

# **EDST5888**

Dfc YWh

GYa YghYf'C bY''##'&\$%

# 7ci fgY Cj Yfj ]Yk

#### GHJZZ7cbHJWh8YHJ]`g`

#### '7cbj Ybcfg'

B Ua Y	9a U]`	5j U]`UV]`]hm	@cWJhjcb	D\cbY
?Yffm6UfbYth		Uddc]bha Ybh	F cca '%\$*ž ; ccXgY`` 6i]`X]b[	-',)%-,*

#### GWkcc~7cbhJWh~abZcfa Uh]cb

GW.cc`cZ9Xi WUhjcb 5ftg'UbX'GcWjU`GWjYbWYg

@Y|Y``%ž'>c\b'; ccXgY``6i]`X]b[ fl &\$Ł

 $H. \, \dot{Z} * \% f \& \dot{L} - \dot{A} , ) \, \dot{M} + + \dot{A}$ 

9. YXi WUhjcb4 i bgk "YXi "Ui

K . YXi WUNcb"Ufhqi bqk "YXi "Ui

## 5 hyb XUb WY F Yei ]fYa Ybhg

#### 5XX]hjcbU`GWkcc`cZ9XiWUhjcb'UhhybXUbWYfYei]fYa Ybhg

#i]g'Yl dYWYX'h\UhiUbmghi XYbhiYbfc``YX`]b'Ub'98GH'Wci fgY'k ]h\ h\Y'GW\cc``cZ9Xi WUh]cb'k ]``a U\_Y'U Wca a ]ha Ybhihc'h\Y]f``YUfb]b[ 'UbX'UhiYbX'U```WUggYg']b'Z ```k \YfY'WcbhYbhi]g'XY`]j YfYX`]b'U'ZJWY!hc!ZJWY a cXY'Yl Wrdh]b'WfW a ghUbWg'k \YfY'UVgYbW'']g'Xi Y'hc']`bYggža ]gUXj Ybhi fY'cfi bZcfYgYYb WfW a ghUbWfg'VYmcbX'h\Y'ghi XYbhg'Wcbhfc`"'5'a ]b]a i a 'UhiYbXUbW''fYei ]fYa YbhcZ, \$i ']g'fYei ]fYX'Zcf YUWX'Wci fgY''' #b'WfhU]b'WfW a ghUbWrgž'U'ghi XYbha Uma ]gg'i d'hc'&\$i 'cZU'Wci fgY'k ]h\ci h\Zcfa U` Udd`]WUh]cb'UbX'i d'hc'' 'i 'cZU'Wci fgY'k ]h\Zcfa U``XcW a YbhUh]cb'fgYbhj ]U'Ya U]`'hc'Wci fgY'Wcbj YbcfŁ dfcj ]X]b[ 'U``h\Y'fYei ]fYa Ybhg'XYhU]`YX'VY`ck 'UfY'a Yh''Ghi XYbhg'bcha YYh]b[ 'h\Y'UhiYbXUbW' fYei ]fYa Ybhg'ci h]bg cj Y'k ]h\ci h\Zcfa U`` 'a Uma ]gg'i d'hc'&\$i 'cZU'Wci fgY'k ]h\ci h\Zcfa U`

# 7ci fgY 8YW] g

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

## Gi a a UfmcZh\Y 7ci fgY

#Dith]giWci fgYžmci ik]```\Uj YiUbicddcfhi b]hmhciVi ]`XicbicfiYl hYbXi]bhYfYghgiXYj YicdYXi]bimci figdYW]U`]gh UfYU'cZYXi WUh]cbiVmi bXYfhU\_]b[ 'U'gYiZiX]fYWhYXiga U```gWU'Yi]bX]j ]Xi U``WUdghcbYidfcYWhzigi ddcfhYXiVmU gi dYfj ]g]b[ 'UWUXYa ]Wzi]biga U```[ fci dgik ]thich\Yfighi XYbhgiZica ith\YigUa YigdYW]U`]gUh]cbi"H\YidfcYWhia i ghXYa cbghfUhYigmbh\Yg]giUbXiUdd`]WUh]cbicZ\_bck `YX[ YiUbXig\_]``giXYj Y`cdYXi]biWci fgYk cf\_ Wca dcbYbhgicZmci figdYW]U`]gUh]cbirciUXXfYggiUidUfh]Wi`UfidfcViYa icfi]ggi Yi]biUidfYj ]ci gicfiWiffYbhk cf\_ WcbhYl h'i

#### 5 hith Y WcbWi g]cb cZth ]g Wci fgY th Y ghi XYbhik ]``VY UV Y the

- %" 8Ya cbghfuhr uxj ubwxi bxyfghubx]b[ 'czu'hcd]Wcz]bhrfyghi]b Yxi Wuhjcb" &" @cWuhr ubx wf]hJwu`myj u`i uhr h\y`z ```fub[ Y`czfyzrfybwrg`fy`yj ubhhc`u'hcd]Wcz]bhrfyghi]b yxi wuhlcb"
- '" I gY`Uddfcdf]UhY`fYgYUfW\`a Yh\cXc`c[mhc`cVhJ]b`UbX`UbU`mgY`XUhU`]b`Ub`]bj Ygh][Uh]cb`cZU`hcd]WcZ ]bhYfYgh]b`YXi WUh]cbž'UbX`fYdcfh'UbX`]bhYfdfYhi\Y`g][b]ZJWUbW'cZh\Y`ZjbX]b[g`]b`fY`Uh]cb`hc i bXYf`m]b[`h\Ycfm'UbX`dfUWh]WYž

## HYUWX]b[ GhfUhY[]Yg

F UhjcbU`Y. 'H\]g`Wci fgY`]g`VY]b[ `cZYfYX`hc`dfcj ]XY`ghi XYbhg`k ]h\`Ub`cddcfhi b]hmhc`i bXYfhU\_Y`U`ga U``! g\W\Y`\WdghcbY`dfc\Y\Mi]b`U`gdY\\Z\\Y]f`gdY\\J\)`]gUhjcb`]b`YXi \\\J\nc\Y\cd`U`XYYdYf`fYZY\\Mj] Y`UddfcU\\\`hc`YXi \\\J\nc\Y\alpha\\Y`UV]`]hmhc`UbU`mgYž Yj U`i UhYžgmbh\Yg]gY`UbX`Udd`m\_bck`YX[Y`UbX`g\_]``g`Zfca `YUf`]Yf`ghU[Yg`cZh\Y]f`dfc[fUa "

HYUWX]b[ 'gffUhY[ ]Yg. '98GH), , , , ']g'U'gY'ZX]fYWfYX'Wci fgY"'C dhJcbU`'[ fci d'a YYhJb[ g'Uhh\Y'VY[ ]bb]b[ fK YY\_'%L'UbX'hck UfXg'h\Y'YbX'fK YY\_'%LcZh\Y'gYa YghYf'cf[ Ub]gYX'Vmgi dYfj ]g]b[ ``YWfi fYf'''H\YgY a YYhJb[ g'k ]``Wcj Yf'[ YbYfU`']ggi Yg']b'WcbXi WhJb[ 'ga U`'!gWU'Y'dfc'YWfg']b'mci f'UfYU'cZgdYWJU']gUhJcbz'Ug k Y``'Ug'h\Y'dfYdUfUhJcb'fYei ]fYX'fY[ "'XYj Y`cd]b[ 'U'dfc'YWfidfcdcgU`'UbX'U'WYUf'ZYUg]V'Y'd`Ub'Zcf ]a d'Ya YbhUhJcbL'''H\Y']b]hJU`'gYgg]cb']g'XYg][ bYX'hc'gha i `UhY'ghi XYbhh\]b\_]b[ 'VYWJi gY'h\YfY'UfY'U bi a VYf'cZ]ggi Yg'h\Uhghi XYbhg'k ]``bYYX'hc'UXXfYgg'gc'h\UhU'ZYUg]V'Y'dfc'YWfiWJb'VY'XYj Y`cdYX'''±b'h\Y Zc``ck 'i d'a YYhJb[ ']bX]j ]Xi U'#[ fci d'X]gW gg]cbg'UbX'dYYf'a Ybhcfg\]d#gi ddcfhik ]``'VY'i hJ`]gYX'hc']bWfYUgY h\Y'WJdUVJ[mmcZghi XYbhg'Zcf'WcbXi WhJb[ 'ga U``!gWU'Y'dfc'YWfg'''H\YgY'UWfjj ]hJYg'k ]``cVWV f']b'U WJa UhY'h\Uh]g'gi ddcfhjj Y'UbX']bWi g]j Y'cZU```YUfbYfg''

# 5ggYgga Ybh

5ggYgga Ybh% Dfc YWhDfcdcgU`

FZ[e [e S Zgd/WfSe]

5 '%\$\$\$!kcfX'dfcYWhdfcdcgU`ž']bWi X]b['h\Y'U]ag'UbX'fUh]cbU`Y'cZh\Y'dfcYWb`ci h`]bY'cZh\Y'dfcdcgYXUddfcUW\ž']bWi X]b['h]aY`]bYž'UbX'YIdYWhYX'Wcbhf]Vi h]cb'hc'h\Y'Z]Y`X"'GUad`Y'dfcZcfaU'VY`ck"

8 UhY Xi Y. "Gi Va ]hcb A cb X Um% "A UfVX "Uh) da "j ]U A cc X Y

5ggYgga Ybh& FYgYUfW FYdcfh

8UhY Xi Y. Gi Va ]hcb A cb XUm( >i b Y Uh) da i ]U A cc X Y

BchY. '5```UggYgga Ybhg`bYYX`hc`VY`gi Va`]hhYX`cb`]bY`j`]U`AccX`Y`Vm) da "`Ghi XYbhg`bc``cb[Yf`bYYX`hc`i gYU'Wcj Yf`g\YYh'`Ghi XYbhg`UfY`U`gc`fYei ]fYX`hc`\_YYd`U```XfUZngž`cf][]bU``XUhU`UbX`ch\Yf`Yj]XYbW\`cZh\YUi h\Ybh]\WhmcZh\Y`k cf\_`Zcf`Uh`YUghcbY`mYUf`UZhYf`YI Ua`]bUh]cb"`=ZUb`UggYgga Ybh`]g`a`]g`U]X`h\Y`ghi XYbh`]g fYgdcbg]V`Y`Zcf`dfcj]X]b[`U`Z fh\Yf`Wcdm'`D`YUgY`gYY`h\Y`Ghi XYbhDc`]\WhYg`UbX`Dfc\WXi fYg`Zcf`]bZcfa Uh]cbfY[UfX]b[`gi Va`]gg]cbž`YI hYbg]cbgž`gdY\\JU``\Wcbg]XYfUh]cbž``UhY`dYbU`h]Yg`UbX`\i fX`Y`fYei ]fYa Ybhg`Yh\V

# 5ggYgga YbhHUg\_g

5ggYgga Ybh'hUg_	K Y][ \h		

F Ydcfr@Yb[ th..', !%\$\models\$\$\$'k cfXgE i U`]hUhjj Y'UbX'ei UbhjhUhjj Y'ZYYXVUW\_'dfcj ]XYX'cb`]bY'h\fci [ \ 'Wci fgY k YVg]hY'k ]h\]b''\\$'XUmg'cZgi Va ]gg]cb"

 $\label{thm:continuous} \begin{tabular}{ll} Hi fb]h]b gYhh]b [. H\]g Ugg][ba Ybh]g gi Va]hhYX hAfci [\Thi fb]h]b UbX ghi XYbhg WUb gYY Hi fb]h]b g]a] Uf]hm fYdcfhg"$ 

## 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]ZWU''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``UVcfUhcfmhYghž`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"'=hWJb'hU\_Y`a Ubm Zcfa gžZfca `XY`]VYfUhY`W\YUh]b[ 'hc`UWW]XYbhU`mWcdm]b[ 'Zfca `U`gci fWY'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

# Fygci fWyg

DfYgWf]VYX F Ygci fWYg

FYWca a YbXYX FYgci fWfg

7 c\Ybž@'žA Ub]cbž@'/ 'A cff]gcbž? "'f&\$%\L"D WeWSdJZ \_ WfZaVe [` WWgUSf[a` ž@cbXcb'UbX'BYk 'Mcf\_. F ci hYX[Y: U`a Yf"