

HfUi f][Yf'6UXYi bZU`. '+, !>Ä\ f][Yf'VY] 8]Yf\ U[Yb'j Yfghc fVYb

5a 'GhfUbX'j cb'8]Yf\ U[Yb'k i fXY'Y]b'+, !>Ä\ f][Yf'A Ubb 'YV'cg'Ui Z[YZ' bXYb"'8]Y'Dc`nY]'Yfa]hhY'h"

5a '&('5i [i gh&\$&(ž[Y[Yb%' .' \$'I \fž'YfY][bYhY'g]W\ Ua 'GhfUbX j cb'%, ' (+'8]Yf\ U[Yb'Y]b'hfU[]gW\ Yf'J cfZU`"'8]Y F Yhi b[g'Y]hghY`Y'XYg'@UbX_fY]gYg'J cfdca a Yfb!F Ø[Yb'Yf\]Y'h Y]bYb'5`Ufa 'ØVYf'Y]bY`YV'cgY'DYfgcbž'X]Y'Ui g'XYa 'K UggYf [Ync[Yb'k cfXYb'k Uf"'8]Y'gW\ bY`Yb'F YU_h]cbYb'XYf'6UXY[ÄghYž X]Y'XYb'A Ubb'Yb'hXYW_hYbž'k UfYb'X]Y'YfghY'<cZbi b[]b'X]YgYf _f]h]gW\Yb'G]hi Uh]cb"'5`g'X]Y'Dc`nY]'Y]bhfUZž'k Uf'YXcW\ 'VYfY]hg _`Ufž'XUgg'Yg'g]W\ 'i a 'Y]bYb'YfbghYb'BchZU`'\ UbXY'hY"

8]Y'6UXY[ÄghY'\UhhYb'X]Y`YV'cgYb'? ØfdYf'XYg'A UbbYgž'Yhk U' \$ V]g(' \$'A YhYf'j ca 'GhfUbX'Yb'hZYfbhž[YgY\Yb'i bX'gcZcfh'U'Ufa]Yfh' 9]bY'Ua 'GhfUbX'Ub'k YgYbXY'Yfnh]b'\UhhY'X]fY_hj Yfgi W\hž'XYb A Ubb'k]YXYfni VY'YVYbž'XcW\ 'hfchn'U`Yf'6Ya Ø\i b[Yb'_cbbhY'XYf BchUfnh'bi f'bcW\ 'XYb'HcX'XYg'+, !>Ä\ f][Yb'I f'Ui VYfg'Ui g'6Yf`]b ZYghghY`Yb"'8Yf'A Ubb'ZØ\fhY`_Y]bY'5i gk Y]gdUd]YfY'VY]g]W\ž'k Ug X]Y'≠Ybh]Z_Uh]cb'ni bÄW\gh'YfgW\k YfhY"

8YhU]`g'ni f'9fa]hh'i b[

B UW\ 'XYf'≠Ybh]Z_Uh]cb'ghY`hY'g]W\ \YfUi gž'XUgg'XYf'J Yfghc fVYbY Y]b'XYi hgW\Yf'6Ygi W\Yf'k Ufž'XYf'a]h'gY]bYb'5b[Y\Øf][Yb'Ub'XYb gW\ØbYb'GhfÄbXYb'8]Yf\ U[Ybg'j Yfk Y]'hY"'8]Y'Dc`nY]ž'X]Y'gW\ bY`ni a 'GW\Ui d'Uhn'[Yfi ZYb'k cfXYb'k Ufž'gdfUb['Y]bž'i a 'X]Y I a ghÄbXY'XYg'J cfZU`g'ni '_`ÄfYb"'8Yf'?f]a]bU'XUi YfX]Ybgh'XYg ?f]a]bU'_ca a]ggUf]Uhg'GhfU`gi bX'k i fXY'\]bni [Ync[Ybž'i a 'Y]b HcXYgYfa]hh'i b[gj YfZU\ fYb'Y]bni 'Y]hYb"'6]g'Ub['[]Vh'Yg'_Y]bY

5bnY]WYb`Z0f`Y]b` : fYa Xj YfgWxi `XYbž`k Ug`XUfUi Z`]bk Y]ghž`XUgg
Yg`g]W`a 0[`]WYfk Y]gY`i a `Y]bYb`hfU[]gWYb`6UXYi bZU``
`UbXY`hY"

8]Yf`U[Ybž`VY`_Ubbh`Z0f`gY]bY`]Xm``]gWYb`Ghf`AbXY`i bX`fi `][Yb
l f`Ui VgcfhYž`k Uf`ni `XYa `NY]hdi b`_h`a]hj]Y`Yb`6Ygi WYfb`[YZ0`hž
X]Y`XUg`gca a Yf`]WY`K YhhYf`[YbcggYb``8]YgYf`JcfZU```Uh
hfUi f][Yfk Y]gY`X]Y`Fi `Y`i bX`XUg`JYf[b0[Ybž`X]Y`XYf`GhfUbX
0V`]WYfk Y]gY`V]YhYhž`UVfi dhi bhYfVfcWYb``8]Y`0fh`]WYb
FYhi b[g_f`AžY`i bX`X]Y`Dc`]nY]k i fXYb`U`Ufa]Yfhž`i a
g]WYfni ghY``Ybž`XUgg`k Y]hYfY`6UXY[`AghY`b]W`h`i]b` ; YZU`f`[YfUhYb`
5i W`k Ybb`X]Y`[YbUi Yb`l a gh`AbXY`XYg`JcfZU``g`bcW`b]W`h
j c``gh`AbX][` [Y`_`Afh`g]bXž`g]bX`X]Y``c`_U`Yb`6Y`0fXYb`XUfUi Z
VYXUW`hž`X]Y`G]WYf`Y]h`XYf`GhfUbXVYgi WYf`ni ` [Yk `A`f`Y]ghYb
i bX`a 0[`]WY` ; YZU`fYb`Ub`XYb`Ghf`AbXYb`VYggYf`ni
_ca a i b]n]YfYb"

2 ZZYbh`]WY`G]WYf`Y]h`i bX`5i Z`_`Afi b[

⊕`5bVYhfUW`h`gc`WYf`HfU[0X]Yb`]gh`Yg`j cb`YbhgWY]XYbXYf
6YXYi hi b[ž`XUgg`gck c`\`9]b`Y]a]gWY`U`g`Ui W`Hci f]ghYb`0VYf
X]Y` ; YZU`fYb`XYg`6UXYbg`]bZcfa]Yfh`k YfXYb``⊕gVYgcbXYfY`gc``hY
X]Y`K U`fbY`a i b[`XYf`Y][YbYb` ; fYbnYb`i bX`XYf`U`_hi Y``Yb
K YhhYf`U[Y`VYhcb`h`k YfXYb``JcfZ`A``Y`k]Y`X]YgYf`_0bbYb`b]W`h`bi f
Xi fW`5i Z`_`Afi b[ž`gcbXYfb`Ui W`Xi fW`X]Y`j Yfgh`A`_hY`Df`AgYbn
j cb`FYhi b[g_f`AžYb`Ub`VY`Y]VhYb`6UXYcfhYb`a 0[`]WYfk Y]gY
j Yf`]bXYfh`k YfXYb"

8]Y`BUW`f]W`hYb`0VYf`XYb`JcfZU```UVYb`Ui W`8]g`_i`gg]cbYb`0VYf
X]Y`G]WYf`Y]h`Ub`Ghf`AbXYb`Ui`g[Y`0gh``6UXY[`AghY`g]bX`[i h
VYfUhYbž`]a a Yf`Ui Z`\fY`l a [YVi b[`ni `UW`hYb`i bX`j cfg]W`h][`ni
gY]bž`]bgVYgcbXYfY`]b` ; Yk `AggYfbž`X]Y`Ui Z[fi bX`ghUf`_Yf
Ghf`0a i b[Yb`i bX`g]W`_`AbXYfbXYf`K YhhYfVYX]b[i b[Yb`[YZ`A`f`]W`
gY]b`_0bbYb"

8]Y`]XYbh]Z]n]YfhYb`5b[Y`0f][Yb`XYg`JYfghc`fVYbYb`k i fXYb`0VYf
XYb`hfUi f][Yb`JcfZU```]bZcfa]Yfh``Gc`WY`A]hY]i b[Yb`g]bX`b]Y
Y]bZUW`ni `0VYfVf]b[Ybž`i bX`X]Y`6Y`0fXYb`VYa 0`Yb`g]W`ž`XYb

5b[Y\Öf][Yb]b`X]YgYf`gWk YfYb`NY]h'gc`j]Y`I bhYfghØhni b[`k]Y
a Ö[`]W`ni _ca a Yb`ni ``UggYb``8]Y`_ca a]ggUf]gWYb
9fa]hhi b[ghYUa`g`j Yfgi WYb`Yb[Yb`?cbhU_h`ni `XYb`6YhfcZYbYb
ni `U`hYbž`i a `a Ö[`]WY`5b`hk`cfhYb`i bX`I bhYfghØhni b[
Ubni V]YhYb"

⇒ @]W`h`X]YgYf`9fY][b]ggY`k]fX`Yf`_YbbVUfž`k]Y`k]W`h][`Yg`]ghž
G]WYf\Y]hgj`cf`_Y\fi b[Yb`k`Å`fYbX`XYg`6UXYbg`Yfbgh`ni `bY`a`Yb`
5i W`k`Ybb`g]W`XYf`J`cfZU``U`g`i b[`ØW`_]W`Yb`hdi`ddhž`gc``hY`Yf`U`g
; Y`Y[Yb`Y]h`ni`f`J`YfVYggYfi b[`XYf`G]WYf\Y]hga`U»bU`a`Yb`Ub
Ghf`ÅbXYb`[Ybi`hnh`k`YfXYb``Bi`f`Xi`fW`Y]bY`_c``Y`_hj`Y
5bghfYb[i b[`_Ubb`g]WYf[YghY``h`k`YfXYbž`XUgg`gc`W`h`fU[]gWY
J`cfZ`Ä``Y`]b`Ni`_i`bZ`ij`Yfa`]YXYb`k`YfXYb"

I a [Ub[`a]h`6UXYi bZÄ``Yb`]b`8Yi hgW`UbX

6UXYi bZÄ``Y`g]bX`]b`8Yi hgW`UbX`Y]b`Yfbghmi bY`a`YbXYg`DfcV`Ya`ž
]bgVYgcbXYfY`k`Å`fYbX`XYf`Gca`a`Yfa`cbU`hY``»XYg`»\`f`fY[]ghf]Yfh
X]Y`8Yi hgWY`@YVYbg!F`Y`hhi b[g!; YgY``gW`UZhifB`@F; Ě`nU`\`fY]WY
J`cfZ`Ä``Yž`VY]XYbYb`DYfgcbYb`]a`K`UggYf`]b`B`ch[YfU`hYb``⇒`»\`f`
&\$&&`k`i`fXYb`VY]gd]Y`gk`Y]gY`]bg[YgUa`h`-`-)`6UXYi bZÄ``Y
[Ya`Y`XYhž`VY]XYbYb`A`YbgWYb`XUg`@YVYb`j`Yf`c`fYb``J]Y`Y`X]YgYf
I`bZÄ``Y`_Ö`bbhYb`Xi`fW`d`f`Aj`Yb]j`Y`A`U»bU`a`Yb`c`XYf`VYggYfY
5i Z`Ä`fi b[`ØVYf`K`UggYfg]WYf\Y]hj`Yf\]bXYfh`k`YfXYb"

8]Y`8`@F; `gYhnh`g]W`]bhYbg]j`ZØ`f`X]Y`5i Z`Ä`fi b[`XYf`²`ZYbh]W`_Y]h
Y]bž`i`a`6Yk`i`gghgY]b`ZØ`f`; YZU`fYb`]a`K`UggYf`ni`gW`UZZYb``8`Uni
[Y\ÖfYb`GWk`]a`a`_i`fgYž`K`UggYfg]WYf\Y]hgi`bhYff]W`h`i`bX
?Ua`dU[bYb`ni`f`6YXYi`hi b[`XYg`F`Y`hhi b[ggW`k`]a`a`YfX]YbghYg"
Ni`XYa`Z`cfXYfh`X]Y`8`@F; `Y]bY`j`Yfgh`Å`f`_hY`Df`Ä`gYbn`j`cb
F`Y`hhi b[g`_f`Ä`ZhYb`Ub`Ghf`ÅbXYb`i`bX`6]bbYbgYYbž`]bgVYgcbXYfY`]b
XYb`<`Ui`dhfY]gYnY]hYbž`i`a`X]Y`G]WYf\Y]h`XYf`6UXY[`Ä`ghY`ni
[Yk`Å`f`Y]ghYb"

B`chZU``a`U»bU`a`Yb`i`bX`9fghY`<`]ZY`Ua
GhfUbX

⇒ a : U`Y`Y]bYg`6UXYi bZU`g`g]bX`UXÄei UhY`B chZU`a U» bU\ a Yb
i bYf`Ägg`]W`"K Ä\ fYbX`X]Y`gdY_hU_i `ÄfY`K]YXYfVY`YVi b[`Xi fW
ei U`Z]n]YfhYg`a YX]n]b]gW`Yg`DYfgcbU`cZh`X]Y`YhnhY`<cZZbi b[`]ghž
`]Y[h`XYf`GW`ØggY`ni f`YfZc`[fY]W`Yb`F`YUb]a Uh]cb`]b`XYb`A]bi hYb
bUW`Y]bYa `dchYbh]Y`Yb`9fhf]b_i b[gi bZU`"9g[]Vhj YfgW`]YXYbY
GW`f]hhYž`X]Y`gck c`6UXY[ÄghY`U`g`Ui W`F`Yhhi b[ggW`k]a a Yf
gcZcfh`Yf[fY]ZYb`gc`hYbž`i a `]b`Y]bYf`gc`W`Yb`G]hi Uh]cb`ni
\UbXY`b"

9fghY`<]`ZY`GW`f]hhY.

- DYfgcb`Ui g`XYa`K UggYf`\c`Yb.`GcZcfh][Y`F`Yhhi b[`XYf
VYhfcZZYbYb`DYfgcb`]gh`Yb`hgW`Y]XYbX"
- 5hYa`k`Y[Y`ZfY]a UW`Yb.`G]W`YfghY`Ybž`XUgg`b]W`hg`X]Y
5hYa`k`Y[Y`V`cW_]Yfh"
- <YfnXfi W_a UggU[Y`i bX`6YUha`i b[.`K`Ybb`_Y]bY
5ha`i b[`ZYgh[YghY`h`k]fXž`gc`hY`a]h`XYf`<Yfn!@ b[Yb!
K]YXYfVY`YVi b[`VY[cbbYb`k`YfXYb"
- Bchfi`Z`UVgYhnYb.`GcZcfh`Y]bYb`BchUfnh`fi ZYbž`i a
dfcZYgg]cbY`Y`<]`ZY`Ubni`ZcfXYfb"

→XYf`gc`hY`X]Y` ; fi bX`U[Yb`XYf`9fghYb`<]`ZY`_YbbYbž`i a `]a
BchZU`g`W`bY`i bX`Y`ZY`_hj`fYU[]YfYb`ni`_ÖbbYb`"8]Y`8@F ;
V]YhYh`fY[Y`a`Ä»][`GW`i`i b[Yb`Ubž`X]Y`Ui`ZX]Y`6YXØfZb]ggY`j`cb
GW`k]a a Yfb`i bX`6UXY[ÄghYb`ni [YgW`b]hhYb`g]bX`"

K`Y]hYfY`F`Y`Yj`Ub`hY`GhUh]gh]_Yb

Ni`gÄhn`]W`ni`XYb`VYfY]hg`Yfk`Ä`b`hYb`i bZU`ghUh]gh]_Yb`]gh`Yg
k]W`h][ž`Ui`ZX]Y`J`YfhY]i b[`j`cb`6UXYi bZÄ`Yb`bUW`5`hYfg[fi`ddYb
\]bni`k`Y]gYb`"9]bY`5bU`mgY`XYf`i bZU`j`Yf`Äi`ZY`nY][hž`XUgg`Ä`hYfY
A`YbgW`Ybž`k]Y`XYf`j`Yfghc`fVYbY`+,`!`Ä`f][Y`A`Ubb`Ui`g`8]Yf`U[Ybž
VYgcbXYfg`[YZÄ`fXYh`g]bX`"⇒`X`Yb`YhnhYb`⇒Ä`fYb`k`i`fXY
ZYgh[YghY`hž`XUgg`X]Y`5`hYfg[fi`ddY`XYf`ØVYf`*)`!`Ä`f][Yb`Y]bYb
g][b]Z]_UbhYb`Ni`k`UW`g`Ub`6UXYi bZÄ`Yb`Ui`Zk`Y]gh`"8]Yg`_Ubb`Ui`Z
j`YfgW`]YXYbY` : U`hc`fYb`ni`fØW_[YZØ`f`h`k`YfXYbž`XUfi`bhYf
[Ygi`bX`Y]h`]W`Y`9]bgW`fÄb_i b[Yb`i bX`a`Ub[Y`bXY
GW`k]a a ZÄ`][`_Y]h"

: Øf`Y]bY`dfÀj Ybh]j Y`GhfUHY []Y`]gh`Yg`YbhgWXY]XYbXž`gc`WXY
GhUh]gh]_Yb`ni `YfZUggYb`i bX`YbhgdFYWXYbXY`A U» bU\ a Yb`ni f
5i Z_`Àfi b[`i bX`G]WXYf\Y]h`ni `Ybhk]W_Y`b``8]Y
G]WXYf\Y]hgVY\`OfXYb`i bX`Cf[Ub]gUh]cbYb`k]Y`X]Y`8@F; `ghY\Yb`]b
ghÀbX][Ya `?cbhU_hž`i a `X]Y`G]hi Uh]cb`ni `UbU`mg]YfYb`i bX
[Y[YVYbYbZU`g`dfÀj Ybh]j Y`Dfc[fUa a Y`ni `Ybhk]W_Y`b"

8]Y`9fZU\fi b[`i bX`X]Y`[YgUa a Y`hYb`8UhYb`Ui g`j Yf[Ub[YbYb
JcfZÀ`Yb`g]bX`j cb`i bgW\ÀhVUfYa `K Yfhž`i a `ni _ØbZh][Yb
HfU[ÒX]Yb`j cfni VYi [Yb``5b`YfghYf`GhY``Y`ghY\h`\]YfVY]`X]Y
5i Z_`Àfi b[`i bX`GW`i `i b[`XYf`6Yj Ò`_Yfi b["

8YhU]`g

6Ygi WXYb`G]Y`i bg`Ui Z.`X]Y!bUW\ f]W\ hYb`"bYh