

**POLS5100** 

# 7ci fgY 8YHJ] g

# 7 fYX]hDc]bhg\*\*

# Gi a a UfmcZh\Y 7ci fgY

# 7 ci fgY @YUfb]b[ Ci hWca Yg

- %" 8 Ya cbglfUhY 'Udd`]YX ']bXYdYbXYbhdfcV`Ya 'gc`j ]b[ 'UV]`]lmi]b 'h\Y 'k cf\_d`UWY 'h\fci [ \ 'h\Y 'gi \W\Y gg\Z ` \ \\ \dag{2} \ \dag{2} \ \\ \dag{2} \ \dag{2} \ \\ \dag{2} \ \dag{2} \ \\ \dag{2} \ \dag{2} \ \\ \dag{2} \ \dag{2
- &" 7 ca a i b]\WhY \WYUf`m\UbX \YZZY\Wfj Y\m]b \Vch\ k f]\HYb \UbX \cfU \Zcfa "
- '"8Yd`cmih\YcfYh]WU``]bg][\hg`Zfca`h\Y`X]gW]d`]bY`hc`fYZYWhWf]h]WU``micb`dc`]Wha\_U\_]b[`UbX#cf cf[Ub]gUh]cbU``dfcWYggYg"
- ("5fh]W`UhY`Ub`Uk UfYbYgg`cZWUfYYf`cdh]cbg`UbX`dcgg]V]`]h]Yg

# HYUWX]b[ GhfUhY[]Yg

#b 'fk ]g' Wei fgY 'ghi XY bhg 'k ]``Yb[ U[ Y 'k ]h\ Vch\ 'h\ Y'dfUWf)W\`UbX'h\ YcfYh]W\`Wea dcbYbhg cZh\ Y]f 'X]gW]d\]bY UbX 'k ]h\ 'h\ Y' Udd\`]WUh]cb 'cZh\ YgY 'Wea dcbYbhg ci hg]XY'i b]j Yfg]m'' Ghi XYbhg 'UfY 'Yl dYWfYX'hc Yb[ U[ Y 'k ]h\ h\ Y]f Yl dYf]YbW 'g' h\ fci [\ 'k cf\_g\cdg'Xi f]b[ 'h\ Y'gYa YghYfdfcj ]X]b[ 'h\ Y'cddcfhi b]mnZcf'fYZYWfj Y ZYXVUW\_UbX'Yl W\ Ub[ Y'cZYl dYf]YbW 'VYhk YYb'dYYfg"'Ghi XYbhg 'UfY 'U'gc 'Yl dYWfYX'hc 'dfYgYbh h\ Y]f Yl dYf]YbWg']b 'h\ Y'Zcfa UhcZU'Wf]h]W\'TYZYWfjcb 'UbX'U'XYhU]'YX'dfc YWhfYdcfh' Ghi XYbhg 'UfY YbWci fU[ YX'hc 'WcbhYl hi U']gY 'h\ Y]f X]gW]d\]bY!fY`UhYX'h\ YcfYh]W\'U'UbX'a Yh\ cXc`c[ ]\W\'\_bck 'YX[ Y']b'h\ Y'fYU'k cfX'cZfYgYUfW\ UbX'dc ']\what UbX'dc ']\what U\_]b[ 'h\ fci [\ 'h\ Y']bhYfbg\]d\ UbX'h\ fci [\ 'h\ Y']bhYfbg\]d\ UbX'h\ fci [\ 'h\ Y']bhYfbg\]d\ 'lbX'\'UbX'\'X]g\]g\]g\]gYX\Zcf'h\ YgY'hc 'VY'\]b\_YX'\Uw\\_h\ YfgY'Yl dYf]YbWg'cZghi XYbhg 'hc 'VY'g\UfYX'UbX X]g\]g\]ggYX\Z'UbX'\Zcf'h\ YgY'hc 'VY'\]b\_YX'\Uw\\_h\ Y'fYU'h\ X\ Yg\Zf'h\ Ycf]Yg\Z'UbX'\ a Yh\ cXg']\b'h\ Y'\X]g\]g\]d\]bY'cZ di \V']\Wdc`]\what Yhg''hc 'VY'\]b\_YY'\Uh]cbg'' Dfc YWhfYdcfhg'k ]\czdot''\CZWcbhYl hg'UbX'\ a UhYf]U'h\ N\ UhX]ZYfYbhghi XYbhg 'H \CY'\Yhf\bW'X'Xi f]b[ 'h\ Y'\Yhf\by\]f\]b\Yfbg\]d\g''

# 5ggYgga Ybh

=a dcfhUbhi]bZcfa Uh]cb. =b cfXYf hc dUgg h\]g Wci fgYž mci a i ghgUh]gZUWcf] mWca d`YhY h\Y UggYgga Ybhg hUg\_g ci h]bYX \YfY]b S` V h\Y hUg\_g U``cWUhYX hc mci Vmmci f`\cgh]bgh]hi h]cb"

D@95G9BCH9 GHI 89BHG7CAD@9HB; H<9FBH9FBG<DKH< >1 6 @995I GHF5@55GD5FHC: H<9FA5FK @69F9EI F98HC@C75H9H<9F9LD9F9B79K H<B6C589FF8965H9G56CI HH<9B5HI F9#8GHFI 6I HCBC: DCK 9FBH9FB5HCB5@GMGH9A \*\*5B8H<9FC@9C: B; CGBH<5HGMGH9A \*\*H<5G5GD97HC: H<95GG\$BA9BHK @69BBHFB5HCB5@GMGH9A\*\*H<9FC@9C: B; H<9FCGGCDG\*BH

# 5ggYgga Ybh'HUg\_g'

5ggYgga Ybh'tUg_	K Y][ \h	8iY'8UhY	Gh XYbh@YUfb]b[ CihWca Ygʻ5ggYggYX
8 fUZriC f[ Ub]gUh]cbU``9 ggUm D`Ub'	%\$ı	\$, #\$+#&\$%- `%%\$\$`DA	%2&2
FYZYW¶jY`>cifbU`	(\$1	% #\$, #&\$% `%% \$\$`DA	%ž&ž(
Cf[Ub]gUh]cbU`'9ggUmi	) \$1	% #\$, #&\$% `%% \$\$`DA	%ž&Ž

## 5ggYgga Ybh8YHJ]`g

5ggYgga Ybh'% '8fUZh'Cf[ Ub]gUh]cbU` '9ggUmD`Ub

GhUfhXUhY. Bch5dd`]WUV`Y

**8YHJ]`g**. '%\$\$\$`k cfXg"'H\Y`U]a 'cZh\]g'Ugg][ ba Ybh]g'hc'[ i ]XY'mci ']b'h\Y'Wc``YWf]cb'cZYj ]XYbW' 'Zcf'mci f cf[ Ub]nUh]cbU``YggUm''K f]hYb'ZYYXVUW\_Zfca '7 ci fgY'Wcbj Ybcf"

#### 5XX]h]cbU`XYhJ]`g.

H\Y'U]a 'cZh\]g'Ugg][ ba Ybh]g'rc'[ i ]XY'mci ']b'h\Y'Wc'`YWf]cb'cZYj ]XYbW'Zcfmci f'YggUm''Mci 'bYYX'rc dfcj ]XY'h\Y'UWUXYa ]WWccfX]bUrcfk ]h\'U'fYdcfhigi a a UfmcZh\Y'hUg\_g'mci '\Uj Y'VYYb'gYh']b'h\Y'WcbhYl hcZh\Y'cghcf[ Ub]nUh]cb'g'k cf\_"'H\Y'fYdcfhigi a a Ufmg\ci `X']bX]WUhY'fUz'h\Y'hUg\_fgz'Ugg][ bYX'rc'mci /fVz'h\Y cj YfU``'dc`]WmZfUa Yk cf\_'cZh\Y'cf[ Ub]nUh]cb/fWz'Ub'Yj U'i Uh]cb'cZmci f'dfc[ fYgg'rc'XUhY/UbX'fXz'Ub UggYgga YbhcZh\Y'k cf\_'fYei ]fYX'rc'Wa d'YhY'mci f']bhYfbg\]d"'H\]g'Ugg][ ba Ybh]g'Wcbglfi WhYX'gc'h\Uh gh XYbhg'UfY'[ i ]XYX']b'gYhh]b[ 'h\Y]f'ck b'fYdcfhei Ygh]cb'UbX'h\YcfYh]Wb`ZfUa Yk cf\_'k\]W'XYa cbglfUhYg Ub'i bXYfgHJbX]b[ 'cZh\Y'fYei ]fYa Ybhg'cZh\Y'Z]bU``HUg\_'gYhZcf'h\]g'Wci fgY"'9b[ U[ ]b[ ']b'h\]g'UggYgga Ybh g\ci 'X']bX]WUhY'U'Yj Y``cZYZZYWh]j Y'Wca a i b]WUh]cb'cZh\Y']b\_'VYhk YYb'h\Y'`]hYfUhi fY'gYhZcf'h\]g'Wci fgY UbX'h\Y'j cWUh]cb''d'UWYa YbhYl dYf]YbWY'U`gc'dfcj ]X]b[ 'U'ghfi Whi fYX'd'Ub'Zcf'h\Y'Uf[ i a YbhUh]j Y'fYdcfh'

Hi fb]hjb gYhjb[. `H\]g Ugg][ ba Ybh]g gi Va ]hhYX h\fci [\ `Hi fb]hjb UbX gh XYbhg Xc 'bchgYY 'Hi fb]hjb g]a ]`Uf]hmfYdcfhg"

5ggYgga Ybh'& FYZYWhjj Y'>ci fbU'

GHJfhXUhY. Bch5dd`]WUV`Y

**8YHJ**]`g. '%) \$\$`k cfXg"'7 f]h]WU``fYZYWf]cb`cb`h\Y`]bhYfbg\]d`YI dYf]YbWY"'I b`]\_Y`h\Y`cf[ Ub]gUh]cbU``YggUmž'h\]g HUg\_g`]g`ZcW gYX`cb`mci f`ck b`dYfgcbU``YI dYf]YbWY`UbX```YUfb]b[ `#hfUbgZcfa Uh]cb`h\fci [ \ci hh\Y`dYf]cX`cZh\Y`]bhYfbg\]d"'': YYXVUW\_`]g`]b`h\Y`Zcfa `cZk f]hhYb`Wca a Ybhg`Zfca `h\Y`Wci fgY`Wcbj Ybcf"

#### 5XX]h]cbU`XYhU]`g.

H\]g^cifbU^g\ciX'VY'Ub'UbU`mt]\WD`fYZY\Wfjcb'cb'h\Y']bhYfbg\]d'YIdYf]Yb\W'''\Mcifg\ciX'XfUk 'cb'h\Y h\Ycf]Yg'UbX#cf'\\cb\W'dhg`mci'\Uj Y'\\cjYfX'Xif]b['mcifib]j Yfg]\migh X]Yg'''H\Y'\cifbU`g\ciX'Ufh]\W`\UhX'\lb\Y']bhYfbg\]d'YIdYf]Yb\W''\UbX']\migh X]Yg''\H\Y'\cifb\Zca''h\Y']bhYfbg\]d'YIdYf]Yb\W''\UbX']\migh Zj\g'\YfY\UhI\BGK'''

 $\label{thm:limit} \begin{tabular}{ll} Hi & fb \end{tabular} $$ $H \ fb \end{tabular} $$ fo \end{tabular} $$ Hi & fb \end{tabular} $$ fo \end{tabular} $$ fo \end{tabular} $$ fo \end{tabular} $$ Hi & fb \end{tabular} $$ fo \en$ 

5ggYgga Ybh' . Cf[ Ub]gUh]cbU 9ggUm

GhUfhXUhY. Bch5dd`]WUV`Y

8 YHJ]`g. "\$\$\$`k cfXg"'I dcb`Wca d`YhJcb`cZh\Y`]bhYfbg\]d`gh XYbhg`UfY`fYei ]fYX`hc`gi Va ]h`Ub`YggUmih\Uh dfcj ]XYg`U`Wf]hJWJ`Yj U`i UhJcb`cZh\Y`]bhYfbg\]d`YI dYf]YbWY`h\fci [\`U`ZcW g`cb`h\Y`\cghcf[ Ub]nUhJcb"'H\]g ]g`bcha YUbhhc`VY`U`Wf]hJei Y`cZh\Y`\cghcf[ Ub]nUhJcb`Vi h`U`XYa cbghfUhJcb`cZk \Uh\Ug`VYYb``YUfbhUVci h h\Y`cf[ Ub]nUhJcb`fUbX`k cf\_]b[ `]b`h\Uh'UfYU`cZdi V`]Wdc`]WhZh\fci [\`h\Y`]bhYfbg\]d`YI dYf]YbWY": YYXVUW\_k ]``VY`]b`h\Y`Zcfa `cZk f]hYb`Wca a Ybhg`Vmh\Y`Wci fgY`Wcbj Ybcf"H\]g`]g`h\Y`ZlbU``Ugg][ ba YbhcZh\Y`Wci fgY

#### 5XX]h]cbU`'XYhU]`g.

 $H\[g'Ugg][ba\Ybh']g'Wcbglfi\WMX'gc'h\Uhighi\XYbhg'UfY'Yb[U[YX']b']bXYdYbXYbh'UbX'fYZYWfj Y'`YUfb]b['''5gUglUff]b['dc]bhmci 'a Um'Wcbg]XYf'h\Y'Zc``ck ]b['ei Ygh]cbg']b'hYfa g'cZglfi Wfi f]b['mci f'YggUm$ 

: fca Ub cf[Ub]gUh]cbU`dYfgdYWh]j Y.

ck\UhXcYgh\Y\cghcf[Ub]gUh]cbXc3

c'\ck']g'h\Y'\cghcf[Ub]gUh]cb'cf[Ub]gYX'hc'UW\]YjY']hg'cV'YWhjjYg3

: fca UZ bWhcb]b[ cZa UbU[ Ya YbhdYfgdYWh]j Y.

c \ck 'UfY'dfcV'Ya g'HUW\_YX'k ]h\]b 'h\Y'\cghcf[ Ub]gUh]cb3

c'k\m'UfY'h\Ym'dfcV'Ya g'k]h\]b'h\Y'\cgh'cf[Ub]gUh]cb3

: fca 'U'\_bck `YX[Y'UbX'dck Yf'dYfqdYWh] Y. '

ck\UhXcYgh\]ghY``mci UVci hh\Ya UbU[Ya YbhdfcW/gg

c flygdyWJU``m]b hyfa g cZcVYWJj y gyhJb[Łk]h\]b h\y \cghcf[Ub]gUJJcb

### 5 hyb XUb WY F Yei ] fYa Ybhg

 $\label{thm:localized-equation} $$H_Y^gW_YX_i^Y_cZh_g^W_ifgY_g^bY_W^ggUf_m^ZY_l^Y_UbX_k_f^X_ZZ_f^Y_UbX_i^gh_XYbhXYdYbX_b[_idcb_h_Y_k_cf_UffUb_Ya_Ybhg_bY_[_ch]Uh_YX_k_]h_h_h_Y^cghcf_Ub_gUh_jcb_fk_]h_h_h_Y^Ugg_gh_W^G_cZh_Y_W^if_fgY_W^ib_j_YbYfL_H^M_JW_m^Z_jbh_fbg_k_]^**gdYbX_cb_Y_XUmdYf_k_YY_k_h_h_h_Y_f^Cghcf_Ub_gUh_jcb_H^K_JW_Xi_f_b[_h_Y_gYa_Ygh_fz_gh_XYbhg_k_]^**W^G_Y_h_Y_f_Z_f_U_k_cf_g\\cd_Uh_l_B_GK_h^K_X_jgW_gg_UbX_fYZY_W^icb_h_Y_jf_jbh_fbg_]d_Yl_dYf_YbW_g^*_H_Y_XUh_Yg_cZ_h_YgY_k_cf_g\\cd_K_j^**VY_U[_fYYX_cb_cb_W^F_h_Y_jbh_fbg_]d_gW_YXi_Y_cZ_U^*_gh_XYbhg_Ug_VYYb_W^cb_Z^fa_YX''$ 

: cf'h\Y'di fdcgY'cZUthYbXUbW'a cb]hcf]b[ž'h\Y'Z]bU``UggYgga YbhZcf'h\]g'Wti fgY']g'h\Y'cf[Ub]nUh]cbU` YggUmk cfh\') \$1 'cZmci f'cj YfU```[fUXY'Zcf'h\]g'Wti fgY"'H\]g']g'h\Y'UggYgga Ybh]hYa 'h\Uhk]```VY'[fUXYX'Uh nYfc']Zmci 'Xc'bcha YYhh\Y'UthYbXUbW'fYei ]fYa YbhZcf'h\]g'Wti fgY"

: cf'h ]g'Wci fgYz'UffYbXUbW' ]g'Wu'W' `UfYX' Ug'g ck b ]b'h Y'HUV'Y'VY`ck.

@YUfb]b[ 'UW¶j ]hm		A]b]aia 'UHYbXUbWY fYei]fYaYbh
±bHYfbg\]d'UWNjj]HjYg'k]H\ \cgh	< cghhc '_YYd 'fc'`	%\$ <i>#</i> /&
AYYMjb[g'k]h\'7cifgY 7cbjYbcf	7 cbj Ybcf'hc'_YYd'fc''	&#&</td></tr></tbody></table>

⊋mci 'Uff]j Y'a cfY'h\Ub'%) 'a ]bi hYg'`UhYžcf``YUj Y'WUgg'k ]h\ 'a cfY'h\Ub'%) 'a ]bi hYg'fYa U]b]b[ žmci 'a UmVY fYWcfXYX'Ug'UVgYbh'' ⊋gi W\ 'U'dYbU`hm`]g']a dcgYXžmci 'k ]``'VY'UXj ]gYX']b'k f]h]b' k ('\ci fg"'5hYa dhg hc'ZJ`g]ZmUhYbXUbWY'fYWcfXg'k ]``'VY'hYUhYX'Ug'gh XYbha ]gWcbXi Whi bXYf'h\Y'E fgVW'f? [eUa` VgUf BdaUWWgdWž

# 7ci fgY GWX YXi `Y

# F Ygci fWyg

## DfYgWf]VYX F Ygci fWyg

 $\label{thm:continuous} $$H\Y'I b]j Yfg]mi]g'UV'Y'hc'ZUW]`]hUhY'gi WWYggZ ``Udd`]WUbhg `]bhYfbg\]dg'k ]h\'h\Y'fYgYUfW\!VUgYX UXj cWU\mB; C'>i V]`YY'5i ghfU`]U'Zfca 'U'WUa di g!VUgYX ``cWUh]cb"Gh XYbhg'a Um'U`gc ]bXYdYbXYbhm`cWUhY'ch\Yf'\cghcf[ Ub]nUh]cbg'UbX'cVhU]b'U'dYfa ]gg]cb'Zfca 'h\Y'A \neq 'Wcbj Ybcf'hc \Uj Y']bhYfbg\]d'h\YfY"$ 

## FYUX]b[ 'UbX'fYgci fWfg

H\YfY`]g`bc`gYhfYUXYf`Zcf`h\]g`Wci fgY"`<ck Yj Yf`h\Y`Zc``ck ]b[`]g`U``]ghcZfYWca a YbXYX`fYUX]b[g`UbX fYgci fW\g`h\Uhk]``\Y`d`mci `Xi f]b[`mci f`]bhYfbg\]d`UbX`k ]h\`mci f`k f]hhYb`UggYgga Ybhg`UbX`cfU` dfYgYbhUh]cbg"`±ik]``VY`YI hfYa Y`mX]Z]W\`hhc`Wca d`YhY`mci f`UggYgga Ybhg`k]h\ci hWcbgi `h]b[`U`bi a VYf`cZ h\Y`fYUX]b[g`cb`h\]g``]gh''

H\YfY']g'U'`chicZYI WY``Ybhi`]hYfUhi fY'cb'h\Y'a U\_]b['cZdi V']Wdc`]Whi]b'5i glfU']Už']b'ch\Yf'Wci blf]Ygž'UbX'Uh h\Y'['cVU```Yj Y`"'H\]g``]ghi]b'bchYI \Ui ghj Yž']b'ZJWhi]hVUfY`mgWfUhW\Yg'h\Y'gi fZJWY'"\Mci 'UfY'YbWci fU[YX'hci gY'h\YgY'gci fW'g'Ug'U'ghJh]b['dc]bhUbX'UXX'mci f'ck b'gci fWg'hc'h\]g``]ghh\fci [\ci hmci f']bhYfbg\]d" H\Y'Zc``ck ]b['`]ghi]bWi XYg'fYWbhVcc\_g'k f]hYb']b'h\]g'UfYU'Ug'k Y```Ug'gca Y'WUgg]WVcc\_g'h\Uh\Uj Y XYZ]bYX'h\Y'UbU`mg]g'cZdi V`]Wdc`]Whi'H\Y'Vcc\_g'mci 'W\ccgY'hc'fYUX'k]``XYdYbX'cb'h\Y'ZcW'g'cZh\Y U[YbWhk\\YfY'mci 'UfY'Xc]b['mci f']bhYfbg\]d'UbX'mci f'ck b']bhYfYghg"'=kk]``dfcVUV`mU`gc'XYdYbX'cb k\Yh\Yf'h\Y]f'cdYfUh]cbg'UfY'`cWJ'ž'bUhJcbU'ž'cf'['cVU'"A cghcZh\Y'Vcc\_g`]ghYX'\YfY'UfY'YX]hYX'k cf\_g'k]h\X]ZZYfYbhWJgY'ghi X]Yg`]b'YUW\WUdhYf'k\]W\a U\_Yg'h\Ya 'j Yfmi d'hc'XUhY'UbX'a YUbg'h\YmWcj Yf'U'j Ugh fUb[Y'cZdi V`]Wdc`]Whi]ggi Yg"'F Ya Ya VYfž'h\Y'Vyghd`UW''hc'Z]bX'dc`]WhiXcW a Ybhg']g'h\Y']bghJhi h]cbž XYdUfha Ybhz'cf'cf[ Ub]gUh]cb'h\UhdfcXi WYX'h\Ya !'gc'h\Uhg\ci X'Uh\Umg'VY'mci f'Z]fghghcd"

+b 'mci f'Yl d`cfUh]cb 'cZh\Y'di V`]Wdc`]Wn`]hYfUhi fYžmci 'k]```Z]bX'h\Y``]VfUfmik YVg]hY'Ub']bj U`i UV`Y'fYgci fW"'`\hd.#k k k "`]VfUfm'i bgk "YXi "Ui

7 Ybh fmf@cbXcb. < UfdYf 7 c``]bgŁ"

7 Y[[žGhYk Ufhf&\$\$\*ŁH\Y G5; 9 \UbXVcc\_cZcf[Ub]nUh]cb gh X]Yg &bX YX]h]cb fl@cbXcb. GU[Y Ł"

7 cbg]X]bYžA Uf\_f&\$\$) ŁžA U\_]b[ 'Di V`]WDc`]WhifT Ua Vf]X[Y. 'Dc`]hmDfYggŁ"

; ccXa Ubž'>"'f&\$%&\z'"Bcb!ghUhY'UWcfg.'A i `h]bUh]cbU``7 cfdcfUh]cbg'UbX'\deltahYfbUh]cbU``Bcb!; cj Yfba YbhU` Cf[Ub]gUh]cbg"ž'\delta'5bh\cbm6i f\_Y'UbX'>]a '; Ycf[Y'f\Ygžfi3`; fdaVgUf[a` fa; fWt Sf[a` S^DWSf[a` ež&bX 9X]h]cbž'7 Ua Vf]X[Y.'7 Ua Vf]X[Y'I b]j Yfg]hmDfYggž'dd"' \%!' &&"

>cfXUbžG"/ 'Hi ]^žDžJ "'f&\$\$\$\zi"Dc`]h]\WJ``F Ygdcbg]\V]`]hm]b 'HfUbgbUh]cbU``B; C '5 Xj c\WJ\\n'ZI ad\V 6\\h\\alpha\b\_ \W fl J c`"'&, ž'B c"'\&\zi'dd"\&\\$) \% \&\xi' "

>i V]`YY`5i glfU`]U`F YgYUfW\`7 YblfY`f&\$%( Ł'J c]\Wg`cZ6ci [ U]bj ]``Y. `B ]\_UbU`? Ub[ g]ž'B ]\_UbU`8cb[ `8 Ua UbUž

Gi Va |gg|cb cZ5ggYgga YbhHUg\_g

Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g

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

#mci 'YbWci bhYf'U'dfcV'Ya 'k \Yb'UhYa dhJb[ 'rc'gi Va ]hmci f'Ugg][ ba YbhNhfci [ \'Hi fb]hJbž'd'YUgY
hY'Yd\cbY'9I hYfbU'Gi ddcfhcb'-', ) "''' %cfYa U]''h\Ya 'cb'YI hYfbU'hY'hgi ddcfh4 i bgk "YXi "Ui '"'Gi ddcfh
\ci fg'UfY', .\$\$Ua '-'%\$.\$\$da 'cb'k YY\_XUmg'UbX'-.\$\$Ua '-') .\$\$da 'cb'k YY\_YbXg'f1 \*) 'XUmg'U'mYUf\zero
UfY'i bUV'Y 'rc'gi Va ]hmci f'Ugg][ ba YbhXi Y'rc'U'ZJi 'hk ]h\'Hi fb]hJb'mci 'a Um'Udd'mZcf'Ub'YI hYbg]cbz'Vi hmci
a i ghfYhJ]b'mci f'hJW\_Yhbi a VYf'Zfca '9I hYfbU''Gi ddcfhfU'cb[ 'k ]h\'Ubmch\Yf'fY'Yj UbhXcW a Ybhg\zero
]bWi XY'Ug'Yj ]XYbWY 'rc'gi ddcfhmci f'YI hYbg]cb'Udd']WUh]cb'''=\mainin' Ya U]''9I hYfbU''Gi ddcfhmci 'k ]'`
Ui hca UhJWJ'`mfYWY]j Y'U'hJW\_Yhbi a VYfz'Vi h]Zmci 'hY'Yd\cbY'mci 'k ]'`'bYYX'hc'gdYWJZJWJ'`mUg\_'Zcf'cbY''
Hi fb]hJb'U'gc'dfcj ]XYg'i dXUhYg'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk ]hYf"

; YbYfU``mž'UggYgga YbhiHug\_g'a i ghVY'gi Va ]hhYX'Y`YVWfcb]\W)``mij ]U'Y]h\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ ba Ybh'' =b']bgHJb\W'g'k \YfY'h\]g']g'bchdcgg]V`Yž']hk ]``'VY'gHJhYX'cb'mci f'\\ci fgY'g'A ccX`Y'g]hY'k ]h\ U`hYfbUh]j Y'gi Va ]gg]cb'XYhJ]`g''

cfi]bZcfa Uh]cbicbi\ckihcigi Va ]hUgg][ ba Ybhgicbi]bYij ]UiA ccXiY.i\hdg.#gh XYbh'i bgk "YXi "Ui #\ck! qi Va ]hUgq][ ba Ybha ccXiY

## 5 WUXYa | W < cbYqlmUbX D`U[ ]Uf]qa

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[ "

7 c``i g]cb.'k cf\_jb['k]h\ch\Yfg'Vi hdUgg]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['UhiUbmh]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 fWYg'k\]WX`\Uj Y`bchVYYb`fYUXžk]h\ci hUW\_bck`YX[]b[`h\Y`″gYWcbXUfm″gci fWY`Zfca 'k\]WX`\_bck`YX[Y`cZh\Ya`\Ug'VYYb`cVhU]bYX"

- i bXYfgfUbX mci f'f][\hg'UbX'fYgdcbg]V]`]hJYg'Ug'U'gh XYbhUhl BGK
- VY`Uk UfY`cZd`U[]Uf]ga ž`Wcdmf][\hz'l BGK `Gh XYbh7cXY`cZ7cbXi WhUbX`5VWWdhUV`Y`l gY`cZ I BGK `=\forall H`F Ygci f\W\g`Dc`]\m\m
- VY 'Uk UfY 'cZh\Y 'ghUbXUfXg 'cZVY\Uj ]ci f'Yl dYWYX 'cZYj YfmcbY ']b 'h\Y 'l BGK 'Wca a i b]hm
- `cWUHY 'gYfj ]WYg'UbX `]bZcfa UH]cb'UVci hI BGK 'UbX'I BGK '@]VfUfm

Gca Y'cZh\YgY'UfYUg'k]``VY'ZJa]`]Uf'hc'mci žch\Yfg'k]``VY'bYk"'; U]b]b['U'gc`]X'i bXYfgHJbX]b['cZU``h\YfY`UhYX'UgdYWhg'cZ9@&9'k]``\Y`d'mci 'a U\_Y'h\Y'a cghicZmci f'ghi X]Yg'UhI BGK "'\\hd.##qi V'YWfi |XYg"`]VfUfm'i bqk "YXi "Ui #\`]qY#JVci hY`]qY

# 5 WUXYa ]W±bZcfa Uhjcb

: cf'YggYbhJU`gh XYbh]bZcfa UhJcb'fY`UhJb['hc.

• fYei YghgʻZcfʻYl hYbg]cb/