



# INST3900

ϠhYfbUh]cbU`Gh X]Yg`5Xj UbW\X`GYa ]bUf

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

GWXcc`cZ<i a Ub]hYg`UbX`@Ub[ i U] Yg`##`I BGK ``5ftg`UbX`GcWU`GWYbWg



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`'`#`h`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`]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`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`DcfhZ`]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`DcfhZ`]c`

GhUfhXUH`. `Bch5dd`]WV`Y`

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

8YHJ]g`.

Gh`XYbh]g`a`i`ghdUfh]W]dUH`Y`]b`WUfYYf`Yj`Ybh]z`k`]h`h`Y`Wcbj`Ybcf]g`Uddfcj`U`z`UbX`WfYUH`U`dcfhZ`]c`hc` XYa`cbgfUH`h`Y]f`Yb[`U[`Ya`Ybhk`]h`h`Y`XYj`Y`cda`Ybh]g`]b`dfcZYgg]cbU`Z]Y`Xg`fY`UH`X`hc`]b`h`fb`U]h]cbU` gh`X]Yg`"Gh`XYbh]dUfh]W]dUH`Y`]b`U`a`]b]a`i`a`c`Z`h`f`Y`Yj`Ybh]g`"Gh`XYbh]g`dfcXi`W`U`f`Y`ZY`W]cb`c`Z`h`Y]f` YI`dYf]YbW]g`f`%`z`\$`\$`\$`k`cfXg`"

Gh`XYbh]g`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 ]XYzdcghYX`cb`A`ccXY`Zcf`Z`""XYHJ]g`cZk`Uh]g`Ugg][`ba`Ybh`

Hi`fb]h]b`gYH]b[`.`h`h]g`Ugg][`ba`Ybh]g`gi`Va`]h]Y`h`fci`[`\`Hi`fb]h]b`UbX`gh`XYbh]g`WU`b`gY`Y`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`XYbh]g`k`]`k`f]h]U`(``z`\$`\$`\$`k`cfX`YggUmVUgYX`cb`h`Ya`Yg`UbX`]g]gi`Yg`dfYgYbhYX`]b`Y`W`h`fYg`""h`h]g`]g`h`Y`





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'fgi 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'fY'Yj UbhXcW a YbHgE'hc  
]bWi XY'Ug'Yj ]XYbVW'hc'gi ddcfhmc i f'YI HYbg]cb'Udd'jW]h]cb" Ʒmci 'Ya U] '9I HYfbU'Gi ddcfhmc i 'k ]  
Ui 'ca UH]W]m'fYW]j Y'U'h]W\_Yhbi a VYfž'Vi h]Zmci 'HY'Yd\cbY'mci 'k ]'b'YX'hc'gdYW]Z]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]hd]cgg]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. \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[ `h`Y`k`cfXg`cf`]XYUg`cZc`h`Yfg`UbX`d`fYgYbh]b[ `h`Ya`Ug`mci`f`ck`b`" `#WUb`hU`\_`Y`a`Ubm`  
Zcfa`gZ`Zca`X`Y`]VYfU`h`V`X`Y`U`h]b[ `h`c`U`W`W`X`Y`b`h`U`m`i`W`c`d`m]b[ `Z`ca`U`g`ci`f`W`k`]h`ci`h`U`W`\_`b`c`k`Y`X[ `Ya`Y`b`h`

I`B`G`K` `[`f`ci`d`g`d`U[ ]Uf]ga `]b`h`c`h`Y`Z`c``c`k`]b[ `W`U`h`Y[ `c`f]Y`g.

7`c`d`m]b[ `.`i`g]b[ `h`Y`g`U`a`Y`c`f`j`Y`f`m`g]a`]U`f`k`c`f`X`g`h`c`h`Y`c`f][`]b`U`h`Y`h`c`f`]X`Y`U`k`]h`ci`h`U`W`\_`b`c`k`Y`X[ ]b[ `h`Y`



