



COMD5000

B; C gž 7]j]`GcWjYmiUbX`8Yj Y`cda Ybh

HYfa `C bY`#`&\$&%

GWXcc`cZGcWJU`GWjYbWg`#`I BGK `5ffg`UbX`GcWJU`GWjYbWg

7 ci fgY`Cj Yfj]Yk

GHJZZ'7cbhJW`8YHJ]`g

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`]m	@cW]h]cb	D\cbY
5b\cbmNk]	U"nk]4 i bgk "YXi "Ui	D`YUgY`Ya U]`hc UffUb[Y`U`h]a Y`hc X]gW gg/d`UW W`i fgY`W`XY`UbX]ggi Y`]b`gi V`YWh \YUX]b["A cbXUm %%\$!%&.\$\$`cf H\i fgXUm %(\ \$!%) \ \$\$	F cca`%&\$ž :]fgh: `ccfž A cfj Yb`6fck b 6`X[ž *%\$(&' * - * (- \$

GWcc`7cbhJW`bZcfa Uh]cb

GWcc`cZGcW]U`GWYbWg

F cca`%) -

A cfj Yb`6fck b`7 &\$

Ya U]`.gcgg4 i bgk "YXi "Ui

d\cbY. \$&`- ' ,)`% \$+

7ci fgY'8YHJ]`g

7fYX]h'Dc]bHg '*`

Gi a a UfmcZ\Y'7ci fgY

; fci d'k cf_]bW X]b[[fci d'dfYgYbU]cb'UbX' [fci d'fYdcfh!'U'_YmY'Ya YbhcZ]g'Wci fgY'k]''bWi XY
[fci d'k cf_'WcbWfb]b['Yb[U[Ya Ybhk]h'Ub'B; C'k cf_]b[]'b'fYU'h]a Y'hc'Wcbf]Vi h'hc']bhfYbU]cbU'
XYj Y'cda Ybh'H\Y'[fci d'k]''fYgYUfW'Ub']ggi Y'hc[YhYfz'dfYgYbh'hc'h\Y'WUgg'UbX'B; C'z'UbX'gi Va]hU
fYdcfhfYZYW]b['h\Y]f']bg][\hg'UbX'[i]XUbW''; fci d'k cf_'g_]`g'UfY'YggYbh]U'hc'k cf_]b[]'b'XYj Y'cda Ybh
gY]b[g''5b']bhf]bg] Y'XUmik]''U'ck 'Wcbgc']XU]cb'cZ[fci dk cf_'g_]`g'UbX']bhfUW]cb"

DUdYf'W]hei Y'ZUW]hU]g'W]hW'UbU'ng]g'cZU'di V']g\YX'dUdYf''H\]g'dfcj]XYg']bg][\hg']bhc'h\Y'dYYf]fYj]Yk
dfcW'gg'UbX'\ck 'ci fbU'Uf]WYg:[Yhdi V']g\YX'Ug'k Y''Ug'Vi]X]b['Wca dYh'bw']b'YI Ua]b]b['UbX
W]hei]b['X]ZYfYbh]mdYg'cZ'ci fbU'Uf]WYg'' : cW'g]b['cb'fYW'bh]m]di V']g\YX'dUdYfg'U'gc'\Y'dg'gh' XYbhg
gYY'\ck 'h\Y'Z]Y'X']g'XYj Y'cd]b['UbX'k \h]ggi Yg'UfY'VY]b['X]gW'ggYX''Gh'XYbhg'dfYdUfY'U'W]hW'
gi a a Ufmi'hUhVf]b[g']b'c'h\Yf''h'fU]h'fY'UbX'dfcj]XYg']bg][\hg']bhc'k \Yh\Yf'c'h\Yfg']b'h\Y'WUgg'g'aci 'X
df]c]h]gY'h\Y'dUdYf']b'h\Y]f'Z' f'h\Yf'fYUX]b['UbX'fYgYUfW'U'W]j]h]Yg"

⊕XYdYbXYbh'YUfb]b['YI YfW]gYg'! 'gca Y'U'W]j]h]Yg'k]''VY'i d'cUXYX'hc'h\Y'A ccX'Y'g]h'UbX'gh'XYbhg'k]''VY
YbWci fU[YX'hc'j]Yk ž'fYgdc]bX'UbX'W]hei Y'h\YgY']b'h\Y]f'ck b'h]a Yž'k]h'U'j]Yk 'hc'g'Uf]b['h\Y]f']bg][\hg
cb']bY''H\Y'Wci fgY'XfUk'g'cb'bi a Yfci g'Z'a g'UbX'j]XYcg'UbX'gh'XYbhg'U'gc'[U]b']bg][\hg']bhc'\ck 'hc
W]h]W''mj]Yk 'h\YgY'a U'h]f]U'g''

5`fYdcfhVm[fci dg`cZ(!*`gh XYbhg`ZcW`g]b[`cb`U`gdYWZ]Wkd]WfY`Uh]b[`hc`fYU`!h]a Y`WU`Yb[Yg`ZU]b[`U
gdYWZ]YX`B; C``Bc`a cfY`h\Ub`(\$\$\$`k cfXg`fk f]hYb`Vmk`c`Y`[fci dE`]bW] X]b[`U`k`c`dU[Y`9I YW`h]j`Y
Gi`a`a`Ufm`K`f]hYb`ZYXVUW`_k`]h`b`%\$`k`cf_]b[`XUmg`"

H\]gž`U`cb[`k`]h`U`dfYgYb]h]cb`hc`Wc`a`a`i`b]W]hY`h`Y`[fci d`Z]bX]b[g`UbX`]bg][\hgž]g`U`a`U`c`f`[fci d`UW]j`]h`m`

F Ygci fWg

DfYgWf]VYX`F Ygci fWg`

DfYgWf]VYX`F Ygci fWg`

H\]g`7ci fgY`XfUk g`cb`U`k]XY`fUb[Y`cZfYgci fWg`UbX`mci `UfY`YbWci fU[YX`hc`VYWca Y`ZJa]`]Uf`k]h`UbX`
YI d`cfY`h`Ya ""H\YgY`fUb[Y`Zca`Zcfa U`hYI hg`hc`dYYf!fYj]Yk YX`Ufh]WYg`hc`cf[Ub]gUh]cbU`fYdcfHg`UbX`
Yj U`i Uh]cbg`hc`V`c[g`UbX`ch`Yf`Zcfa g`cZa YX]U""H\Y`a U]b`g]h`Zcf`]XYbh]Z]b[`fY`Yj Ubha Uhf]U`g`]g`j]U`
A ccX`Y`UbX`@Y[Ubhc`i`g]b[`h`Y`Wci fgY`A ccX`Y`dU[Y""=k]`Xc`a mVYghc`X]fYWmci `hc`U`ga U`Yf`bi`a VYf`
cZa i ghfYUX`]h`a g`Vi`hk]`U`gc`VY`\][\`][\h]b[`U`k]XY`fUb[Y`cZch`Yf`a Uhf]U`g`z`]bW`X]b[`dcXWUghg`UbX`
Z`a g""=YI dYWh`h`Uh`mci `k]`Yb[U[Y`k]h`h`g`UbX`Z]bX`h`Y`gc`fHg`cZa Uhf]U`g`h`Uhk]`Y`d`mci ``YUfb`!`Zcf`
YUWk`dYfgcb`h`g`]g`]_Y`mhc`VY`X]ZYfYbh`

=]_Y``]ghYb]b[`hc`dcXWUghg`UbX`j]Yk]b[`Z`a g`UbX`j]XYcU`cf`ghfYUa]b[`Ui`X]cVcc_g`!\`cdYZ` ``m`mci `Xc`hc`c`
Zbch`h`YfYf]g`a`cfY`h`Ub`Ybci [\`hc`fYUX`UbX`h`]b`_UVci h`""#a`YI dYW]b[`mci `k]`g`UfY`mci`f`]bg][\hg`UbX`
j]Yk dc]b]g`k]h`YUWk`ch`Yf`!`=_bck`h`YfY`]g`U`chcZYI dYf]YbW`UbX`X]ZYfYbhdYfgdYW]j Yg`k]h`]b`ci`f`
WUgg`"

]bHfYgž'nci f`YUfb]b[žUbX'nci f`Včbg]XYfU]cb""=\cdY'hUhičgY'cZnci 'j Ybhi fY']bhc'hYgY'gdUWg'k]`

5]X8UHJ-`cdYb`XUHJ`Zcf`]bHf`bUhc]bU`XYj`Y`cda`Ybh`[\hfd.##k k "UjXXUHJ"cf\]](#)

C I ZcfX`Dcj`Yfmi`<`i`a`Ub`8Yj`Y`cda`Ybh`h]h]Uhj`Y`fC`D<`Z`g`A`i`h]X]a`Ybg]cbU`Dcj`Yfmi`hXYI`
[\hfd.##k k "cd\"cf\]`i`#`a`i`h\]X\]a`Ybg\]cbU`!dcj`Yfmi\]bXYI`#`U`bYk`XYj`Y`cda`Ybh\]bXYI`XYj`Y`cdYX`VmiH`Y`](#)
C I ZcfX`Dcj`Yfmi`UbX`<`i`a`Ub`8Yj`Y`cda`Ybh`h]h]Uhj`Y`Z`bck`U`XcdH`X`VmiH`Y`I`b]H`X`B`Uhc]b`g`8Yj`Y`cda`Ybh`
Dfc`[`fUa`Zcf`]bHf`[`fUhc]b]b]b`c`h`Y`Ubbi`U`<`i`a`Ub`8Yj`Y`cda`Ybh`F`Ydcf`g`

; YbYfU`8UHJ`DcfHJ`g.

C 978. [\hfd.##k k "cYVX"cf\]`#`YbXYf#XUHJ#`](#)

K cfX`6Ub`_`[\hfd.##XUHJcd\]Wg"kc fXVUb`_`cf\]`#`YbXYf#`](#)

A 98Yj`9Wcb. [\hfdg.##g\]hYg"\[`cc\[`Y`Wca`#g\]h`#`YXYj`YWcb#XYj`Y`cda`Ybh`YWcbca`\]Wg#XYj`YWcbXUHJ`](#)

!`k`YVg]h`"b_g`h`c`U`j`Uf]Y`m`c`Z`X`U`h`g`Y`h`g`Z`c`f`Y`a`d]f]W`"XYj`Y`cda`Ybh`YWcbca`]g`h`g`Z`a`c`g`h`c`Z`k`\\`W`X`U`f`Y`Z`Y`Y`m`
U`W`W`g`g]V`Y`/[`f`Y`U`h`k`Y`V`g]h`"h`c`Y`I`d`c`f`Y`U`b`X`"Y`U`f`b`]Z`m`c`i`U`f`Y`]b`h`c`X`U`H`

I B8D`g`A`]`Y`bb]i`a`8Yj`Y`cda`Ybh;`c`U`g`A`cb]h`c`f. [\hfd.##k k "a X\[a cb\]h`c`f"cf\]](#)

A :`K`c`f`X`9`W`c`b`c`a`]`W`c`i`h`c`c`_`f`k`9`C`Z`z`:`c`V`U`:`]`b`U`b`W]U`"G`H`U`V`]`m`i`F`Y`d`c`f`g`U`b`X`:`c`V`U`"A`c`b]`h`c`f]`b`[`F`Y`d`c`f`g`.
[\hfd.##k k "ja`Z`c`f\]`#`I`h`f`b`U`#`d`i`V\]b`X`"h`a`](#)

C`f`[`U`b]n`U`h]c`b`Z`c`f`9`W`c`b`c`a`]`W`7`c`c`d`Y`f`U`h]c`b`U`b`X`8`Y`j`Y`c`d`a`Y`b`h`[\hfd.##k k "cYVX"cf\]](#)/`[`c`c`X`g`c`i`f`W`c`Z`
a`U`W`f`c`Y`W`c`b`c`a`]`W`X`U`H`c`b`h`Y`C`9`7`8`a`Y`a`V`Y`f`g`h`U`h`g`Z`U`g`k`Y`"U`g`a`U`b`m`U`b`U`m`h]W`"f`Y`d`c`f`g`c`b`g`U`]Y`b`h`
Y`W`c`b`c`a`]`W`d`c`]`W`h`g`g`i`Y`g`"5`g`c`W`X`Y`W`c`i`h`h`Y`]f`8`Y`j`Y`c`d`a`Y`b`h`5`g`g]g`h`U`b`W`"7`c`a`a`]`h`Y`f`B`5`7`E`f`Y`d`c`f`g`U`b`X`
X`U`H`c`b`U`]X`Z`c`k`g`U`b`X`h`Y`b`X`g`"

J`j]c`b`c`Z`<`i`a`U`b]m;`c`V`U`"D`Y`U`W`"h`X`Y`I`/`U`b`Y`k`k`U`m`h`c`"c`c`_`U`h`X`Y`j`Y`c`d`a`Y`b`h`
[\hfd.##k k "j`j\]c`b`c`Z`i`a`U`b\]m`c`f\]`#`#`d\]U`Y`#`b`X`Y`I`Y`g`#`c`V`U`!`d`Y`U`W`!`\]b`X`Y`I`](#)

M`c`i`k`j`"U`g`c`V`Y`b`Y`Z`h`Z`c`a`V`Y`W`c`a`]b`[`Z`J`a`]U`f`k`]h`k`:`c`c`[`Y`G`W`X`c`U`f`f`[\hfd.##g`W`X`c`U`f`\[`c`c\]`Y`W`c`a`](#)`E`U`g`U`_`Y`m`
g`Y`U`f`W`X`Y`b`[`]b`Y`Z`c`f`U`W`X`Y`a`]W`d`i`V`]W`U`h]c`b`g`U`b`X`f`Y`d`c`f`g`"M`c`i`W`U`b`g`Y`h`i`d`h`Y`d`f`Y`Z`f`Y`b`W`g`h`c`]b`_`h`c`h`Y`
I`B`G`K`@]V`f`U`f`m`Y`j`Y`b`k`Y`b`m`c`i`U`f`Y`b`c`h`c`b`W`J`a`d`i`g`"

;`c`h`c`:`c`c`[`Y`G`W`X`c`U`f`2`g`Y`h]b`[`g`2`"V`f`U`f`m`]b`g`Z`U`b`X`Y`b`h`Y`f`"I`b]`Y`f`g]m`c`Z`B`Y`k`G`c`i`h`K`U`Y`g`"j`b`h`Y`V`c`i`Z`c`f`
"@]V`f`U`f`m`".M`c`i`W`U`b`g`[`b`i`d`Z`c`f`H`U`V`Y`c`Z`7`c`b`h`b`h`g`f`h`C`7`E`U`Y`f`g`Z`c`a`h`Y`"c`a`Y`d`U`[`Y`g`c`Z`f`Y`Y`U`b`h`c`i`f`b`U`g`Z`
h`c`f`Y`W`]j`Y`U`b`Y`a`U`]k`Y`b`Y`j`Y`f`b`Y`k`U`f`h]W`Y`g`U`f`Y`d`i`V`]g`Y`X`]b`h`U`h`c`i`f`b`U`">`c`i`f`b`U`k`Y`V`g]h`Y`g`k`j`"c`Z`Y`b`W`U`f`f`m`
]b`Z`c`f`a`U`h]c`b`c`b`h`Y`a`c`g`h`j`]Y`k`Y`X`U`b`X`a`c`g`h`W`h`Y`X`U`f`h]W`Y`g`h`Y`g`Y`U`f`Y`"Y`m`h`c`V`Y`]b`h`Y`f`Y`g`h]b`[`U`b`X`c`Z`h`b`
]b`Z`i`Y`b`h]U`"W`c`b`h]V`i`h]c`b`g`";`c`c`[`Y`G`W`X`c`U`f`k`j`"U`g`c`d`c]b`h`m`c`i`h`c`U`f`h]W`Y`g`h`U`h`U`j`Y`W`h`Y`X`U`d`U`f`h]W`U`f`U`f`h]W`Y`
U`b`X`Y`b`W`k`j`"V`Y`f`Y`U`h`Y`X`h`c`h`Y`h`c`d]W`"

=\U`j`Y`U`h`k`]h`Y`f`U`W`W`c`i`b`h`h`U`h`=i`g`Y`Z`c`f`X`f`U`k`]b`[`U`h`h`b`h]c`b`h`c`f`Y`Y`j`U`b`h`X`Y`j`Y`c`d`a`Y`b`h`X`Y`V`U`h`g`Z`d`c`X`W`U`h`g`h`Z`V`c`c`_`
f`Y`j`]Y`k`g`U`b`X`d`i`V`]W`U`h]c`b`g`"G`c`a`Y`h`a`Y`g`="c`Z`Y`f`a`m`i`c`k`b`c`d]b]c`b`g`"G`f`U`f`Y`m`X`Y`g`W`]V`Y`k`U`h`=\U`X`Z`c`f`
V`f`Y`U`_`Z`U`h`"Q`Z`m`c`i`U`f`Y`c`b`h`k`]h`Y`f`Z`c`"c`k`[\hfdg.##k`\]h`Y`f`W`c`a`#`95`F`8`U`h`B`G`K`!](#)U`g`c`U`g`U`h]U`[`g`.8Yj`G`h`X`g`

Gi Va]gg]cb`cZ5ggYgga YbhiHUg_g

Hi fb]h]b`Gi Va]gg]cb

≠mci`YbWci bHYf`U`dfcV`Ya`k` \Yb`UH`Ya` dh]b[`hc`gi`Va`]hmc`i`f`Ugg][`ba`Ybhi`h`fci`[`\`Hi`fb]h]b`z`d`Y`Ug`Y`
HY`Yd`cb`Y`9I`HY`fb`U`Gi`ddc`fh`cb`-`,`)`"``"``%`cf`Ya`U]`h`Ya`i`cb`YI`HY`fb`U`HY`hgi`ddc`fh`4`i`bgk`"YXi`"Ui`""Gi`ddc`fh`
`l`ci`fg`Uf`Y`,`.\$`\$Ua`-`-%`\$.\$`\$da`i`cb`k`YY`_X`Umg`U`b`X`-`.\$`\$Ua`-`-`).`.\$`\$da`i`cb`k`YY`_Y`b`X`g`f`l`*)`X`Umg`U`m`Y`U`f`l`"≠mci`
Uf`Y`i`b`U`V`Y`h`c`gi`Va`]hmc`i`f`Ugg][`ba`Ybhi`Xi`Y`h`c`U`Z`Ji`h`k`]h`Hi`fb]h]b`mci`i`a`Um`U`dd`m`Z`c`f`U`b`YI`HY`bg]cb`z`Vi`hmc`i`
a`i`gh`f`Y`h]b`mci`f`h]W`Y`h`bi`a`V`Y`f`Z`ca`9I`HY`fb`U`Gi`ddc`fh`f`U`cb[`k`]h`U`b`m`c`h`Y`f`f`Y`Y`U`b`h`X`c`W`a`Y`b`h`g`k`h`c`
]b`Wi`X`Y`U`g`Y`j`]X`Y`b`W`h`c`gi`ddc`fh`mci`f`YI`HY`bg]cb`U`dd`]W`h]cb`"≠mci`Ya`U]`9I`HY`fb`U`Gi`ddc`fh`mci`k`]`
Ui`h`c`a`U`h]W`U`m`f`Y`W`]j`Y`U`h]W`Y`h`bi`a`V`Y`f`z`Vi`h]Z`mci`HY`Y`d`cb`Y`mci`k`]`b`Y`Y`X`h`c`g`d`Y`W`Z]W`U`m`U`g`_`Z`c`f`c`b`Y`"
Hi`fb]h]b`U`g`c`d`f`c`j`]X`Y`g`i`d`X`U`h`Y`g`c`b`h`Y`]f`g`m`g`h`Y`a`i`g`h`U`h`g`c`b`H`k`]h`Y`f`"

;`Y`b`Y`f`U`m`z`U`gg`Y`g`g`a`i`gh`V`Y`gi`Va`]h`Y`X`Y`Y`W`f`c`b]W`U`m`j`]U`Y`]h`Y`f`Hi`fb]h]b`c`f`U`A`cc`X`Y`
U`gg][`ba`Y`b`h`i`h`]b`g`h`U`b`W`g`k` \Y`f`Y`h`l`g`]g`b`c`h`d`c`g`g]V`Y`z`]h`k`]`V`Y`g`h`U`h`X`c`b`mci`f`W`c`i`fg`Y`g`A`cc`X`Y`g`]h`k`]h`
U`h`Y`fb`U`h]`Y`gi`Va`]gg]cb`X`Y`h]g`"

:`c`f`]b`Z`c`f`a`U`h]c`b`c`b`l`c`k`h`c`gi`Va`]h`U`gg][`ba`Y`b`h`g`c`b`]b`Y`j`]U`A`cc`X`Y`.\`h`d`g`#`g`h`X`Y`b`h`i`bgk`"YXi`"Ui`#`c`k`!
gi`Va`]h`U`gg][`ba`Y`b`h`a`cc`X`Y`"

5 WUXYa]W< cbYgmiUbX`D`U[]Uf]ga

- i bXYfghUbx'mci f'f][\hg'UbX'fYgdcbg]V]h]Yg'Ug'U'gh XYbhUhl BGK
- VY'Uk UfY'cZd'U[]Uf]ga ž'Wc'dmf][\hž' BGK 'Gh XYbh7cXY'cZ7cbXi W'Ubx'5W'W'dhUV'Y'I gY'cZ I BGK '⇒H'F'Ygci f'W'g'Dc']W'h
- VY'Uk UfY'cZ'Y'ghUbxUfXg'cZVY\Uj]ci f'YI dY'W'X'cZYj Yfmcby']b'h'Y'I BGK 'W'a a i b]m
- 'cW'W'h'gYfj]W'g'UbX']bZ'fa U]cb'UVci hl BGK 'UbX'I BGK '@]VfUfm

Gca Y'cZ'Y'gY'UfY'Ug'k]''VY'ZJa]]Uf'hc'mci ž'c'h'Y'fg'k]''VY'bYk "'; U]b]b['U'gc']X'i bXYfghUbx]b['cZU''h'Y fY'U'Y'X'UgdY'W'g'cZ9@-G9'k]''\Y'd'mci 'a U_Y'h'Y'a cghcZmci f'gh X]Yg'Uhl BGK ""

[\h'hd.##gi V'Y'W'i \]X'Yg" \]VfUfm'i bgk "YXi "Ui #' \]gY#UVci h' \]gY](#)

5 WUXYa]W=Zcfa Uh]cb

: cf`YggYbh]U`ghi XYbh]bZcfa Uh]cb`fY`Uh]b[`tc.

- fYei Yg]Zcf`YI H`bg]cb/

-