

# 7ci fgY<sup>·</sup>Cj Yfj ]Yk

## GHJZZ:7cbHJWh:8YHJ]`g`

## 7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`]lm	@cWUh]cb	D\cbY
>]b[ 'n\Uc		J	Fa&' %8ž FcVYfh	

### 5WUXYa]W±bZcfaUh]cb

: cf`YggYbh]U``ghi XYbh`]bZcfa Uh]cb`fY`Uh]b[ 'hc. 'fYei Yghg`Zcf`Yl hYbg]cb/fYj ]Yk 'cZa Uf\_g/cWW dUh]cbU``\YU`h\UbX`gUZYhm'Yl Ua ]bUh]cb'dfcWYxi fYg/gdYW]U``Wcbg]XYfUh]cb`]b'h\Y'Yj YbhcZ]``bYgg`cf`a ]gUXj Ybhi fY/ghi XYbh`Yei ]hmUbX`X]gUV]`]hm'UbX`ch\Yf`YggYbh]U``UWUXYa ]W]bZcfa Uh]cbž gYY`\hdg.#k k k "Ufhg"i bqk "YXi "Ui #W ffYbhqhi XYbhq#UWUXYa ]W]bZcfa Uh]cb#dfchcWc`q![i ]XY`]bYq#

### 7ci fgY 8YHJ] g

### 7 fYX]hDc]bhg\*\*

#### Gi a a UfmcZh\Y 7ci fgY

H\]g`Wci fgY`k]``dfcj]XY`mci `k]h\`U`WcbhYa dcfUfm'UbX`Wf]h]WU``i bXYfghUbX]b[`cZh\Y`Z bXUa YbhU``WcbW'dhg UbX`dfcWfggYg`h\Uhi bXYfd]b`di V`]WfY`Uh]cbg`ghfUhY[]Yg`UbX`WJa dU][ bg"`H\Y`Wci fgY`ZcWi gYg`cb`ghfUhY[]W Wca a i b]WUh]cb`d`Ubb]b[ ždi V`]WfY`Uh]cbg`fYgYUfW\žh\Y`fc`Y`cZWi`hi fY`]b`di V`]WfY`Uh]cbgž]ggi Yg`UbX`Wf]g]g Wca a i b]WUh]cbž`WcfdcfUhY`gc\Y]U`fYgdcbg]V]`]mn'UbX`Yh\]Wg"

#### 5 hh Y WcbWi g]cb cZh ]g Wci fgY h Y gh XYbhk ] ` VY UV Y hc

- %" i bXYfghUbX`h\Y`fUb[Y`cZUddfcUWXYg`UbX`XYVUhYg`UVci hh\Y`bUh fYžfc`Y`UbX`j U`i Y`cZdi V`]W fY`Uhcba
- &" i bXYfYgHJbX`k \mih\Y`d`Ubb]b[ 'dfcWYgg']g']a dcfHJbhž]XYbhJZmfYgYUfW. 'UddfcUW\Ygž'XYhYfa ]bY ghfUhY[ ]WcVYW]j YgžgY`YWhJbX`^ ghJZmgHfUhY[ ]Ygž'UbX`XYj Y`cd'WJa dU][ b'HJWŊWq
- ' " 5dd`m'Wca a i b]WUh]cb'UbX'glfUhY[ m'WcbWYdhg'hc'WUa dU][ b'd`Ubb]b[ 'UbX'dfYdUfY'di V']WfY`Uh]cbg Wca a i b]WUh]cb'HYI hg'UbX'a UhYf]U`q
- ("5ddfyWJUHYTh\Y]adcffUbWYcZYh\JWU`diV)WfY`UhJcbg'dfUWJWYUbXgcWJU`fYgdcbg]V]`Jhm

#### HYUWX]b[ GhfUhY[]Yg

H\]g'Wci fgY'k ]``Ya d`cmgYa ]bUfg'hc'dfcj ]XY'fY[i `Uf'cddcfhi b]hJYg'Zcf'dfcXi Wfj Y'X]U`c[i Yg'UbX Wc``UVcfUhJcb"'Ghi XYbhg'k ]``Yb[U[Y']b'ghfUhY[mXYj Y`cda Ybh'UbX'UbU`mg]gž'X]gW gg'WcbhYa dcfUfm gWbUf]cgž'UbU`mgY 'WugY'ghi X]Yg'UbX'XYj Y`cd'Wca a i b]\WhJcb'hYl hg"'H\Y'`YUfb]b['dfc\Wgg'k]``Ya d\Ug]gY 'fYU`'k cf'X''di V`]\WfY`UhJcbg'dfcV'Ya gž'W.U``Yb[Yg'UbX'cddcfhi b]hJYg'hc'Ugg]ghighi XYbhg'hc fY`UhY'h\YcfYhJ\U'\Wb\Wdfy'hc'h\Y'dfU\WfJ\W'cZdi V`]\WfY`UhJcbg'':\DhYfU\Wfj Y'UbX'fYZY\Wfj Y'hYU\X]b['UddfcU\XYg'k]``'VY df]cf]hJgYX'U`cb['k]h\'Xb\Wdhi U``ZfUa Yk cf\_g'UbX'Udd`]YX'a Yh\cXg''

## 5ggYgga Ybh

### 5ggYgga Ybh'HUg\_g'

5ggYgga Ybh'hJg_	K Y][\h	8i Y <sup>.</sup> 8UhY	Gh XYbh@YUfb]b[ Ci hWca Yg 5ggYggYX
Hi hcf]U``ZUWj^]hUhjcb`	&\$I	DYf'hi hcf]U`'gW.YXi `Yg	% <u>*</u> &
FYdcfh	' \$ı	&*#\$,#&\$% `%%) - `DA	% <b>ž</b> &Ž
7 Ua dU][ b·7 f]h]ei Y·	) \$1	&%#%\$#&\$% `%%) - `DA	%ž&Ž Ž(

### 5ggYgga Ybh'8YhJ]`g

5ggYgga Ybh% 'Hi hcf]U` 'ZUWj`]hUhjcb

GhUfh XUhY.

@Yb[ h\.^&\$a ]b^Zcf^U^dU]f^cZgh XYbhg

8 YHJ]`g. `&\$`a ]bi hYg`Zcf`U`dU]f`cZghi!XYbhg"Ghi XYbhg`k ]```fYWY]j Y`Wca a Ybhg`]b`WUgg`UbX`k f]hHYb`ZYYXVUW\_k ]h\`U`bi a Yf]WJ``[fUXY`k]``VY`dfcj ]XYX`j ]U`h\Y`@YUfb]b[`A UbU[Ya YbhGmghYa"

## Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g

 $Gh\ XYbhg\ 'UfY\ 'YI\ dYWhYX\ 'hc\ 'di\ hh\ Y]f\ 'bUa\ Yg\ 'UbX\ 'gh\ XYbhbi\ a\ VYfg\ 'cb\ 'Yj\ YfmdU[\ Y\ 'cZh\ Y]f\ 'Ugg][\ ba\ Ybhg\ ''$ 

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

- K cf\_'gi Va ]hhYX'%\$'hc'% 'XUmg'UZhYf'h\Y'gh]di `UhYX'XYUX`]bY'k ]``VY'UggYggYX'UbX'ZYYXVUW\_dfcj ]XYX'Vi h'U'a Uf\_'cZnYfc'k ]``VY'fYWcfXYX'''=Zh\Y'k cf\_'k ci `X'\Uj Y'fYW']j YX'U'dUgg'a Uf\_'Vi h'Zcf h\Y'`UhYbYgg'UbX'h\Y'k cf\_']g'U'Wca di `gcfm'Wci fgY'Wca dcbYbh'f\i fX`Y'fYei ]fYa Ybhz'U'gh XYbh'k ]``VY'XYYa YX'hc'\Uj Y'a Yhh\UhfYei ]fYa Ybh/
- K cf\_'gi Va ]hhYX`&\$`cf`a cfY`XUmg`UZhYf`h\Y`gh]di `UhYX`XYUX`]bY`k ]```bchVY`UWW\dhYX`Zcf UggYgga YbhUbX`k ]```fYWY]j Y`bc`ZYYXVUW\_ža Uf\_'cf`[ fUXY"'=Zh\Y`UggYgga YbhHUg\_']g`U`Wca di `gcfm Wca dcbYbhcZh\Y`Wci fgY`U`gh XYbhk ]```fYWY]j Y`Ub`l bgUh]gZJWcfm: U]``fl : Ł`[ fUXY`Ug`U`fYgi `hcZ i bgUh]gZJWcfmdYfZcfa UbWY`]b`Ub`YggYbh]U``Wca dcbYbhcZh\Y`Wci fgY"

H\]g']bZcfa Uh]cb']g'U`gc'Uj U]`UV`Y'Uh

\hdg.#k k k "Uffg"i bgk "YXi "Ui #W ffYbhgh XYbhg#UWJXYa ]W]bZcfa Uhcb#dfchcWc`g![i ]XY`]bYg#

#### GdYWJU`7cbq]XYfUhcb55dd`]WUhcbq

 $\label{thm:condition} $$Mci `WUb`Udd`m'Zcf'gdYW]U``Wcbg]XYfUh]cb`k \Yb`]``bYgg`cf`ch\Yf`W]fW a ghUbWfg`]bhYfZYfY`k ]h\`mci f UggYgga Ybh'dYfZcfa UbWf''$ 

G]W\_bYggža ]gUXj Ybhi fY'cf'ch\Yf'W]fW a ghUbWrg'VYmcbX'mci f'Wcbhfc``a Um

ł DfYj Ybhmci Zfca Wca d`Yhjb[ 'U'Wci fgY'fYei ]fYa Ybhž

ł "? YYd 'mci 'Zfca 'UthYbX]b[ 'Ub 'UggYggUV'Y 'UWhj ]lmž

ł Ghod moi igi Va ]hh]b[ iUggYggUV Y k cf\_ Zcf U Wci fgYž

ł G][ b]ZJWUbhmiUZZYWimci fidYfZcfa UbWY]biUggYggUVYkcf\_žVYjhUiZcfa U`YbX!cZgYa YghYfiYl Ua ]bUhjcbžU WUggihYghžU`UVcfUhcfmhYghžU`gYa ]bUfidfYgYbhUhjcbicfiUbmch\YfiZcfa icZUggYgga Ybh'

cfilia fth Yfixyfuljgi]bify`uhjcbihciGdYWju`i7 cbg]XYfuhjcbi]bWi X]b[iiK \Ybihci5dd`mižii<ckihci5dd`mi`ubXiiGiddcfhjb[i8cWia Ybhuhjcbiid`YugYifyZyfihcih\YiGdYWju`i7 cbg]XYfuhjcbik YVghjY.ii\hdg.#ghiXYbhibgk "YXii"ui #gdYWju`iWcbg]XYfuhjcb

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

D`U[]Uf]ga `]g`i g]b[ 'h\Y`k cfXg`cf`]XYUg`cZch\Yfg`UbX`dfYgYbh]b[ 'h\Ya `Ug`mci f`ck b"'\lefi\Wb'hU\_Y`a Ubm Zcfa gžZfca `XY`]VYfUhY`W\YUh]b[ 'hc`UVW]XYbhU`mWcdm]b[ 'Zfca `U`gci f\W' k ]h\ci hUW\_bck `YX[ Ya Ybh'

IBGK [fcidgdu[]Uf]ga ]bhch\YZc``ck]b[ WUhY[cf]Yg.

7 cdm]b[.'i g]b['h\Y'gUa Y'cf'j Yfmg]a]`Uf'k cfXg'hc'h\Y'cf][]bU`hYl h'cf']XYU'k]h\ci h'UW\_bck `YX[]b['h\Y gci fW'cf'i g]b['ei chUh]cb'a Uf\_g"'H\]g'U`gc'Udd`]Yg'hc']a U[Ygž'Ufh'UbX'XYg][b'dfcYWhgž'Ug'k Y``'Ug dfYgYbhUh]cbg'k \YfY'gca YcbY'dfYgYbhg'Ubch\Yf'g']XYUg'cf'k cfXg'k]h\ci h'WfYX]h'

⇒ Uddfcdf]UhY 'dUfUd\fUg]b[...7\Ub[]b[ 'U'ZYk 'k cfXg'UbX'd\fUgYg'k \]'Y 'a cghmfYhJ]b]b[ 'h\Y'cf][]bU` ghfi Wh fY 'UbX#cf'dfc[fYgg]cb'cZ]XYUg'cZh\Y'cf][]bU'žUbX']bZcfa Uh]cb'k ]h\ci hUW\_bck `YX[Ya Ybh'H\]g'U`gc Udd`]Yg']b'dfYgYbhUh]cbg'k \YfY'gca YcbY'dUfUd\fUgYg'Ubch\Yf'g']XYUg'cf'k cfXg'k ]h\ci hWfYX]hUbX'hc d]YW]b[ 'hc[Yh\Yf'ei chYg'UbX'dUfUd\fUgYg']bhc'U'bYk 'k \c`Yžk]h\ci hUddfcdf]UhY'fYZYfYbW]b[ "

 $7c^{i}$  g]cb. 'k cf\_]b[ 'k ]th. 'cth. Yfg'Vi h'dUgg]b[ 'c\Zth. Y'k cf\_'Ug'U'dYfgcb'g']bX]j ]Xi U''k cf\_"'7c''i g]cb'U'gc

## FYgci fWfg

DfYgWf]VYX F Ygci fWYg

5j U]`UV`Y`cb'A ccX`Y

FYWca a YbXYX FYgci fWYg

5j U]`UV`Y`cb'AccX`Y

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

H\]g`Wci fgY`k]```i bXYf[ c`Wcbf]bi U``XYj Y`cda Ybhžij]U`ZYYXVUW\_`dfcWfggYg`gi W.`Ug`75H9=UbX`Wc``Y[]U`fYj]Yk"`K Y`h\YfYZcfY`HU\_Y`mci f`ZYYXVUW\_`j YfmgYf]ci g`m'`K Y`k]```U`gc`Wc``YWh]bZcfa U``ZYYXVUW\_`]b`h\Y Zcfa `cZUbcbma ci g`gi [[Ygf]cbg`UbX`Wca a Ybhg`f\fci [\ci hh\Y`Wci fgY"`

= U[Y'7fYX]h

6cX]Yg'/ \*bhYfZJWYg'&\$%\*

7F = 7CG

7F =7 C G 'Dfcj ]XYf'7cXY. '\$\$\$-,;