

**EDST5808** 

# 7ci fgY<sup>.</sup>Cj Yfj ]Yk

## 7ci fgY 8YW] g

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

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

H\]g`Wci fgY`]g`Ub`]bfcXi Wfjcb'hc`h\Y`\_YmWcbWidhg`UbX`]ggi Yg`gi ffci bX]b[`[]ZhYX`YXi WUhjcb"`H\fci [\`U a ]I hi fY`cZcb`]bY``YWi fYgžgY`Z\X]fYWhYX`UWhj ]hJYgžX]gW gg]cb`Zcfi a g`UbX`gY`Z\X]fYWhYX`fYUX]b[žmci `k ]`` [U]b`]bZcfa Uhjcb`UbX`g\_]``g`fY`Uhjb[`hc`h\Y.`fUŁ`XYZ]b]hJcbgžWcbWidh]cbgžUbX`a cXY`g`cZ[]ZhYXbYggž ]bWi X]b[`h\cgY`Wca a cb`mi gYX`]b`5i ghfU`]Ub`gW\cc`gžffVŁ'h\Y`Wc[b]hJj Y`UbX`UZYWhJ Y`W\UfUWhYf]ghJWg`cZ []ZhYX`ghi XYbhg`fUbX`h\Y]fXJZYfYbWig`hc`h\Y`Wc[b]hJ Y`UbX`UZYWhJ Y`W\UfUWhYf]ghJWg`cZbcb![]ZhYX`ghi XYbhg`žfXŁ'X]j YfgY`[fci dg cZ[]ZhYX`ghi XYbhgž]bWi X]b[`h\]jWj`YI WYdhJcbU``ghi XYbhgžUbX`flYŁ WYYUhji ]m'i

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

- %" ⇒ YbhjZmUbX`Yj U`i UhY`h\Y`W ffYbhjggi Yg`h\UhjbZi YbWY`h\Y`YXi WUhjcb`cZ]bhY``YWh U``m[]ZhYX ghi XYbhg"
- &" 8 ]gWi gg`k Umg`]b`k \ ]WX`]bhY``YWi U``mi[ ]ZhYX`ghi XYbhg`X]ZZYf`Zfca `h\Y]f`U[ Y`dYYfg`]b`h\Y]f`Wc[ b]hjj Y UbX`gcWjc! UZZYWfj Y`XYj Y`cda Ybh'
- ' " 5ggYgg h\Y WUi gYg cZUWUXYa ]Wi bXYfUW\]Yj Ya Ybh]b [ ]ZhYX gh XYbhg"
- ("91 Ua]bY'gcaY'cZh\Y'Waaab'amh\g'UggcWJUhYX'k]h\'h\Y'`YUfb]b['bYYXg'cZ[]ZhYX'gh XYbhg"

## HYUWX]b[ 'GhfUhY[]Yq'

#### HYUW ]b[ ghfUhY[ ]Yg

H\Y`H\'UW\]b[`gHfUH\'[]Yg`hc`VY`i gYX`]b`h\Y`Wci fgY`k]```Wca df]gY`U`a]l hi fY`cZcb`]bY``YWhi fYgž'gY`Z\X]fYWhYXUWhj] ]hj\Ygž'dUfh]WjdUhjcb`]b`cb`]bY`X]gWi gg]cb`Zcfi a gž'UbX`gY`Z\X]fYWhYX`fYUX]b[`h\UhfYZYWhYj]XYbWY!VUgYXHYUW\]b[`dfUWhJWYg"

#### F UhlcbU`Y

H\Y`WcbhYbhcZh\Y`Wci fgY`dfcj ]XYg`mci `k ]h\`Ub`cj Yfj ]Yk `cZh\Y`a U'cf`]ggi Yg`fY`Yj Ubhhc`h\Y`YXi WUh]cb`cZ [ ]ZhYX`UbX`hU`YbhYX`ghi XYbhg"'H\Y`hYUW\]b[ 'UddfcUW\'UhhYa dhg`hc`UWh] Y`mYb[ U[ Y`mci `]b`X]gW gg]cb`cZ W ffYbhih\YcfmUbX`dfUWhJWYž'UbX`Ugg]ghg`mci `]b``YUfb]b[ `bYk `]bZcfa Uh]cb`UbX`g\_]`g`fY`UhYX`hc`\_Ym WcbWYdhg`]b`[ ]ZhYX`YXi WUh]cb"'Mci `k ]```VY`fYei ]fYX`hc`hU\_Y`fYgdcbg]V]`]mmZcf`mci f`ck b``YUfb]b[ `]b`h\]g Wci fgY"

# 5i ghfu`]Ub DfcZYgg]cbU`; fUXi UhY HYUWX]b[ GhUbXUfXg

GHJbXUfX	8 YgWf]dh]cb
%"&""	9I dUbX'i bXYfgHUbX]b['cZ\ck'ghi XYbhg'`YUfb'i g]b['fYgYUfW\'UbX'k cf_d`UWY_bck `YX[Y"
%") "'	9j U`i UhY``YUfb]b[`UbX`hYUW\]b[`dfc[fUa gž`i g]b[`ghi XYbh'UggYgga Ybh'XUhUž'h\Uh'UfY X]ZZYfYbh]UhYX`Zcf`h\Y`gdYW]Z]W`YUfb]b[`bYYXg`cZghi XYbhg`UWfcgg`h\Y`Zi```fUb[Y`cZ UV]`]h]Yg"
1 111 111	Gi ddcfhWc``YU[i Yg'hc'gY`YWhUbX'Udd`mYZZYWhjjY'hYUWX]b['ghfUhY[]Yg'hc'XYjY`cd _bck`YX[Yžg_]``gždfcV`Ya'gc`j]b['UbX'Wf]hjWU``UbX'WfYUhjjY'h\]b_]b[
"*"&	9j U`i UHY`dYfgcbU``HYUVX]b[`'UbX``YUfb]b[`'dfc[fUag'ig]b[`'Yj]XYbWYž]bWiX]b[`'ZYYXVUW_ Zfca 'ghiXYbhg'UbX'ghiXYbh'UggYggaYbh'XUHJžhc']bZcfa 'd`Ubb]b["
*"&"&	DUfhjWjdUhY`]b``YUfb]b[`hc`i dXUhY`_bck`YX[Y`UbX`dfUWfjWYž'hUf[YhYX`hc`dfcZYgg]cbU`bYYXg`UbX`gWkcc``UbX#cf`gmghYa`df]cf]hjYg"
*"("&	I bXYfftJ_Y`dfcZYgg]cbU```YUfb]b[ `dfc[ fUa g`XYg][ bYX`hc`UXXfYgg`]XYbh]Z]YX`ghi XYbh `YUfb]b[ `bYYXg"

## 5ggYgga Ybh

; YbYfU``UggYgga Ybh]bZcfa Uh]cb'a UmVY`UWWYggYX`]b'A ccX`Y"

## 5ggYgga Ybh'HUg\_g'

5ggYgga Ybh'hUg_	K Y][ \h	GH XYbh@YUfb]b[ Ci hWca Yg 5ggYggYX	5 +HG@'DfcZYgg]cbU`; fUXi UHY HYUWX]b[ 'GHJbXUfXg'5ggYggYX	8iY 8UhY
F YZYW]cb'	(\$1	%ž&ž( ž)	%'&"' ž%") "' ž "' "'	&*#\$'#& \$% \$).\$\$ DA
5XjcWUWmUffjWY	*\$1	&Z Z(Z)	%"&"	8%#\$) #& \$% \$) .\$\$ DA

 $\label{eq:continuous} D`YUgY`fYZYf`hc`3gefcS`fS`BcbXWee[a`S^EfS`VSolveXadFWSUZWcb`cb`h\Y`dfYj]cig`dU[YBcbCb].$ 

5ggYgga Ybh'8YHJ]`g

5ggYgga Ybh% FYZYW**j**cb

GhUfhXUhY. Bch5dd`]WUV`Y

**8YHJ]`g.** `HUg\_`%'! `DfYdUfY`U`dUdYf`th.Uhidfcj ]XYg`U`fYZYWf]cb`cb`[ ]ZhYX`ghi XYbhg# ]ZhYX`YXi WUh]cb`k ]th. fYZYfYbWY`hc`th.Y``]hYfUhi fY"Ghi XYbhg`k ]```fYWY]j Y`k f]hhYb`ZYYXVUW\_`k ]th.]b`%\$`XUmg`cZgi Va ]gg]cb

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

Gh XYbhg UfY Yl dYWYX 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

#mci YbWci bhYf'U'dfcV'Ya k \Yb'UhYa dhJo['hc'gi Va ]hmci f'Ugg][ ba Ybhh\fci [\'Hi fb]h]bž'd'YUgY
hY'Yd\cbY'9l hYfbU'Gi ddcfhcb'-', ) "''' %cf'Ya U]'h\Ya 'cb'<u>Yl hYfbU'hY'hgi ddcfh4 i bgk "YXi "Ui"</u>"'Gi ddcfh
\ci fg'UfY', .\$\$Ua '-'%\$.\$\$da 'cb'k YY\_XUmg'UbX'-.\$\$Ua '-').\$\$da 'cb'k YY\_YbXg'fl \*) 'XUmg'U'mYUfŁ"'#mci
UfY'i bUV'Y'hc'gi Va ]hmci f'Ugg][ ba YbhXi Y'hc'U'ZJi 'hk ]h\'Hi fb]h]b'mci 'a Um'Udd'mZcf'Ub'Yl hYbg]cbž'Vi hmci
a i ghfYhJ]b'mci f'h]W\_Yhbi a VYf'Zfca '9l hYfbU''Gi ddcfhfU'cb['k]h\'Ubmch\Yf'fY'Yj UbhXcW a YbhgŁ'hc
]bWi XY'Ug'Yj ]XYbW'hc'gi ddcfhmci f'Yl hYbg]cb'Udd']WUh]cb"'#mci 'Ya U]''9l hYfbU''Gi ddcfhmci 'k]''
Ui hca Uh]WU''mfYWf']j Y'U'h]W\_Yhbi a VYfž'Vi h]Zmci 'hY'Yd\cbY'mci 'k]'''bYYX'hc'gdYW]ZJWU''mUg\_'Zcf'cbY"
Hi fb]h]b'U'gc'dfcj ]XYg'i dXUhYg'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk]hYf"

; YbYfU``mž'UggYgga YbhitUg\_g'a i ghVY'gi Va ]hhYX'Y`YWfcb]WU``mj ]U'Y]h\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ ba Ybh'' =b']bghUbWfg'k \YfY'h\]g']g'bchdcgg]V`Yž']hk ]```VY'ghUhYX'cb'mci f'Wci fgY'g'A ccX`Y'g]hY'k ]h\U`hYfbUh]j Y'gi Va ]gg]cb'XYhU]`g''

@UhY 5 ggYgga YbhDYbU`hJYg

ł `G][ b]Z]\WbhmUZZY\Wimci f`dYfZcfa Ub\Wr`]b`UggYggUV`Y`k cf\_ž`VY`]h'U`Zcfa U``YbX!cZgYa YghYf`Yl Ua ]bUh]cbž`U`\WUgg`hYghž`U``UVcfUhcfmihYghž`U`gYa ]bUf`dfYgYbhUh]cb`cf`Ubmch\Yf`Zcfa 'cZUggYgga Ybh'

### 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 fW'k ]h\ci hUW\_bck `YX[ Ya Ybh'

IBGK [fcidg'd'U[]Uf]ga ]bhc'h\Y'Zc``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'

#JUddfcdf]UhY`dUfUd\fUg]b[.'W\Ub[]b['U'ZYk'k cfXg'UbX'd\fUgYg'k\]'Y`a cghmfYhU]b]b['h\Y`cf][]bU`ghi Whi fY`UbX']bZcfa Uh]cb`k]h\ci h'UW\_bck `YX[Ya Ybh''H\]g'U`gc'Udd`]Yg']b'dfYgYbhUh]cbg'k\YfY`gca YcbYdUfUd\fUgYg'Ubch\Yf'g']XYUg'cf'k cfXg'k]h\ci h'WfYX]h''#iU`gc'Udd`]Yg'hc'd]YW]b['hc[Yh\Yf'ei chYg'UbXdUfUd\fUgYg']bhc'U'bYk'k\c`Yž'k]h\ci h'fYZYfYbW]b['UbX'U'ghi XYbhg'ck b'UbU`mg]g'hc'Vf]b['h\Y'a UhYf]U`hc[Yh\Yf'

7 c``i g]cb. 'k cf\_]b[ 'k ]h\ 'ch\Yfg'Vi h'dUgg]b[ 'cZZh\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'ghi XYbhVYZcfY'h\Y'Xi Y'XUhYžcf'Zcf'h\Y'di fdcgY'cZh\Ya d`U[ ]Uf]g]b[ 'Uh'Ubmh]a Yž'dUm]b[ 'Ubch\Yf'dYfgcb'hc'dYfZcfa 'Ub'UWUXYa ]WhUg\_ž'ghYU`]b[ 'cf'UWei ]f]b[ Ubch\Yf'dYfgcb'g'UWUXYa ]Wk cf\_'UbX'Wcdm]b[ ']hz'cZYf]b[ 'hc'Wca d`YhY'Ubch\Yf'dYfgcb'g'k cf\_'cf'gYY\_]b[ dUma YbhZcf'Wca d`Yh]b[ 'UWUXYa ]Wk cf\_"

±bUddfcdf]UhY`W]hUh]cb.`7]h]b[ˈgci fW/gˈk \]WX`\Uj Y`bchVYYb`fYUXžk]h\ci hUW\_bck`YX[]b[ˈh\Y`″gYWcbXUfm″gci fW/Zfca k \]WX`\_bck`YX[Y`cZh\Ya`\Ug'VYYb`cVhU]bYX"

8 i d`]\WUh]cb`ff`gY`Zld`U[]\Uf]ga "Ł`gi Va]\h]b[`mci f`ck b`k cf\_ž]b`k \c`Y`cf`]b`dUfhžk \YfY`]h`\Ug`dfYj]ci g`m VYYb`dfYdUfYX`cf`gi Va]\hYX`Zcf`Ubch\Yf`UqqYqqa Ybhcf\Wci fgY`UhI\_BGK\_`cf`Ubch\Yf`i b]\Yfq]\m"

7 cffYWhfYZYfYbWb[ dfUWhWyg.

• Dufud\fug]b[žgi a a Uf]g]b[žYggUmk f]h]b["UbX"h]a Y a UbU[Ya Ybh

•

- VYMYfa UbU[Ymcifh]a Y
- i bXYfgHJbX'mci f'f][ \hg'UbX'fYgdcbg]V]`]h]Yg'Ug'U'ghi XYbh'Uhi BGK
   VY'Uk UfY'cZd`U[ ]Uf]ga ž'Wcdmf][ \hž'I BGK 'Ghi XYbh'7cXY'cZ7cbXi Wh'UbX'5WWYdhJV`Y'I gY'cZ I BGK '= H'F Ygci fWfg'Dc`]Wh