



## HUMS2007

F YgYUfVX 'D`UW`a Ybh=ž'5 fhg`UbX`GcWU`GWYbWYg

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

7ci fgY`Cj Yfj ]Yk

GHJZZ7cbHJW`8YHJ]`g

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`]m	@cW]h]cb	D\cbY
B Uca ]`DUf_]bgcb	b"dUf_]bgcb4 i bgk "YXi "Ui	6mUddc]bħa Ybh	' ' *`A 6	

GWXcc``7cbHJW`ħZcfa Uh]cb

GWXcc``cZ<i a Ub]h]Yg`UbX`@Jb[ i U[ Yg

@cW]h]cb. `GWXcc``C Z]W]žA cfj Yb`6fck b`6i ]X]b[ ž@Yj Y``&ž&),

C dYb]b[ `<ci fg. `A cbXUm! : f]XUmž- Ua `!`) da

D\cbY. `Ž\*%&`-' , ) `)\*, %

: U! . `Ž\*%&`-' , ) ; , +\$)

9a U]: [\U`4 i bgk "YXi "Ui](#)

7 ci fgY'8YHJ]`g

7 fYX]hDc]bHg`%&`

Gi a a UfmicZ`h`Y'7 ci fgY

h`h]g`W`ci fgY`z`mci `k ]`Yb[ U[ Y`]b`U`fYU`! ]Z`U`WUXYa ]WfYgYUfW`YI dYf]YbW`cb`U`a U`c`f`dfc`Y`W`h`Y`X`Vm  
I`B`G`K`g`W`c`U`fg`]b`5`f`g`/`G`c`W`U`G`W`Y`b`W`g`"Mci `k ]`k`c`f`\_`k ]h`U`Y`UX]b[ `g`W`c`U`f`z`W`a`d`Y`h`c`f][ ]bU`  
fYgYUfW`UbX`k`f]h`U`d`UdYf`UVci hmc`i`f`U`fYU`c`Z`fYgYUfW`"

7 ci fgY`@YUfb]b[ `Ci hW`a`Yg

%`9I`Y`W`h`Y`U`gg][ bYX`fYgYUfW`hUg\_g`]b`U`W`a`d`Y`h`b`h`z`d`f`c`Z`Y`g`]c`b`U`UbX`h`a`Y`m`a`U`b`b`Y`f`  
&`7`f]h]W`m`f`Y`Z`Y`W`h`c`b`m`c`i`f`f`Y`g`Y`U`f`W`h`U`g`g`z`X`Y`a`c`b`g`f`U`h]b[ `m`c`i`f`i`b`X`Y`f`g`h`U`b`X]b[ `c`Z`m`c`i`f`f`Y`g`Y`U`f`W`  
d`f`c`Y`W`h]b`][ `h`c`Z`g`c`a`Y`f`Y`j`U`b`h]h`f`U`h`f`Y`  
'`" `F`Y`Z`Y`W`h`c`b`m`c`i`f`Y`I`d`Y`f]Y`b`W`c`Z`k`c`f\_]b[ `c`b`U`f`Y`g`Y`U`f`W`d`f`c`Y`W`h`

HYUW`X]b[ `G`h`f`U`h`[ ]Yg`

H`h]g`W`U`g`g`k ]`W`X]Y`Z`m`V`Y`h`U`i [ `h`h`h`f`c`i [ `c`b`Y`!`c`b`Y`c`f`g`a`U`][ `f`c`i`d`a`Y`Y`h]b[ `g`k ]h`m`c`i`f`f`Y`g`Y`U`f`W`  
g`i`d`Y`f]`j`g`c`f`"

Mci`f`g`i`d`Y`f]`j`g`c`f`k ]`i`[ ]j`Y`m`c`i`U`W`c`Y`Y`b`h`g`a`U`!`g`W`U`Y`d`f`c`Y`W`h`h`c`k`c`f`\_`c`b`" `h`a`U`m]b`W`i`X`Y`d`f]a`U`f`m`f`Y`g`Y`U`f`W`#`  
X`U`h`U`b`U`m`g]g`U`b`X`#`f`g`Y`W`c`b`X`U`f`m`f`Y`g`Y`U`f`W`":`c`f`Y`I`U`a`d`Y`z`m`c`i`a`U`m`Y`d`h`c`f`Y`g`Y`U`f`W`U`V`c`c`\_`c`f`c`i`f`b`U`  
U`f]h]W`Y`Z`c`f`h`Y`a`z`X`c`g`W`c`d]b[ `f`Y`g`Y`U`f`W`Z`c`f`U`b`Y`k`d`f`c`Y`W`z`c`f`Y`d`h`c`[ `U`h`Y`f`z`h`U`b`g`W]V`Y`z`]b`X`Y`I`U`b`X`U`b`U`m`g`Y`  
d`f]a`U`f`m`f`Y`g`c`i`f`W`g`z`]b`h`Y`f]`j`Y`k`g`c`f`c`h`Y`f`X`U`h`U`"

h`k`Y`Y`\_`m`c`f`Z`c`f`h]b[ `h`m`a`Y`Y`h]b[ `g`z`m`c`i`f`g`i`d`Y`f]`j`g`c`f`k ]`i`g`i [ [ `Y`g`h`f`Y`U`X]b[ `g`z`c`f`m`c`i`h`c`X`c`z`X]g`W`g`g`m`c`i`f`  
d`f`c`[ `f`Y`g`g`z`h`U`\_`h`c`m`c`i`U`V`c`i`h`m`c`i`f`Y`j`c`j ]b[ `i`b`X`Y`f`g`h`U`b`X]b[ `c`Z`h`Y`f`Y`g`c`i`f`W`g`m`c`i`U`j`Y`V`Y`Y`b`]b`g`f`i`W`Y`X`h`c`  
k`c`f`\_`c`b`U`b`X`Y`d`m`c`i`d`U`b`c`k`h`c`a`c`j`Y`h`Y`d`f`c`Y`W`h`Z`c`f`k`U`f`X`"5`Z`h`f`Y`U`W`a`Y`Y`h]b[ `z`m`c`i`g`l`c`i`X`g`Y`b`X`U`  
Z`c`k`i`d`Y`I`a`U`]`W`c`b`Z`f`a`]b[ `m`c`i`f`i`b`X`Y`f`g`h`U`b`X]b[ `c`Z`h`Y`h`U`g`\_`U`gg][ bYX`U`b`X`f`Y`W`c`f`X]b[ `m`c`i`f`d`f`c`[ `f`Y`g`g`"H`Y`g`Y`  
W`c`a`a`i`b]W`h]c`b`g`k ]`d`f`c`j`X`Y`]a`d`c`f`h`U`b`h`Y`j`X`Y`b`W`Z`c`f`m`c`i`f`d`c`f`h`Z`]c`"

Mci`f`a`U`c`f`k`f]h]b[ `h`U`g`\_`U`f`Y`U`f`Y`g`Y`U`f`W`d`c`f`h`Z`]c`h`U`h[ `U`h`Y`f`g`Y`j`]X`Y`b`W`c`Z`U`b`X`f`Y`Z`Y`W`h]c`b`g`c`b`m`c`i`f`  
f`Y`g`Y`U`f`W`Y`I`d`Y`f]Y`b`W`U`b`X`U`f`Y`g`Y`U`f`W`f`Y`d`c`f`h`h`U`h`X`Y`a`c`b`g`f`U`h]g`m`c`i`f`W`d`U`W]h`m`h`c`X`c`]b`X`Y`d`Y`b`X`Y`b`h`g`W`c`U`f`m`  
k`c`f`\_]b`h`Y`U`f`Y`U`c`Z`m`c`i`f`f`Y`g`Y`U`f`W`"

# 5ggYgga Ybh

## 5ggYgga YbhHUg\_g`

5ggYgga YbhHUg_	K Y][ \h	8i Y'8UH	Gh XYbh@YUfb]b[ Ci Hwta Yg'5ggYggYX
F YgYUfW`DcfhZ`]c`	( \$i	%* #/0/#&\$&\$ \$) . \$\$ DA	%Z
F YgYUfW`F Ydcfh	( \$i	%* #/0/#&\$&\$ \$) . \$\$ DA	&
F YgYUfW`Gi dYfj ]gcf 5ggYgga Ybh	&\$i	Bch5dd`]WVY	%

## 5ggYgga Ybh8YHJ]`g

5ggYgga Ybh%`F YgYUfW`DcfhZ`]c`

GhUfhXUH. `K YY\_`C bY

@Yb[ h. ` \$\$\$!) \$\$\$

8YHJ]`g.

hYfbg\]d`dcfhZ`]c` fl \$\$\$!) \$\$\$`k cfXgk`H\Y`dcfhZ`]c`g\ci`X`VY`UggYa`VYX`h`fci`[` \ci`h`h`Y`h`fa`" `h`g`l`ci`X`  
XcW`a`Ybh`mci`f`Yi`dYfj]YbW`gZ`dfc`[`fYgg`UbX`fYZYW]cbg`cZmci`f`F`@`dfc`[`fUa`" `8`c`W`a`Ybh]h`cb`]bW`i`XYg`  
Z`f`h`b`[` \`h`m`i`f`Y`d`c`f`h`g`Z`UbX`Y`j`]X`Y`b`W`c`Z`f`Y`g`Y`U`f`W`i`b`X`Y`f`U`\_`Y`b`" `h`g`l`ci`X`U`g`c`]bW`i`XY`U`W`h`j`W`i`f`Y`Z`Y`W`h`c`b`c`b`  
mci`f`dfc`W`g`g`Z`dfc`[`fYgg`Z`UbX`k` \`h`V`b`g`h`h`h`g`U`g`i`W`W`g`g`Z`" `f`Y`g`Y`U`f`W`i`d`f`c`Y`W`h`]b`h`]g`Z`Y`X`" `M`c`i`k`]`  
k`c`f`\_`g`l`c`d`mci`f`dcfhZ`]c`k`]h`mci`f`V`b`j`Y`b`c`f`c`f`X`Y`Y`[`U`h`U`b`X`f`Y`W`]j`Y`Z`c`f`a`U`h`j`Y`Z`Y`X`V`U`W`\_`c`b`mci`f`dfc`[`fYgg`  
U`h`h`Y`a`]X`d`c`]b`h`c`Z`h`Y`h`fa`" `H`l`g`d`c`f`h`Z`]c`k`]`V`Y`[`f`U`X`Y`X`V`m`h`Y`V`b`j`Y`b`c`f`c`f`X`Y`Y`[`U`h`U`b`V`b`g`i`h`U`h`c`b`k`]h`  
mci`f`gi`dYfj]gcf":`Y`X`V`U`W`\_`k`]`V`Y`[`]j`Y`b`j`]U`U`a`U`f`\_`b`[`f`i`V`f`]W`U`b`X`]b`k`f`h`b`[`"

Gi Va ]gg]cb`bchYg.J ]U`9a U`

Hi fb]h]b`gYH]b[ .`H\]g`]g`bchU`Hi fb]h]b`Ugg][`ba`Ybh

5ggYgga Ybh&`F YgYUfW`F Ydcfh

GhUfhXUH. `K YY\_`)

@Yb[ h. `&\$\$\$

8YHJ]`g.

F YgYUfW`F Ydcfhf&\$\$\$`k cfXgk`Mci`f`fYgYUfW`fYdcfhdfc] ]XYg`Ub`c`d`d`c`f`h`b`]m`h`c`k`f`h`U`f`Y`g`Y`U`f`W`i`d`U`d`Y`f`  
V`U`g`Y`X`c`b`U`b`U`g`d`Y`W`i`c`Z`mci`f`fYgYUfW`h`U`h`U`g`d`U`f`h`W`U`f`m`g`d`U`f`\_`Y`X`mci`f`]b`h`f`Y`g`h`Z`c`f`h`c`f`Y`Z`Y`W`h`c`b`mci`f`  
fYgYUfW`d`U`W`a`YbhYi`dYfj]YbW`" `Mci`g`l`ci`X`d`f`c`d`c`g`Y`mci`f`dfc`Y`W`h`]b`k`f`h`b`[`U`b`X`U`U`j`Y`]h`U`d`d`f`c`j`Y`X`V`m`mci`f`  
gi`dYfj]gcf`U`b`X`h`Y`V`b`i`f`g`Y`V`b`j`Y`b`c`f`V`Y`Z`c`f`Y`h`Y`a`]X`Y`c`Z`h`Y`h`fa`" `h`a`U`m`U`j`Y`U`b`c`f`U`d`f`Y`g`Y`b`h`j`c`b`  
V`b`a`d`c`b`Y`b`h`-`h`c`V`Y`X`Y`h`fa`]b`Y`X`]b`V`b`g`i`h`U`h`c`b`k`]h`mci`f`gi`dYfj]gcf":`H`l`g`k`]`V`Y`X`c`i`V`Y`a`U`f`\_`Y`X`V`m`mci`f`  
V`b`j`Y`b`c`f`c`f`X`Y`Y`[`U`h`U`b`X`mci`f`gi`dYfj]gcf":`Y`X`V`U`W`\_`k`]`V`Y`[`]j`Y`b`j`]U`U`a`U`f`\_`b`[`f`i`V`f`]W`U`b`X`]b`k`f`h`b`[`"

Gi Va ]gg]cb' bchYg.J ]U'9a U]

Hi fb]h]b'gYh]b[ . 'H\]g' ]g' bchU'Hi fb]h]b'Ugg][ ba Ybh

F Ygci fWg

DfYgWf]VYX`F Ygci fWg`

BchUj U]UV`Y

F YWca a YbXYX`F Ygci fWg

BchUj U]UV`Y

7ci fgY`9j U`i Uh]cb`UbX`8Yj Y`cda Ybh

Gh XYbhZYXVUW\_k ]`VY [ UH\YfYX`j ]U`Ya U]`UhiH\Y`YbX`cZH\Y`Wci fgY`VmiH\Y`Wci fgY`Wcbj Ybcf`"Gh XYbfg  
k ]`VY`fYei YghYX`hc`dfcj ]XY`ZYXVUW`cb`H\Y]f`Ugg][ bYX`dfc`YWhf]bWi X]b[ `ei U]`micZ  
gi dYfj ]g]cb/k cf`cUX/HfUbgZfUV]`]micZfYgYUfVW`g\_]`g/\ck`Yb[ U[ ]b[ `H\YmZci bX`H\Y`Ugg][ bYX`dfc`YVW`  
H\Ymk ]`U`gc`VY`fYei YghYX`hc`Wca a Ybhcb`H\Y`cj YfU`g`gfi Wi`fY`cZH\Y`Wci fgY`UbX`]hg`UggYgga Ybfg`"  
: YYXVUW`cb`]bX]j ]Xi U`dfc`YVWg`k ]`VY`fYZYffYX`hc`gi dYfj ]gcf]g`hc`[ i ]XY`h\Ya` ]b`g`gfi Wi`f]b[ `a UH\Yf]U`Zcf  
Z hi fY`<| A G&\$+\$`fYgYUfVW`]bhYfbg`": YYXVUW`cb`H\Y`Wci fgY`k ]`VY`i gYX`hc`UX↑gha`cXYg`cZ  
UggYgga Ybh`

Gi Va ]gg]cb 'cZ5ggYgga YbhiHUg\_g

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

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

D`U[ ]Uf]ga ]g'i]b[ 'hY'k cfXg'cf]XYUg'cZcH.Yfg'UbX'dfYgYbh]b[ 'hYa 'Ug'mci f'ck b" #WUb'hU\_Y'a Ubm  
Z'ca gZ'Zca 'XY'VYfUHY'WX.YU]b[ 'hc'UWV]XYbhU'mWcdm]b[ 'Zca 'U'gci fW'k ]h'ci hUW\_bck 'YX[ Ya Ybh'

I BGK '[ fci dg'd`U[ ]Uf]ga ]bhc'hY'Z'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'  
gci fW'cf'i]g]b[ 'ei chU]cb'a Uf\_g" 'H\]g'U'gc'Udd'Yg'hc ]a U[ YgZ'UfhUbX'XYg][ b'dfc YWgZ'Ug'k Y''Ug  
dfYgYbhU]cbg'k \YfY'gca YcbY'dfYgYbhg'Ubch.Yf'g]XYUg'cf'k cfXg'k ]h'ci hWYX]h'

#Uddfcdf]UHY'dUfUd\UfUg]b[ .7\Ub[ ]b[ 'U'Zk'k cfXg'UbX'd\UfUg'k \]Y'a cghmfYU]b]b[ 'hY'cf][ ]bU'  
ghf' W'fY'UbX#f'dfc[ fYgg]cb'cZ]XYUg'cZcH.Y'cf][ ]bU'z'UbX']bZ'ca U]cb'k ]h'ci hUW\_bck 'YX[ Ya Ybh'H\]g'U'gc  
Udd'Yg]b'dfYgYbhU]cbg'k \YfY'gca YcbY'dUfUd\UfUg'g'Ubch.Yf'g]XYUg'cf'k cfXg'k ]h'ci hWYX]h'UbX'hc  
d]YW]b[ 'hc[ Y'hYf'ei chYg'UbX'dUfUd\UfUg'g]bhc'U'bYk'k \c'Yz'k ]h'ci hUddfcdf]UHY'fYZYfYbW]b[ "

7 c`i]g]cb.k cf\_]b[ 'k ]h'c'hYfg'Vi hdUgg]b[ 'cZcH.Y'k cf\_'Ug'U'dYfgcb'g]bX]j ]Xi U'k cf\_"7 c`i]g]cb'U'gc  
]bWi XYg'dfcj ]X]b[ 'mci f'k cf\_'hc'Ubch.Yf'g]h'XYbhVYZ'fY'hY'Xi Y'XUHY'z'cf'Z'f'hY'di fdcgY'cZcH.Ya  
d`U[ ]Uf]g]b[ 'UhUbmi]a Yz'dUm]b[ 'Ubch.Yf'dYfgcb'hc'dYfZ'ca 'Ub'UWXYa ]W]Ug\_z'gh'U']b[ 'cf'UW'ei ]f]b[  
Ubch.Yf'dYfgcb'g'UWXYa ]Wk cf\_'UbX'Wcdm]b[ ]h'cZ'Zf]b[ 'hc'W'ca d'YHY'Ubch.Yf'dYfgcb'g'k cf\_'cf'gYY\_]b[  
dUma YbhZ'f'W'ca d'Y]b[ 'UWXYa ]Wk cf\_"

#Uddfcdf]UHY'W]U]cb.7 ]h]b[ 'gci fW'g'k \]W\Uj Y'bhVYYb'fYUXz'k ]h'ci hUW\_bck 'YX[ ]b[ 'hY''gYW'cbXUfm'  
gci fW'Z'ca 'k \]W'\_bck 'YX[ Y'cZcH.Ya '\Ug'VYYb'c'U]b]YX"

8 i d']WU]cb'f'fY'Z'd`U[ ]Uf]ga 'E'gi Va ]h]b[ 'mci f'ck b'k cf\_z]b'k \c'Y'cf]b'dUf'z'k \YfY'j'h\Ug'dfYj ]ci g'm  
VYYb'dfYdUfYX'cf'gi Va ]hYX'Z'f'Ubch.Yf'UggYgga Ybhcf'W'ei fgY'Uhi BGK 'cf'Ubch.Yf'i b]j Yfg]h'

7 cffYW'fYZYfYbW]b[ 'dfUW]W]g.

- DUfUd\UfUg]b[ žgi a a Uf]g]b[ žYggUmk f]h]b[ 'UbX'h]a Y'a UbU[ Ya Ybh
- 5ddfcdf]UHY'i gY'cZUbX'Uhf]Vi h]cb'Z'f'U'fUb[ Y'cZa UHYf]U'g]bWi X]b[ 'hYi hz]a U[ YgZ'Z'ca i 'UY'UbX  
W'cbW'dhg"

#X]j ]Xi U'Ugg]ghU'W'g]Uj U]UV'Y'cb'fYei YghZ'ca 'H\Y'@YUfb]b[ '7YbhY'f'hd.#k k k "Wi bgk "YXi "Ui #"  
Gh XYbhg'UfY'U'gc'fYa ]bXYX'hUhWfYz' h]a Y'a UbU[ Ya Ybh]g'Ub ]a dcfU'bhduf'hcZ'gh'XmUbX'cbY'cZcH.Y  
]XYbh]ZYX'W]i gYg'cZ'd`U[ ]Uf]ga ]g'dccf'h]a Y'a UbU[ Ya Ybh'Gh XYbhg'g'lc'i 'X'U'ck'gi Z]WYbh]h]a Y'Z'f  
fYgYUfW'z'XfU]b[ 'UbX'dfcdYf'fYZYfYbW]b[ 'cZgci fW'g]b'dfYdUf]b[ 'U''UggYgga Ybh]h]a g"

I BGK '@]VfUfmU'gc'\Ug'hY'9@G9'hc'Uj U]UV'Y'hc'Ugg]ghmci 'k ]h'mci f'gh'XmUhi BGK "'9@G9']g  
XYg][ bYX'hc ]bhcXi W'bYk'gh XYbhg'hc'gh X]b[ 'Uhi BGK 'Vi h]hW'Ub'U'gc'VY'U'[ fYUhfYZYg\Yf'Xi f]b[ 'mci f



- i bXYfgHUbX'mci f'f][ \hg'UbX'fYgdcbg]V] ]hYg'Ug'U'gh XYbhUhl BGK
- VY'Uk UfY'cZd'U[ ]Uf]ga ž'Wcdmf][ \hž' BGK 'Gh XYbh7cXY'cZ7cbXi WñUbX'5WwdfUV'Y'I gY'cZ I BGK '⇒H'F Ygci fW'g'Dc`]Wñ

5 WUXYa ]W**ϕ**Zcfa Uh]cb

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