

Nk Y]`B]YXYf`ÀbXYf`k Y[Yb`8fc[Yb\UbXY`
bUW\`FcgYb\Y]a Yf`HcXYgZU```Ub[Y_`U[h

⇒ a : U`` GW\ bYYghi fa `Yf\YVh`X]Y`7mVYfWf]a Y!NYbhfU`ghY``Y
6UmYfb`5b_`U[Y`[Y[Yb`nk Y]`B]YXYf`ÀbXYf`k Y[Yb
8fc[Yb\UbXY`g"

8]Y`NYbhfU`ghY``Y`7mVYfWf]a Y`6UmYfb`\`Uh`Yhnh`Yfbgh\UZhY`GW\ f]hhY
[Y[Yb`X]Y`8fc[YbgnYbY`]a `Ni gUa a Yb\Ub[`a]h`XYa : U``
GW\ bYYghi fa `i bhYfbca a Yb" `b`Y]bYa `_ca d`YI Yb
9fa]hh`i b[g_cbhYI h`g]bX`nk Y]`B]YXYf`ÀbXYf`Ub[Y_`U[h`k cfXYbž
X]Y`g]W\`k Y[Yb`XYg`VUbXYba `À»][Yb`< UbXY`g`a]h
6Yh`Ài Vi b[ga]hh`Y`b`j YfUbhk cfhYb`a ØggYb" `8]YgY`9bhk]W_`i b[Yb
g]bX`Y]b`X]fY_hYg`9f[YVb]g`j`cb`Ub[k]Yf][Yb`i bX`]bhYbg]j Yb
9fa]hh`i b[YbžX]Y`a Y\ fYfY`6Y\ØfXYb`VYhY`][h\UVYb`i bX`X]Y`g]W\
bUW\`Y]bYa `hfU[]gW\Yb`JcfZU``]a `X\ f`&\$&%]b`FcgYb\Y]a
Yf[YVYb`\UVYb"

⇒ a `5df]`&\$&%k Uf`Y]b`hfU[]gW\Yf`HcXYgZU``Y]bYg`(`(!`À\ f][Yb
A UbbYg`i]b`FcgYb\Y]a `XYf`5i g[Ub[gdi b_h`ZØf`X]Y`9fa]hh`i b[Yb"
9f`k Ufž`i bhYf`UbXYfYa ž`Ui Z[fi bX`Y]bYf`?c_U]b!`bhcI]_Uh]cb
j YfghcfVYbž`i bX`X]Y`XUfUi Z]b`Xi fW\ [YZØ\fhYb`9fa]hh`i b[Yb
Yf[UVYbžXUgg`Yf`gY]bY`8fc[Yb`ØVYf`Y]bY`gdYn]Y``Y`K YVg]hY
VYghY``h\UhhY" `8]YgY`9f_Yb`bh]ggY`ZØ\fhYb`X]Y`9fa]hh`Yf`X]fY_h`ni f
NYbhfU`ghY``Y`7mVYfWf]a Y`6UmYfbž`k`c`j`cb`C_hcVYf`&\$&%Ub`Y]bY
i a ZUggYbXY`i bhYfgi W\i b[`[YghUfhYh`k i fXY"

9fa]hh`i b[Yb`i bX` : YghbU\ a Yb

8]Y`Ni gUa a YbUfVY]h`nk]gW\Yb`j YfgW\]YXYbYb`6Y\ØfXYb`k]Y
XYa `6UmYf]gW\Yb`@UbXYg_f]a]bU`Ua h`fb`@?5łž`XYa
Nc``ZU\ bXi b[gUa h`A ØbW\Yb`i bX`XYf`; YbYfU`ghUUhgUb`k U`hgW\UZh

6Ua VYf['k Uf'YbhgWXY]XYbX'Z0f'XYb'9fZc`['XYf'9fa]hhi b[Yb"
Nk]gWXYb'8YnYa VYf'&\$&%i bX'5i [i gh'&\$&'k i fXYb'Xi fW'X]Y
; fi ddYž'X]Y'\]bhYf'XYf'K YVg]hY'ghYW_hž'gW'Àhni b[gk Y]gY'' * \$\$
8fc[Yb`]YZYfi b[Yb'j YfUb'UggH'Hfc hn'XYf'a Ugg]j Yb'8]a Ybg]cbYb
XYg'8fc[Yb\UbXY'gž']gh'X]Y': YghbU\ a Y'j cb'?f]a]bY''Ybž'X]Y']b
X]YgYf'c f[Ub]gUh]cb'hÀh]['g]bXž'Y]bY'dcg]h]j Y'9bhk]W_i b['Z0f'X]Y
5i ZFYW hYf\U'hi b['XYf'ÒZZYbh]WXYb'G]WXYf\Y]h"

9]b'k]W'h][Yf'9fZc`['Z0f'X]Y'9fa]hhiYf'ZUbX'Ua ' &, "5i [i gh'&\$&'
ghUhž'U'g'Y]b'' &! 'À\ f][Yf'? Zn!A YWU b]_Yfž'XYf'a i ha U»`]W'U'g
?i f]Yf'Z0f'X]Y'6UbXY'hÀh]['k Ufž']b'8ØggY'XcfZ'ZYgh[Ybca a Yb
k i fXY''6Y]'X]YgYf': YghbU\ a Y'k i fXYb'Yhk U'&\$?']c[fUa a
8fc[Ybž'XUfi bhYf'bU\Yni 'Y]b'?]c[fUa a '<Yfc]bž'VYgW'U[bU\ a h'
9g'k]fX'Ub[Ybca a Ybž'XUgg'X]YgYf'?i f]Yf'fY[Y'a À»][
6YhÀi Vi b[ga]hY''i bX'6Uf[Y'X'bUW'8Yi hgW'UbX'hfUbgdcfh]YfhY
i bX'Z0f'gY]bY'8]YbghY'V]g'ni ') \$\$\$'9i fc'dfc': U\fh'Yf\Y]h"

Ni gÀh`]W'ni 'XYa 'A YWU b]_Yf'k i fXY'Ub'XYa gY'VYb'HU[']b
5a ghYfXUa 'Y]b'' ' ! 'À\ f][Yf'≠H!: UW a Ubbž'XYf'U'g'Y]b
<Ui dhU_hYi f'XYf'; fi ddY []'hž'ZYgh[Ybca a Yb''8]YgY'gW'bY''Yb
9bhk]W_i b[Yb'nY][Ybž'k]Y'U_h]j 'X]Y'GhfUž] YfZc`[i b[gVY\ÖfXYb
[Y[Yb'XYb'8fU\hn]Y\Yf'X]YgYf'_f]a]bY''Yb'c f[Ub]gUh]cb
j c f[Y\Yb''6Y]XY'A ÀbbYf'g]bX'XYfnY]h]b'l bhYfgi W'i b[g\Užhž
k À\ fYbX'X]Y'ž gh]n]b'XYb'_ca a YbXYb'HU[Yb'ØVYf'X]Y'Ni 'Uggi b[
XYf'5b'_U[YgW'f]Zhi bX'X]Y'9fÒZZbi b['XYg'<Ui dh] YfZU\ fYbg
YbhgWXY]XYb'k]fX"

8 Yf'fYW h`]WXY'F U\ a Yb

8]Y'5b'_U[Y' [Y[Yb'X]Y'VY]XYb'B]YXYf'ÀbXYf']gh'Y]b'_UfYf'<]bk Y]g
Ui ZX]Y'9fbgh\Užh][_Y]hž'a]h'XYf'X]Y'VUmYf]gWXYb'6Y\ÖfXYb
8fc[YbXY'_hY'j YfZc`[Yb''æ 'F U\ a Yb'XYf'5b'_U[YgW'f]Zhi'k]fX
\bYb'XUg'VUbXYba À»][Y'i bYf'Ui VhY'<UbXY'hfY]VYb'a]h
6YhÀi Vi b[ga]hY'b']b'b]W'h[Yf]b[Yf'A Yb[Y'j c f[Yk c fZYb''8]Yg
]gh'_Y]bY''Y]W'hY'5b'_U[Y/X]Y'; YgYhnY']b'8Yi hgW'UbX'gY\Yb
XUZ0f'Y]bY': fY'\Y]hgghfUZ]j cb'Z0bZV]g'ni '%) 'š\ fYb'j c fž'ZU'g'X]Y
A ÀbbYf'j Yfi fhY]'h'k YfXYb"

8 Ug' [YgUa hY'9fa]hhi b[gj YfZU\ fYb'nY][h'b]W h'bi f'X]Y
?ca d'YI]hÅh'XYf'a cXYfbYb'7mVYf_f]a]bU`]hÅh'Ui Z'gcbXYfb'Ui W
X]Y'9bhgW`cggYb\Y]h'XYf'6Y\ ÒfXYbž' [Y[Yb'XYb'8fc [Yb\UbXY`
j cfni [Y\Yb"8]Y`_ccdYfUh]j Y'5bghfYb[i b['nk]gWXYb'XYi hgWXYb
i bX'b]YXYf'ÀbX]gWXYb'9fa]h'Yfb'\YVh\Yfj cfž'k]Y'k]W h][
]bhYfbUh]cbU'Y'Ni gUa a YbUfVY]h'ZØf'X]Y'6Y_Åa dZi b['XYf
cf[Ub]g]YfhYb'?f]a]bU`]hÅh'gh"K Å\ fYbX'X]Y'5b_'U[Y'XYf'VY]XYb
A ÅbbYf'k Y]hYf\]b'X]Y'GW'U[nY]Yb'VYgh]a a hž'V'Y]Vh'UVni k UfhYbž
k Y'WXY'k Y]hYfYb' ðZcfa Uh]cbYb'Ui g'XYb'Ui ZYbXYb'9fa]hhi b[Yb
\Yfj cf[Y\Yb'k YfXYb"

5i gg]W hYb'ZØf'X]Y'Ni _i bZh

8]Y'XUf[YghY`hYb'9fa]hhi b[Yb'k Y]gYb'Ui ZY]bY'k UWgYbXY
<YfUi gZcfXYfi b['j]b'XYf'6Y_Åa dZi b['XYg'8fc [Yb\UbXY'g'\]bž
]bgVYgcbXYfY'ja 'X][]hU'Yb'NY]hU'hYf"8]Y'G]WYfghY`i b['j cb
6Yk Y]gYbž'X]Y'Xi fW'a cXYfbY'HYWbc'c[]Yb'[YgUa a Y'h'k i fXYbž
k]fX'ja a Yf'YbhgWY]XYbXYf"8]YgY': Å`Y'YfÒZbYb'Y]bY'VfY]hY
8]g_i gg]cb'ØVYf'X]Y'J YfUbhk cfhi b['XYf'D'UhZcfa Ybž'X]Y'XYb
<UbXY`a]h]'Y[U'Yb'Gi VghUbnYb'Yfa Ò['WXYb"8]Y'6Y\ ÒfXYb
a ØggYb' ['Y]WnY]h]['XYb'_fYUh]j Yb'A Yh\cXYb'VY[Y[bYbž'X]Y
'?f]a]bY`Y'bi hnYbž'i a ']\fY'5_hj]hÅhYb'ni 'j YfgW'Y]Yfb"

8]Y'9fa]hhi b[Yb'ja ' : U`' GW'bYYghi fa 'g]bX'HY]'Y]bYf'[fÒ» YfYb
ð]h]Uh]j Y'ni f'6Y_Åa dZi b['XYg'cf[Ub]g]YfhYb'8fc [Yb\UbXY'g']b
9i fcdU" ð'XYb'YhnhYb' ð\ fYb'\UVYb'nU\ fY]WXY'@ÅbXYfž'XUfi bhYf
8Yi hgW'UbX'i bX'X]Y'B]YXYf'UbXYž'j YfghÅf_h'A U» bU\ a Yb
Yf[f]ZYbž'i a ' [Y[Yb'X]Y'ni bY\ a YbXY'; YZU\ f'j cb
6YhÅi Vi b[ga]hY'b'ja ' ðhYfbYhj cfni [Y\Yb"8]YgY
9bhk]W_i b[Yb'g]bX'b]W h'bi f'Ui Z'X]Y'9bhghY\i b['bYi Yf
8fc [Yb\UbXY'gbYhmk Yf_Y'ni fØW_ni ZØ\ fYbž'gcbXYfb'Ui W'Ui Z'XYb
ghY][YbXYb'?cbgi a 'j cb'dgmW'chfcdYb'Gi VghUbnYb"

æa 'FU\ a Yb'X]YgYf'6Ya Ø\i b[Yb'UfVY]hYh'X]Y'NYbhfU'ghY`Y
7mVYfWf]a Y'6UmYfb'Yb['a]h'bUh]cbU'Yb'i bX']bhYfbUh]cbU'Yb
Dc`nY]cf[Ub]gUh]cbYb'ni gUa a Yb"8]Y'VY_Åa dZhYb
BYhmk Yf_ghfi _hi fYb'g]bX'cZh'k Y]hY]WXYbX'i bX'cdYf]YfYb'ØVYf
' ; fYbnYb'\]bk Y[ž'k Ug'Y]bY'_ccfX]b]YfhY'FYU_h]cb'YfZcfXYfh"9]b

6Y]gd]Y`ZØf`Y]bY`gc`WXY`Ni gUa a YbUfVY]h]gh`X]Y`C dYfUh]cb
:]Y`X ž`X]Y`g]W`a]h`XYa `8Uf_bYh]8fc[Yb\UbXY`VY]ZUgghY`i bX`Ub
j YfgW]YXYbYb`Yi fcd`À]gWYb`GhUbXcfhYb`k Y]hfY]WXYbXY
: YghbU\`a Yb`ni f`c`[Y`\UhhY"

8Yf`gcn]U`Y`8fc[Yba Uf_h`i bX`XYggYb
5i gk]f_i b[Yb

8]Y`J YfVfY]hi b[]j cb`8fc[Yb`ØVYf`XUg`b hYfbYh`\Uh`Ui W
h]Y]Z[fY]ZYbXY`gcn]U`Y`?cbgYei YbnYb``8]Y`Ni [`Àb[`]W`_Y]h]j cb
6Yh`Ài Vi b[ga]hY`bž`]bgVYgcbXYfY`i bhYf`š [YbX`]WXYbž`Vf]b[h
Yfbgh\UZhY`[Ygi bX\Y]h]WXY`F]g]_Yb`a]h`g]W`"@Ui h`XYa `U`hi Y`Yb
8fc[YbVYf]W`h`XYf`6i bXYgnYbhfU`Y`ZØf`[Ygi bX\Y]h]WXY
5i Z`Àfi b[`f`bN[5E`_cbgi a]YfYb`]a a Yf`a Y`f`↑ b[Y`A YbgWXYb
Gi VghUbnYb`k]Y`A 8A 5`i bX`@G8ž`\`Ài Z][`c`bY`g]W`XYf
dchYbn]Y`Yb`; YZU`fYb`VYk i ggh`ni `gY]b``8]YgY`8fc[Yb`_ØbbYb
b]W`h`bi f`U`i hY`[Ygi bX\Y]h]WXY`DfcV`Ya Y`j Yfi fgUWXYbž`gcbXYfb
Ui W`Ub[Zf]gh][Y`dgmW]gWXY`GhØfi b[Yb`\Yfj cffi ZYb``: Øf
: Ua]`]Yb`i bX`XUg`gcn]U`Y`l a ZY`X`XYf`6YhfcZZYbYb`Yf[]Vh`g]W`cZh
Y]b`\c`Yf`Ya ch]cbU`Yf`i bX`Z]bUbn]Y`Yf`8fi W`"

8]Y`6Y`_Àa dZi b[`X]YgYf`DfcV`Ya Y`YfZcfXYfh`Y]bYb`[UbN\Y]h]WXYb
5bgUhnž`XYf`gck c`\`df`Àj Ybh]j Y`A U» bU\`a Yb`U`g`Ui W
_cbgYei YbhY`9fa]hhi b[Yb`i bX`fYW`h]WXY`c`[Yb`ZØf
8fc[Yb\`ÀbX`Yf`i a ZUggh``8]Y`b`U`hY`j cb
8fc[YbUi Z`Àfi b[g_Ua dU[bYb`a ØggYb`Ub`X]Y`l fgUWXYb`i bX
FU\`a YbVYX]b[i b[Yb`XYg`8fc[Yb`_cbgi a g`Ub`_bØdZYbž`i a `Y]bY
bUW\U`h][Y`K]f_i b[`ni `Yfn]Y`Yb"

8UhYb`i bX`GhUh]gh]_Yb`]a `?cbhYI h`XYg
8fc[Yb\UbXY`g

: Øf`Y]b`VYggYfYg`J Yfgh`ÀbXb]g`XYg`8fc[Yb\UbXY`g]b`8Yi hgW`UbX
g]bX`fY`Yj UbhY`GhUh]gh]_Yb`i bYf`Àgg`]W`"@Ui h`XYa `š\`fVi W`Gi W`h
&\$&%`_cbgi a]YfhYb`]b`8Yi hgW`UbX`Yhk U`%ž*`A]`]cbYb`A YbgWXYb
fY[Y`a `À»][]`Y[U`Y`8fc[Yb``6YgcbXYfg`VYhfcZZYb`g]bX`↑ b[Y
9fk UW`gYbY`nk]gWXYb`%, `i bX`&) `š\`fYb``8]Y`8i b`_Y`n]ZZYf`]gh

ŸXcW`k U\fgWY]b`jW`j]Y`\"`Œ\Yfž`XU`j]Y`Y`?cbgi a YbhYb`b]W`h
VYfY]hg]bXž`\fY`Bi hni b[`cZZYb`ni ni [YVYb`"8]Y`NU\`XYf
8fc[YbVYX]b[hYb`HcXYgZÄ`Y`nY][h`YVYbZU`g`Y]bYb`U`Ufa]YfYbXYb
HfYbX.`&\$&%[UV`Yg`b`8Yi hgW`UbX`ØVYf`&"&\$`HcXYgZÄ`Y`]a
Ni gUa a Yb\Ub[`a]h`8fc[Ybž`k Ug`Y]bYb`5bgh]Y[`]a `JYf[`Y]W`
ni a `Jcf`U\`f`XUfghY`hž`k]Y`X]Y`8Yi hgW`Y`; YgY`gW`UZh`ZØf
Gi W`hZc`fgW`i b[`i bX`Gi W`h\YfUd]Y`fB; !Gi W`h`VYf]W`hYh"

8]YgY`GhU]gh]_Yb`j YfXYi h]W`Yb`X]Y`B`c`k`YbX][_Y]hž`VYghY`YbXY
; YgYhnYg`ØW`_Yb`ni `gW`Y]Y»Yb`i bX`X]Y`DfÄj`Ybh]cbgUfVY]h
Ui gni VUi Ybž`i a `X]Y`[Ygi bX`Y]h]W`Yb`i bX`gc]U`Yb`DfcV`Ya`Y`]a
Ni gUa a Yb\Ub[`a]h`8fc[Yb`ni `VY`_Äa`dZYb"

8YhU]`g

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