

J ca 'F ØW_YbdfcV`Ya 'ni f'; c`Xa YXU]`Y.
H]a '5l Yfg`hf]i a d\U`Yf`9A !5VYbhYi Yf

H]a '5l Yf'j ca 'GJ`BYdhi b'5UWYb`[Yk]bbh'VY]'XYf`9A 'jb
Dc`Yb`X]Y`A]l YX!; c`Xa YXU]`Y`hfchn`J Yf`Yhni b[gdfcV`Ya Yb"

H]a '5l Yfž`Y]b`%+!`Å\`f][Yf`K UggYfgdf]b[Yf`XYg`GJ`BYdhi b'5UWYbž
\Uh`VY]'XYf`9i fcdUa Y]ghYfgWUZh'i b`F nYgnc k ž`Dc`Ybž`a]hgY]bYa
HYUa `c`Y[Yb`C`Y`F`Ög`Yf`i bX`XYb`UbXYfYb`5h\`YhYb`B]bU`6Yf[Yf
i bX`9a]`m`GhY]b\U[Yb`Y]bY'; c`Xa YXU]`Y`]a `A]l YX!K Yhh_Ua dZ
[Yk cbbYb`"8]YgY`@Y]ghi b[]gh`VYgcbXYfg`VYa Yf`Yb`gk Yfhž`XU
5l Yf`_i fn`j cf`XYa `K YhhVYk YfV`a]h`F`ØW_YbdfcV`Ya Yb`ni
_Åa dZYb`\UhY`" J YfXfY\hž[YnYffh`VY]a `Gdf]b[Ybž]W`k i gghY`Yg
Ui W`b]W`h`gc`fYW`hž`UVYf`]W`a i gghY`Ui Z`YXYb` : U`Yfgh`Y]ba U`
Ui Zg`Gdf]b[Yb`j Yfn]W`hYb` ž`gW`]`XYfhY`Yf`gY]bY`UbZ`Ab[`]W`Yb
GW`k]Yf][_Y]hYb"

B UWXYa '5l Yf`Ua `N]Y`cfh`Ub[Y`_ca`a Yb`k Ufž`a i gghY`Yf`a Y`fYfY
HU[Y`a]h`GhUV]`]gUh]cbgØVi b[Yb`i bX`D`mg]ch`YfUd]Y`j YfVf]b[Ybž
VYj cf`Yf`k]YXYf`Ub`XYb`Gdfi b[VfyhhYfb`ghY`Yb`_cbbhY`"8 Ug
A]l YX!HYUa ž`VYghY`YbX`Ui g`5h\`YhYb`XYf`5!`i bX`6!`š [YbXž
nY][hY`VYY]bXfi W`YbXY`9]bnY`gdfØb[Y`gck]Y`GmbW`fcbU`h]cbYb
j ca `%!A YhYf!6fyhh`i bX`" !A YhYf!Hi fa "

I bYfk UfhYhY`K YhhVYk YfVgYfZc`[Y

⇒ J Yf`Ui Z`XYg`K YhhVYk YfVg`ghY`hY`g]W`Y`YfUi gž`XUgg`X]Y
XYi hgW`Y`A UbbgW`UZh`UbZUb[g`]b`hYf`XYa `i`_fU]b]gW`Yb`HYUa
ni fØW`_U["5l Yfž`XYf`Ui Z[fi bX`gY]bYf'; fÖ»Y`i bX`gY]bYg'; Yk]W`hg
VYj cfni [h`ZØf`X]Y`9]bnY`gdfØb[Y`Ui g[Yk Å`h`k i fXYž
VYY]bXfi W`hY`XUg`Di V`_i a `i bX`X]Y`š fcYb`VY]`gY]bYb`GdfØb[Yb`
GY]bY`<`Ö\Ydi b`_hY`k UfYb`Y]b`XfY]Y]b\U`VZUW`Yf`GU`hc`j cfk`Åfhgž

XYf'XUg'HYUa`V]g'Ui Z'Y]bYb'Di b_h'Ub`X]Y`ZØ\fybXYb'i`_fU]bYf
`YfUbZØ\fhY" `b`Y]bYa`gdUbbYbXYb`:]bU`Y`gcf[hYb`X]Y`GmbW fcb!
8UfV]Yhi b[`j`cb`@YXYfYf#f`Ög`Yf'a`]h`Y]bYa`Z]bYb`Gdfi b[`ZØf`XYb
YbhgW`Y]XYbXYb'Di b_h`z`XYf`XYb`8Yi hgW`Yb`XYb`YfghYb`D`Uhn`a`]h
'`(-`ž&\$`Di b_h`Yb`g]W`YfhY"

K`]f`\UhhYb`i`bg`j`cf\Yf`gW`cb`Yhk`Ug`Ui`g[`YfYW`bYh`i`bX`Ui`Z`Y]bY
A`YXU]`Y`[`Y\c`Zh`ž`Äi`»`YfhY`5I`Yf"8`Yf`K`Yh`_Ua`d`Zk`Uf`ZØf`]\b`j`cb
[`Ya`]gW`hYb`];`Y`ZØ\`Yb`[`YdfÄ[`h`z`XU`Yf`]b`Ub`XYfYb`8]gn`d`]bYb`ž`]b
XYbYb`Yf`YVYbZU`g`hY`]bU`a`ž`b]W`h`XUg`DcX]i`a`YffY]W`Yb`_c`b`bhY"
`a`J`cf`_Ua`d`Z`ni`a`!`!A`YhYf!6fYh`Ub`XYhY`Yf`Ui`Z`D`Uhn`j`]Yf`i`b`X
VfUW`hY`]a`:]bU`Y`bi`f`XYb`g`YW`ghYb`D`Uhn`b`UW`<`Ui`gY"5i`W`VY]a
Hi`fa`gdf]b[`Yb`k`Uf`XUg`9f[`YVb]g`a`]h`Y]bYa`nk`Ö`ZhYb`D`Uhn
YbhÄi`gW`Yb`Xž`k`Ug`Ui`Z`gY]bY`F`ØW`_Yb`VYgW`k`Yf`XYb
ni`fØW`_ni`ZØ\fyb`k`Uf"

N]Y`Y`i`bX`Ni`_i`bZhgdYfgdY`_h]j`Yb

5I`Yfž`XYf`gY]h`g]YVYb`š\`fYb`ZØf`XYb`GJ`B`Ydhi`b`5UW`Yb`gdf]b[`hž
\`Uh[`Yd`Ub`hž`Ui`W`b`UW`gY]bYf`gdcfh]W`Yb`?`Uff]YfY`X]Y
<`YfUi`gZcfXYfi`b[`]a`K`UggYfgdf]b[`Yb`Zcfhni`gYhnYb"9f`]gh[`YVØfh]
Ui`g`9f`ZhghUXhi`bX`\`Uh]b`?`Ö`b`a`]h`XYa`Gdcfh`VY[`cbbYbž`VYj`cf`Yf
bUW`5UW`Yb`k`YW`gY`hY`ž`k`c`g]W`VYggYfY`HfU]b]b[`gVYX]b[`i`b[`Yb
VchYb"Ä`]h`XYa`VYj`cfghY\YbXYb`K`YW`gY`]b`XYb`GYb]cfYbVYfY]W
i`bX`XYa`bU\YbXYb`%,`";`YVi`fhghU[`V`]W`h`5I`Yf`Ui`Z`X]Y
ni`_ØbZh[`Yb`<`YfUi`gZcfXYfi`b[`Yb"Ä`W`ZfYi`Y`a`]W`gW`cb`gY`f`Ui`Z
X]Y`š`[`YbX!K`Y`ha`Y]ghYfgW`UZh"b`UW`Ä`c`bhYU`k`]YXYf`gc`Y]bY
hc`Y`@cWWh]cb`ž`gU[`hY`Yf'a`]h`J`cfZfYi`XY"

:`Øf`_ca`a`YbXYb`B`cj`Ya`VYf`d`Ub`h`5I`Yf`gY]bY`b`Yi`Y`Gdfi`b[`gYf]Y
VY]a`i`U!`?`]b[`Yf!7i`d`]b`5UW`Yb`ni`d`fÄgYbh]YfYb"9f`\`Uh]g]W
VYfY]hg`ZØf`X]Y`š`[`YbX!K`Y`ha`Y]ghYfgW`UZhYb`]b`F]c`XY`š`bY]fc
ei`U`]Zn]Yfhi`bX`a`ÖW`hY`VY]`X]YgYb`K`Yh`_Äa`d`Z`Yb`a`]h`gY]bYb
bYi`Ybž`gW`k`]Yf][`YfYb`GdfØb[`Yb[`Ä`bnYb"8]Y`b`Yi`Yb`GdfØb[`Y
nY][`Y`]W`UVYf`Yfghž`k`Ybb`g]Y`Ui`W`f]W`h][`g]hnYb`ž`gc`5I`Yf"

5I`Yf`\`Uh]g]W`VYfY]hg`Ua`V]h]cb]YfhY`N]Y`Y`[`YgYhnh"b]W`h`ni`Y`hnh
hfÄi`a`h`Yf`j`cb`Y]bYf`HY]`bU`a`Y`Ub`XYb`C`ma`d]gW`Yb`Gd]Y`Yb

&\$&, 'j b '@c g'5 b[Y`Yg" 9g'k]fX`Y]bY`[fc»Y`<YfUi gZcfXYfi b[žXU
]W`'b]W`h'bi f`XUg'6fYhž'gcbXYfb`Ui W`'XYb`Hi fa`'gdf]b[Y" Jcf`XYa
Hi fa` \UVY`]W`'j]Y`F YgdY`_h'bUW`'Y]b][Yb`J Yf`Yhni b[Yb` ž[YghUbX
Yf" `GY]b`gdcfh]W`Yg'9b[U[Ya` Ybh'bVYb`XYa`'Ghi X]i a`'gc`]\a
\Y`ZYbž'gY]bYb`[fc»Yb`HfUi a`'ni`'j Yfk]f`_]W`Yb"

8 Yf`K Y[`ni`'XYb`C`ma`d]gW`Yb`Gd]Y`Yb

8]Y`@Y]ghi b[Yb`j cb`H]a`'5l Yf`i bX`'gY]b`A i hž'hfchn
[Ygi bX`Y]h]W`Yf`F ØW`_gW`_À[Y`k`Y]hYfni`_Àa`dZYbž'g]bX
]bgd]f]YfYbX"': Øf`'† b[Y`5h`YhYb`k]fX`Yf`ni a`'JcfV]`Xž`k]Y`a`Ub
a`]h`K]Xf][`_Y]hYb`i a`[Y`h`i bX`XYb`bcW`'gY]bY`gdcfh]W`Yb`N]Y`Y
j YfZc`[h`'8]Y`b`ÀW`ghYb`A`cbUhY`k YfXYb`Yb`hgW`Y]X`YbX`'gY]b`ZØf
gY]bY`9bhk]W`_i b[`i bX`'gY]bY`ni`_ØbZh][Yb`K`Yh`_Àa`dZY"5l Yfg
F Y]gY`]b`XYf`K`Y`h`XYg`K`UggYfgdf]b[Ybg`V`Y]Vh`gdUbbYbXž`i bX
gY]bY`6YghfYVi b[Yb`_ØbbhYb`]\b`Y]bYg`HU[Yg`Ui ZX]Y`[fc»Y
c`ma`d]gW`Y`6Ø\bY`ZØ\ fYb"

< YfUi gZcfXYfi b[Yb`]a`'K`UggYfgdf]b[Yb

K`UggYfgdf]b[Yb`[Y`\Øfh`ni`'XYb`Ub`gd`fi W`gj c`ghYb`GdcfhUfhYbž`X]Y
hYW`b]gW`Y`Df`Àn]g]cbž`_ØfdYf`]W`Y`:]hbYgg`i bX`'a`YbhU`Y`Gh`Àf`_Y
YfZcfXYfb"5h`YhYb`k]Y`H]a`'5l Yf`a`ØggYb`g]W`'b]W`h'bi f
_ØfdYf`]W`Yb`<YfUi gZcfXYfi b[Yb`ghY`Ybž'gcbXYfb`Ui W`
dgmW`c`c`[]gW`Yb"8]Y`5b[gh`j`cf`J`Yf`Yhni b[Yb`]gh`U`[Y[Ybk`Àfh][ž
]bgVYgcbXYfY`bUW`'9fZU`fi b[Yb`k]Y`XYb`j`cb`5l Yf" `C`Zh`a`ØggYb
Gdf]b[Yf`hfc`hn`d`l`mg]gW`Yf`6YgW`k`YfXYb`k`Y]hYfhfU]b]YfYb`i bX`Ub
K`Yh`_Àa`dZYb`hY]`bY`a`Ybž`k`Ug`ni`g`Àh`n`]W`Yb`8`fi`W`_YfnYi`[h`

8`Ug`HfU]b]b[`i`a`ZUggh`nU`fY]W`Y`9`Ya`YbhYž`j`cb`?`fUZh`i`bX
:`YI`]V`]h`À`ghfU]b]b[`V]g`]\b`ni`gdYn]Z]gW`Yb`Gd`fi`b[hYW`b]_Yb" `⊕
XYf`F`Y[Y`k`]fX`XUg`HfU]b]b[`]b`D`UgYb`i`bhYfhY]`hž`i`a`X]Y`5h`YhYb
cdh]a`U`Ui`Z`K`Yh`_Àa`dZY`j`cfni`VYfY]hYb`i`bX`[`Y]W`nY]h][
J`Yf`Yhni b[Yb`ni`'j`Yfa`Y]X`Yb" `⊕`j`]Y`Yb`Gh`À`X`h`Ybž`X`Ufi`bhYf`Ui`W`
5`UW`Ybž`\UVYb`Gdcfh]`YfV`À`b`X`Y`VYgcbXYfg`[`i`h`Ui`g[YghUhhYhY
HfU]b]b[ga`Ò[`]W`_Y]hYb`[YgW`UZZYbž`i`a`'XYb`5h`YhYb`]X`Y`U`Y
6`YX]b[i`b[Yb`ni`'V]YhYb"

K]fhgW\ UZh`]W\ Y`I bhYfghØhni b[`i bX Gdcbgcf]b[

8]Y`Z]bUbn]Y`Y`I bhYfghØhni b[`j cb`BUW\k i W\gUh\`YhYb`]gh
i bYf`Ågg`]W\ž i a `]`bYb`X]Y`YfZcfXYf`]W\Yb`HfU]b]b[gfYggci fW\ b
i bX`K Yhh_Ua dZa`Ò[`]W\`Y]hYb`ni `V]YhYb`"Gdcbgcf]b[`ca a h`cZh
j cb`Gdcfhj YfV`ÀbXYbž`c`_U`Yb`I bhYfbY\ a Yb`i bX`[fc» Yb
Gdcfha Uf`_Ybž`X]Y`g]W\`ZØf`X]Y` : ÒfXYfi b[`† b[Yf`HU`YbhY
Yb[U[]YfYb`"8Yf`GJ`BYdhi b`5UW\Yb` \Uh`VY]gd]Y`gk Y]gY`]b`XYf
J Yf[Ub[Yb`Y]h`Xi fW\`DUf`hbYfgW\UZ`Yb`a`]h`fY[]cb`U`Yb`GdcbgcfYb
gck]Y`Xi fW\` : ÒfXYfdfc[fUa` a Y`XYg`8Yi hgW\Yb`C`ma`d]gW\Yb
GdcfhVi bXYg`fBCG6ŁI bhYfghØhni b[`Yf`U`hYb`"

9]b`k Y]hYfYf`k]W\h][Yf`5gdY`_hg]bX`X]Y`F Y]gY`_cghYbž`X]Y`VY]
]bhYfbUh]cb`U`Yb`K Yhh`Àa dZYb`gW\ bY`UbghY][Yb`_ÒbbYb`" <]Yf`]gh
Y]bY`?ca`V]bUh]cb`Ui`g`ÒZYb`h]W\Yf`i bX`df]j UhYf` :]bUbn]Yfi b[`cZh
bch`k YbX][ž i a `HU`YbhY`k]Y`5I Yf`Ui`Z`X]Y`]bhYfbUh]cb`U`Y`6Ø`bY`ni
Vf]b[Yb`"8]YgY`I bhYfghØhni b[`hf`À[h`XUni`VY]ž`XUgg`5h`YhYb`g]W\
Ui`Z]\fY`@Y]ghi b[`cbnYbhf]YfYb`_ÒbbYbž`c`bY`g]W\`ni`g`Àh`n]W\`i`a
Z]bUbn]Y`Y`6Y`Ughi b[Yb`_Øa`a`Yfb`ni`a`ØggYb`"

K Yhh_Ua dZghUh]gh]_Yb`i bX`9fZc`[Y`XYf XYi hgW\Yb`K UggYfgdf]b[Yf

8Yi hgW\`UbX`\Uh`Y]bY`Ub[Y`i bX`YfZc`[fY]W\Y`HfUX]h]cb`]a
K UggYfgdf]b[Yb`"6Y]`XYb`Y`h`hYb`C`ma`d]gW\Yb`Gd]Y`Yb`&\$&%
\UVYb`X]Y`XYi hgW\Yb`K UggYfgdf]b[Yf`VYa`Yf`_Ybgk`YfhY
@Y]ghi b[Yb`[YnY][hž]bgVYgcbXYfY`]a`[Ya`]gW\hYb
GmbW\fc`bk Yhh_Ua dZž`k`c`XUg`HYUa`Y]bY`G]`VYfa`YXU]`Y`[Yk`Ubb`"
GhUh]gh]_Yb`nY][Ybž`XUgg`8Yi hgW\`UbX`ØVYf`X]Y`ž\`fY`\]bk`Y[
_cbghUb`h`A`YXU]`Yb`VY]`]bhYfbUh]cb`U`Yb`K Yhh`VYk`YfVYb`Yffi b[Yb
\Uhž`k`Ug`X]Y`\c`Y`E`i`U`]h`À`h`XYg`HfU]b]b[g`i`bX`X]Y`gdcfh]W\Y
9b`hk]W`_i b[`]a`BUW\k i W\gVYfY]W\`i bhYfghfY]W\`h`"

ž\`f	9fY][b]g	A`YXU]`Yb
&\$&%	C`ma`d]gW\Y`Gd]Y`Y	%`G]`VYf`fb`]l`YX GmbW\fc`bŁ

&\$%-	K A 'b'; k Ub[↑	&'; c`Xž%'G]`VYf
&\$%,	9A 'b'; `Ug[ck	''; c`Xž&'G]`VYf

8]YgY`9fZc`[Y`g]bX`b]W\h`bi f`Z0f`X]Y`5h\`YhYb`j cb`6YXYi hi b[ž
 gcbXYfb`hfU[Yb`Ui W\`ni f`Dcdi `Uf]hÅh`XYg`Gdcfhg]b`8Yi hgW\`UbX
 VY]"`BUW\k i W\gUh\`YhYb`k]Y`H]a `5I Yf`dfcZ]h]YfYb`j cb`X]YgYf
 dcg]hj] Yb`FYgcbUbnž`XU`g]Y`Y]bY`[f0» YfY`G]W\hVUf`_Y]hi bX`XUa]h
 Ui W\`a Y`f`I bhYfgh0hni b[`Yf`U`hYb"

8YhU]`g

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