



INST3900

ϠhYfbUh]cbU`Gh X]Yg'5Xj UbW\X`GYa]bUf

HYfa `H\fYY`##`&\$&\$

7ci fgY'8YHJ]`g

7fYX]hDc]bqg '*`

Gi a a UfmicZ\hY'7ci fgY

H\]g`Wci fgY`Ug_g`mci`hc`Yj`U`i`UH`U`bi`a`VY`f`c`Z`W`b`h`Ya`dc`f`U`m`i`X`Y`V`U`H`g`i`g`]b[`_`b`c`k`Y`X`[`Y`[`U`]b`Y`X`
h`f`c`i`[`\`c`i`h`h`Y`'6`#`G`H`'d`f`c`[`f`U`a`'U`b`X`'c`j`Y`f`g`Y`U`g`Y`i`W`X`U`b`[`Y`'m`Y`U`f`'f`c`f`Y`e`i`]`j`U`Y`b`h`'D`U`f`h`W`'U`f`'U`h`Y`b`h`c`b`'k`]'`V`Y`
d`U`]X`'h`c`'h`Y`[`f`U`b`X`'W`X`U`'Y`b`[`Y`g`Z`U`W`]b[`'g`c`W`Y`m`i`U`b`X`'c`b`[`g`h`U`b`X`]b[`'c`V`g`h`U`W`Y`g`'h`c`'Y`e`i`]`m`i`h`U`h`U`f`Y`'b`c`k`'j`a`d`U`W`]b[`
]g`g`i`Y`g`'g`i`W`'U`g`[`\`c`V`U`'d`c`j`Y`f`m`z`U`]X`'X`Y`'j`Y`f`m`z`X`Y`j`Y`c`d`a`Y`b`h`z`'a`][`f`U`h`c`b`z`U`b`X`'c`c`X`'c`j`Y`f`b`U`b`W`'m`c`i`'k`]'`
Y`i`d`'c`f`Y`'W`c`a`d`Y`h`]b[`\`z`c`f`W`g`'U`b`X`'X`m`b`U`a`]M`g`'U`b`X`'h`Y`'f`Y`g`d`c`b`g`Y`g`'h`c`'h`Y`a`'V`m`[`c`j`Y`f`b`a`Y`b`h`z`]b`g`h`h`h`c`b`g`'U`b`X`
d`Y`c`d`Y`g`'k`c`f`X`k`]X`Y`'`#`i`k`]'`U`'g`c`'d`f`c`j`]X`Y`'m`c`i`'U`'W`X`U`b`W`'h`c`'\`c`b`Y`'m`c`i`'f`'d`f`c`Z`Y`g`g`]c`b`U`'g`_]`g`'U`b`X`'_`b`c`k`'Y`X`[`Y`'V`U`g`Y`
]b`'f`Y`'U`h`c`b`'h`c`'W`U`f`Y`f`g`'j`b`]b`h`f`b`U`h`c`b`U`'g`h`X`]Y`g`"

7ci fgY`@YUfb]b[`Ci hWca Yg

%`]X`Y`b`h`z`m`_`Y`m`X`m`b`U`a`]M`g`'U`b`X`'d`f`c`W`g`g`Y`g`'h`U`h`U`f`Y`'g`U`d`]b[`']b`h`f`Y`X`d`Y`b`X`Y`b`W`]Y`g`'f`Y`[`"z`Y`W`c`b`c`a`]W`z`
Y`b`j`]f`c`b`a`Y`b`h`U`z`'\`i`a`U`b`'X`Y`j`Y`c`d`a`Y`b`h`z`'d`c`]h`]W`z`'g`Y`W`f`]m`k`'j`b`'h`c`X`U`m`g`'k`c`f`X`"
&"`Y`j`U`i`U`H`Y`'h`Y`g`Y`'X`m`b`U`a`]M`g`'U`b`X`'d`f`c`W`g`g`Y`g`'j`b`'f`Y`'U`h`c`b`'h`c`'U`'g`d`Y`W`]Z`W`W`c`i`b`h`f`m`c`f`'k`c`f`X`'f`Y`[`]c`b`"
'`"]b`h`Y`[`f`U`H`Y`'U`b`U`'m`h`]W`'g`_]`g`z`k`f`]h`]b[`\`W`d`U`V`]h`Y`g`z`'d`f`c`V`Y`a`'g`c`j`]b[`'U`b`X`'d`f`Y`g`Y`b`h`U`h`c`b`'g`_]`g`'j`b`'h`Y`
W`c`b`h`i`h`c`Z`]b`h`f`b`U`h`c`b`U`'g`h`X`]Y`g`"
(`"a`U`h`W`'d`f`c`Z`Y`g`g`]c`b`U`'W`c`a`d`Y`h`f`b`W`]Y`g`'U`b`X`'W`U`f`Y`f`f`Y`'Y`j`U`b`h`_`b`c`k`'Y`X`[`Y`'h`c`'d`f`U`W`]W`'j`b`]b`h`f`b`U`h`c`b`U`
c`f`[`U`b`]g`U`h`c`b`g`'U`b`X`'V`i`g`]b`Y`g`g`Y`g`"

HYUWX]b[`GhfUH[]Yg`

H\]g`XY`[`f`Y`Y`'W`d`g`h`c`b`Y`'W`c`i` fgY`'\`U`g`'V`Y`Y`b`'`X`Y`j`Y`c`d`Y`X`'h`c`'h`U`_`Y`']b`h`c`'U`W`W`c`i`b`h`h`Y`'C`G`D`'Y`i`d`Y`f`]Y`b`W`g`'c`Z`g`h`X`Y`b`h`g`
f`c`f`'h`Y`'Y`e`i`]`j`U`Y`b`h`Y`i`d`Y`f`]Y`b`W`'E`'`#`G`H`' -`\$`\$`]'g`'h`U`i`[`\`h`c`j`Y`f`%`\$`k`Y`Y`_`g`'W`c`b`g`]g`h`]b[`\`c`Z`U`' '\`c`i`f`'W`c`i` fgY`'f`&`\`f`
'Y`W`i`f`Y`'U`b`X`'%'f`'h`'h`c`f`]U`'c`b`'_`Y`m`]g`g`i`Y`g`'U`b`X`'W`X`U`'Y`b`[`Y`g`]'b`'#`h`f`b`U`h`c`b`U`'G`h`X`]Y`g`'"H`Y`g`Y`'U`f`Y`Z`Y`Y`!`Z`c`k`]b[`
X`]g`W`g`g`]c`b`g`'W`'b`h`f`Y`X`'c`b`'d`f`c`j`c`W`U`h`j`Y`'h`'h`c`f`]U`'e`i`Y`g`h`c`b`g`'Y`U`W`'k`Y`Y`_`z`k`'\`Y`f`Y`'g`h`X`Y`b`h`g`'X`Y`V`U`H`'h`Y`']g`g`i`Y`g`
U`b`X`'Z`b`X`'g`c`'i`h`c`b`g`'h`c`'h`Y`'d`f`c`V`Y`a`g`'U`b`X`'W`X`U`'Y`b`[`Y`g`'c`Z`c`i`f`'h`j`a`Y`g`z`X`f`U`k`]b[`\`c`b`'h`Y`]f`d`f`Y`j`c`i`g`'"m`Y`U`f`g`'c`Z`
g`h`X`m`]b`W`i`X`]b[`\`%`m`Y`U`f`g`d`Y`b`h`U`V`f`c`U`X`'j`b`'h`f`U`j`Y`'U`b`X`'g`h`X`m`X`i`f`]b[`\`C`G`D`"

5ggYgga Ybh

D`YUgY`gYY`hY`5ggYgga Ybh; i]XY`Zcf`Z`""XYHJ]`g`cZk` \Uh]g`YI`dYWYX`]b`h.]g`WUgg`UbX`Zcf`UXX]h]cbU`]bZcfa`Uh]cb`UVci`hk`YY`_mWcbhYbhzk`f]h]b[`YI`dYWU]h]cbg`UbX`gc`cb"

5ggYgga YbhHUg_g`

5ggYgga YbhHUg_	K`Y][` \h	8i`Y`8UH`	Gh`XYbh@YUfb]b[` Ci`hWca`Yg`5ggYggYX
7`UfYYf`DcfhZc`]c`	`\$i	%`*`#`/\$`#&`\$&\$`\$`\$(`.\$`\$`DA	`z`(`
A`Ucf`9ggUm)`\$i	&`*`#`%`#&`\$&\$`\$`\$(`.\$`\$`DA	%z&z`
DfYgYbhU]h]cb`	&\$i	K`YY`_m	%z&z`

5ggYgga Ybh8YHJ]`g`

5ggYgga Ybh%`7`UfYYf`DcfhZc`]c`

GhUfhXUH`. `Bch5dd`]WV`Y`

@Yb[`h.`%z\$\$\$`k`cfXg`

8YHJ]`g`.

Gh`XYbh]a`i`ghdUfh]W]dUH`Y`]b`WUfYYf`Yj`Ybhgz`k`]h`hY`Wcbj`Ybcff]g`Uddfcj`U`z`UbX`WfYUH`U`dcfhZc`]c`hc` XYa`cbgfUH`hY]f`Yb[`U[`Ya`Ybhk`]h`hY`XYj`Y`cda`Ybhg`]b`dfcZYgg]cbU`Z]Y`Xg`fY`UH`X`hc`]bhYfbU]h]cbU` gh`X]Yg`"Gh`XYbh]dUfh]W]dUH`Y`]b`U`a`]b]a`i`a`cZ`h`fY`Yj`Ybhg`"Gh`XYbhg`dfcXi`W`U`fYZYW]cb`cZ`h`Y]f` YI`dYf]YbW]g`f%z\$\$\$`k`cfXg`"

Gh`XYbhg`fYW]j`Y`U`bi`a`Yf]W]`a`Uf`_`UbX`k`f]h]b`ZYXVUW`"

5XX]h]cbU`XYHJ]`g`.

D`YUgY`GYY`5ggYgga Ybh; i]XZdcghYX`cb`A`ccX`Y`Zcf`Z`""XYHJ]`g`cZ`h.]g`Ugg][`ba`Ybh

Hi`fb]h]b`gYH]b[`. `h\]g`Ugg][`ba`Ybh]g`gi`Va`]hYX`h`fci`[`\`Hi`fb]h]b`UbX`gh`XYbhg`WU]b`gY`Hi`fb]h]b`g]a`]Uf]m` fYdcf]g`"

5ggYgga Ybh&.`A`Ucf`9ggUm

GhUfhXUH`. `Bch5dd`]WV`Y`

@Yb[`h.`(`z\$\$\$`k`cfXg`

8YHJ]`g`.

Gh`XYbhg`k`]`k`f]h]U`(`z\$\$\$`k`cfX`YggUmVUgYX`cb`h`Ya`Yg`UbX`]g]gi`Yg`dfYgYbhYX`]b`YW]h`fYg`""h\]g`]g`hY`

F Ygci fWg

DfYgWf]VYX`F Ygci fWg`

D`YUgY`fYZf`h`A ccX`Y`UbX`h`Y`5ggYgga Ybh; i]XY"

F YWca a YbXYX`F Ygci fWg

6Y`ck`UfY`ci fbU`fYgci fWg`UbX`k YVg]hYg`h`Uhmci`a][\hZ]bX`i gYZ`:

5a Yf]Wb`>ci fbU`cZGcW]c`c[m`5a Yf]Wb`Dc`]h]W]`G]W]YbW`F Yj]Yk /Dc`]h]W]`G]W]YbW`E i UfhYfm`F Yj]Yk
cZ`hYfbU]cbU`Dc`]h]W]`9Wcbca m`hYfbU]cbU`Gh X]Yg`F Yj]Yk /hYfbU]cbU`5ZU]fg/>ci fbU`cZDYUW
F YgYUfW`/>ci fbU`cZGfU]Y []WGh X]Yg/: cfY][b`5ZU]fg/: cfY][b`Dc`]Wm5bU]mg]g/>ci fbU`cZF YZ [YY
Gh X]Yg/H\]fX`K cfX`E i UfhYfm]K cfX`8Yj Y`cda Ybh]`>ci fbU`cZ8Yj Y`cda YbhGh X]Yg]8Yj Y`cda YbhUbX
7\Ub[YZ9i fcdYUb`>ci fbU`cZ8Yj Y`cda YbhGh X]Yg]G5`G`fYj]Yk "

hYfbU]cbU`A cbYUfm: i bX`f]A : E`-`hhd.##k k k "]a Zcf[#I hYfbU`#bXYI "\ha

K cfX`6Ub_!`hhd.##k k k "k cfXVUb_"cf[#

H\Y`C f[Ub]nU]cb`Zcf`9Wcbca]W7 ccdYfU]cb`UbX`8Yj Y`cda Ybh]C 978E!`hhd.##k k k "cYWX"cf[#

K cfX`HfUXY`C f[Ub]nU]cb`fK HC E!`hhd.##k k k "k hc"cf[#

I b]hX`B U]cbg`8Yj Y`cda YbhDfc[fUa a Y`fi B 8 D E`-k k k "i bXd"cf[

I B < 7 F`-k k k "i b\W"cf[

I G5`8`-k k k "i gU]X"[cj

Gi Va]gg]cb 'cZ5ggYgga YbhiHUg_g

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

Ʒmci 'YbWci bHYf'U'dfcV'Ya 'k \Yb'UH'Ya dh]b['hc'gi Va]hmc i f'Ugg][ba YbhiH'fci [\ 'Hi fb]h]bž'd'YUgY
HY'Yd\cbY'9I HYfbU'Gi ddcfhcb'-',) " ' ' %cf'Ya U] 'H'Ya 'cb'YI HYfbU'HY'f'gi ddcfh4 i bgk "YXi "Ui "'Gi ddcfh
\ci fg'UfY', .\$\$Ua '—%\$.\$\$da 'cb'k YY_XUmg'UbX'-. \$\$Ua '—) .\$\$da 'cb'k YY_YbXg'fI *) 'XUmg'U'm'YUfI" Ʒmci
UfY'i bUV'Y'hc'gi Va]hmc i f'Ugg][ba YbhiXi Y'hc'U'Zi 'hk]H'Hi fb]h]b'mci 'a UmUdd'm'Zc'f'Ub'YI HYbg]cbž'Vi hmc i
a i ghfYH]b'mci f'h]W_Yhbi a VYf'Z'ca '9I HYfbU'Gi ddcfhfU'cb['k]H'UbmcH'Yf'f'Yj UbhXcW a YbHgE'hc
]bWi XY'Ug'Yj]XYbVW'hc'gi ddcfhmc i f'YI HYbg]cb'Udd'j]W]h]cb" Ʒmci 'Ya U] '9I HYfbU'Gi ddcfhmc i 'k]
Ui 'ca UH]W]m'f'YW]j Y'U'h]W_Yhbi a VYfž'Vi h]Zmci 'HY'Yd\cbY'mci 'k]'b'YX'hc'gd'YW]W]m'Ug_ 'Zc'f'cbY"
Hi fb]h]b 'U'gc'dfcj]XYg'i dXUH'g'cb'H'Y]f'gmgh'Ya 'ghU'g'cb'Hk]HYf"

; YbYfU'mž'UggYgga YbhiHUg_g'a i ghVY'gi Va]HYX'Y'YW'fcb]W]m'j]U'Y]H'Yf'Hi fb]h]b'cf'U'A ccX'Y
Ugg][ba YbH' 'b]bg]UbVW'g'k \YfY'H'g]g'bc]hdccg]V'Yž'hk]'VY'gh'UH'X'cb'mci f'Wci fgY'g'A ccX'Y'g]H'k]H
U'HYfbUH] Y'gi Va]gg]cb'XYH]g"

: cf]bZ'fa UH]cb'cb'\ck 'hc'gi Va]hUgg][ba YbHg'cb]bY'j]U'A ccX'Y. \h'hdg.#gh XYbH'i bgk "YXi "Ui #ck!
gi Va]hUgg][ba YbH'a ccX'Y

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

D`U[]Uf]ga `]g`i g]b[`hY`k cfXg`cf`]XYUg`cZc`hYfg`UbX`dfYgYbh]b[`hYa `Ug`mci f`ck b" `#WUb`hU`Y`a Ubm
Zcfa gZ`Zca `XY`]VYfUHY`WXYUH]b[`hc`UWV]XYbhU`mWc`dm]b[`Zca `U`gci fW`k]h`ci hUW`bck `YX[Ya Ybh`

I BGK `[fci dg`d`U[]Uf]ga `]bhc`hY`Zc`ck]b[`WUHY[cf]Yg.

7 cdm]b[.`i g]b[`hY`gUa Y`cf`j Yfmg]a]Uf`k cfXg`hc`hY`cf][]bU`hYI hcf`]XYU`k]h`ci hUW`bck `YX[]b[`hY

