]f`a i gghYb`Y]b`6Ui [Ygi W
Y]bFY]WYb`i bX`XYb`D`Uhn`cZZ]n]Y`dUW`hYb"l a`gcbgh]gh`XUg`b]W`h
[Ubñ`Ui W`k Ybb`k]f`b]W`hg`nU`Yb`a ØggYb`žYf`_`Åfh`<Ubg
?]ZYf`Y"

8Yf`GhUbXcfhk Uf`ghfUHY []gW`i [Yk`Å`h`ž`XU`Yf`Ub`Y]bYa
GdUn]Yfk Y[`]Y[hž`XYb`XUg`9`YdUUf`fY[Y`a`Å»][`bi`hnh`Gc`_`ÖbbYb
g]Y`Y]W`hbUW`XYa`F`YW`hYb`gY`Yb`i bX`XUg; fØb`i a`XUg`?fYi n
dZY[Yb" ð`XYb`d`fYb`a i gghYb`g]Y`X]Y`Cf][]bU`Z][i`f`Ui`g`<c`n`ž`X]Y
XYb`K]hhYfi b[Yb`b]W`h`ghUbX`Y`hž`Xi`fW`Y]bY`?i bghghc`Z]`Yfg]cb
YfgYhnYb" <Yi`hY`]gh`X]Y`<c`n`Z][i`f`]b`XYf`?]fW`Y`Gh`i`æ`gYZ`]b
6]f`_YbXcfZ`k]YXYfni`Z]bXYb"

8]Y`bYi`Y`l`a [YVi`b[`XYg: Y`X_fYi`nYg`]gh`bi`b`Z]gW`_`Yf[Yf]W`hYhž
k`Ug`VYXYi`hYhž`XUgg`bcW`Yhk`Ug`NY]hj`Yf[Y`hž`V]g`XUg; fUg
`YfUb`k`ÅW`gh"l`a`X]Y`K`UfhYnY]h`ni`ØVYfVfØW`_Ybž`_UVYb`X]Y
?]ZYf`Yg`Y]bYb`Vi`bhYb`GhfUi`»`GcbbYbV`i`a`Yb`i`bhYf`XUg`?fYi`n
[YghY`h`i`bX`d`UbYbž`]b`XYf`_Ø`YfYb`d`fYgnY]h`Y]bYb`6Ui`a`ni
dZUbnyb"9]bY`a`Ugg]j`Y`<c`n`VUb`_`_`ÅXh`a`]hh`Yfk`Y]Y`Y]bž`Xcfh`ni
j`Yfk`Y]Yb`i`bX`ni`VYhYb"

9]b`gW`Öb`Yf`Yf`GhUbXcfh

6Y]XYf`5Vgh]a`a`i`b[`XYg`bYi`Yb`GhUbXcfhg`k`Uf`X]Y`6]VYfUW`Yf
GhUXhj`Yfk`U`hi`b[`i`bhYfghØhnYbX`hÅh]["6Ui`VØf[Yfa`Y]ghYf
7`f]gh]Ub`?i`_`a`Ubb`VYa`Yf`_hY`VY]XYf`5VbU`a`Y`XYf
<cW`k`UggYfgW`i`hna`U»`bU`a`Yb.`_`W`Z]bXYž`XUgg`XUg: Y`X_fYi`n
`Yhnhgc[Uf`bcW`gW`ÖbYf`ni`f; Y`hi`b[`ca`a`h`U`g`Ua`U`hYb`D`Uhn"
8]YgY`A`Y]bi`b[`hY]h`<Yff`?]ZYf`Yž`XU`Yf`a`]h`gY]bYf: fUi`_`c`Z`hž
XUgg`Yhnhk`]YXYf`j`]Y`Y`GdUn]Yf[Åb[Yfž`æ[[Yf`cXYf`F`UXZU`fYf`XUg
?fYi`n`VYgi`W`Yb`i`bX`gY]bY`fi`_][Y`5i`gghfU`i`b[`[Yb]Y»Yb
_ÖbbYbž`k]Y`gY]h`%-`-`*`Ua`U`hYb`GhUbXcfh"

8Ug`9b[U[Ya`YbhXYg`9`YdUUfg`?]ZYf`Y`nYi [hj`cb`Y]bYf`h]YZYb
JYfVi`bXYb`Y]h`ni`a`i; `Ui`VYb`i`bX`ni`f; Ya`Y]bgW`UZ`h`9g`]gh`Y]bY
_`Y]bYž`UVYf`VYXYi`hgUa`Y; YghYž`X]Y`nY][hž`k]Y`k]W`h][
HfUX]h]cbYb`i`bX`C`fhY`XYg; `Ui`VYb`g`]b`Y]bYf`g]W`gh`ÅbX][

j YfÅbXYfbXYb`l a [YVi b[`V`Y]VYb"8 Ug: Y`X_fYi n']gh`b]W`h`bi f
Y]b`F`Y`_h`XYf`J`Yf[Ub[Yb`Y]hž`gcbXYfb`Ui W`Y]b`NY]W`Yb`XYf
<cZbi b[`i bX`XYg'; `Ui VYbg`ZØf`X]Y`Ni _i bZi"

8]Y`6YXYi hi b[`j cb` : Y`X_fYi nYb`]b`XYf F Y[]cb

: Y`X_fYi nY`UVYb`]b`XYf`ÅbX`W`Yb`?i`hi`f`8Yi hgW`UbXg`Y]bY
`Ub[Y`HfUX]h]cb" G]Y`g]bX`cZi`Ub`GhfU»Ybž`K`Y[Yb`cXYf`]b`XYf`B`Å`Y
j cb` : Y`XYfb`d`Uhm]Yfhi`bX`X]YbYb`]W`h`bi`f`U`g`fY`][`]ØgYg`Gma`Vc`ž
gcbXYfb`Ui W`U`g`NY]W`Yb`ZØf`XYb`GW`i`hn`XYg`@UbXYg`i`bX`XYf
; Ya`Y]bgW`UZh" `b`j`]Y`Yb`8`ØfZYfb`i`bX`Gh`XhYbž`XUfi`bhYf`Ui`W`
6]VYfUW`ž`g]bX` : Y`X_fYi nY`C`fhY`XYg'; YVYhg`i`bX`XYf`6Yg]bbi`b[
ZØf`X]Y`5bk`c`bYf`i`bX`6Ygi`W`Yf"8Yf`6fUi`W`ž`gc`W`Y`?fYi`nY
Ui`Zni`ghY`Ybž`[Y`h`ni`fØW`V]g`]bg`A`]hY`U`hYfž`U`g`g]Y`c`Zi`Ub`C`fhYb
XYf'; YZU`f`cXYf`XYg`i`a`Yfn]Y`Ybg`Yff]W`hYh`k`i`fXYbž`i`a`GW`i`hn
ni`V]YhYb"

⇒ `ÅbX`]W`Yb`F`Ui`a`Zi`b[]YfYb`g]Y`ni`XYa`U`g`@UbXa`Uf`_Yb" `Δ`f
9f`U`h]ghj`]Y`Yb`6Øf[Yfb`k`]W`h][ž`XU`g]Y`Y]b`GhØW`<Y]a`Uh`i`bX
; YgW`]W`hY`gma`Vc`]g]YfYb"8]Y`DZY[Y`X]YgYf`?fYi`nY`]gh`c`Zi`]b`XYf
<UbX`j`cb`Yb[U[]YfhYb`; Ya`Y]bXYa`]h[]YXYfbž`X]Y`g]W`i`a`X]Y
fY[Y`a`Å`][Y`K`Ufhi`b[`i`bX`XUg`Åi`»YfY`9fgW`Y]bi`b[gV]`X
_Øa`a`Yfb"8]Yg`nY][`h`g]W`Ui`W`VY]`XYb`?`]ZZYf`Ygž`X]Y`XUg`?fYi`n
gY]hj`]Y`Yb`Δ`fYb`VYhfYi`Yb"

5 _hi Y`Y`Y`<c W`k UggYfgW`i hna U» bU`a`Yb`i`bX XYfYb`9]bZi`gg

⇒ XYb`Y`hYb`Δ`fYb`UVYb`j`]Y`Y`; Ya`Y]bXYb`]b`8Yi`hgW`UbXž
XUfi`bhYf`6]VYfUW`ž`A`U»bU`a`Yb`ni`a`<cW`k`UggYfgW`i`hn
j`Yfgh`Å`f`_h"8]YgY`g]bX`cZi`Y]bY`FYU`_h]cb`Ui`Z`ni`bY`a`YbXY
K`YhhYfYi`hfYa`Y`i`bX`GhUf`fY[YbYfY][`b]ggYž`X]Y`Xi`fW`X`Yb
?`]a`Uk`UbXY`VYX]b[`h`g]bX"8]Y`GhUXh`6]VYfUW`_]b]Ygh]Yfhi]b
⇒ ZfUghfi`_hi`fdfc`Y`_hYž`i`a`VYfgW`k`Ya`a`i`b[Yb`ni`j`Yf`]bXYfb
i`bX`X]Y`G]W`Yf`Y]h`XYf`5bk`c`bYf`ni`[Yk`Å`f`Y]ghYb"8]Y`5fVY]hYb
Ua`<U[YbVi`W`Yf'; fUVYb`g]bX`HY`]X]YgYf`i`a`ZUggYbXYb

GhfUhy []Y"

8]Y`cWk UggYfVYX]b[hYb`5bdUggi b[Yb`_ÖbbYb`YXcW`Ui W`XYb
J Yf`i gh`cXYf`X]Y`J YfgYhni b[`hfUX]h]cbY`Yf`CV`Y`_hY`ni f` : c` [Y
`UVYbž`k]Y`Yg`VY]`XYa` : Y`X`_fYi n`XYf` : U`k Uf`"8Yb`bcW`k]fX`]b
6]VYfUW`XUfUi Z[YUW`hYhž`X]Y`_i`hi fY`Yb`i bX`\\]ghc`f]gW`Yb
9`Ya YbhY`XYg`GhUXhV]`XYg`ni`Yf`U`hYbž`k Ug`g]W`]b`XYf
gc`f[Z`h][Yb`D`Ubi b[`i bX`l a gYhni b[`gc`W`Yf`Dfc`Y`_hY
k]XYfgd]Y[Y`h"

8]Y`F`c`Y`j`cb` ; Ya Y]bgW`UZh`i`bX`=XYb]h`h`h`

8]Y`DZY[Y`XYg` : Y`X`_fYi nYg`gck]Y`X]Y`=h]Uh]j Yb`ni f
K]YXYf`YfghY`i b[`XYggYb`G]W`hVUf`_Y]h`Ub`Y]bYa`bYi Yb`GhUbXc`fh
nY][Yb`XUg`9b[U[Ya Ybh`XYf` ; Ya Y]bgW`UZh`"Gc`W`Y`Dfc`Y`_hY
ZÖfXYfb`b]W`h`bi`f`XUg` ; Ya Y]bgW`UZhg[YZÖ`ž`gc`bXYfb`gh`f`_Yb
Ui W`X]Y`c`_U`Y`=XYb]h`h`h` =`NY]hYb`j`cb`J Yf`AbXYfi b[ž`gY]`Yg
Xi fW`]bZfUghfi`_hi fY`Y`9bhk]W`_i b[Yb`cXYf`gc`n]U`Y`8mbUa]_Ybž
V`Y]Vh`XYf`F`ØW`_U`h`Xi fW`HfUX]h]cbYbž`k]Y`XUg`5i ZghY`Yb`i bX
DZY[Yb`j`cb` : Y`X`_fYi nYbž`Y]bY`_cbghUbhYf`5b`_Yf`ZÖf`X]Y
6Øf[Yf]bbYb`i bX`6Øf[Yf"

8 Ug`Ni gUa`a`Ybk]f`_Yb`j`cb`GhUXhj`Yfk`U`hi b[`i bX`Yb[U[]YfhYb
6Øf[Yfb`k]Y`XYb`?]ZYf`Yg`]gh`Y]b`6Y]gd]Y`ZÖf`X]Y`5fh`i bX`K`Y]gYž
k]Y`c`_U`Y`HfUX]h]cbYb`a`]h`a`cXYfbYb`5bZc`fXYfi b[Yb`]b`9]b`_Ub[
[YVfUW`h`k`YfXYb`_ÖbbYb`"8]YgY` : cfa`XYf`Ni`gUa`a`YbUfVY]h`hf`h`h`
a`U» [YV`]W`ni`Y]bYf`dcg]h]j Yb`K`U`fbY`a`i b[`XYf`GhUXh`i bX`ni
Y]bYa`ghUf`_Yb`Ni`gUa`a`Yb[Y`Öf][`_Y]hg[YZÖ`]b`XYf
; Ya Y]bgW`UZh`VY]"

8YhU]`g

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