



ENGG9743

: i Y`7 mWYž'K UghY`UbX`@]Z'7 mWY`A UbU[Ya Ybh

HYfa`Cby`##`&\$&%

GWcc`cZA YWUbjWU`UbX`A Ubi ZUW`f]b[`9b[]bYYf]b[`##`I BGK `9b[]bYYf]b[

HD`YUgY`bchY`hUhihY`GWcc`C Z]W`k]`bch_bck`k`Yb#Zmci`fWti`fgY`Wtj`Ybcf`]g`cb`Wla`di`g`cf`
Uj`U]UV`Y`

9a`U]`

[9b\[\]bYYf\]b\[\]Gh`XYbhGi`ddcfhGYfj`\]Wg`](#) -`W`ffYbhighi`XYbhYbei`]f]Yg`

- Y"["Ybfc`a`Ybž`dfc[`fYgg]cbž`WUg`fYei`Ygřž`Wti`fgY`]ggi`Yg`cf`dfc[`fUa`!fY`UH`X`ei`Yf]Yg`

hc[YhYf'k]h'gca Y'fYUX]b['a Uhf]U""5'gh XYbh'f'f[fci d'cZgh XYbh'k]"VY' bca]bUhfX'Ug'h'Y'h'd]W
a cXYfUhc'ff'g" H\Ymk]"dfcj]XY'Ub']b]h]U'gi a a UfmcZ'h'Y'h'd]W'UbX'Ug_'dfcj cW]h] Y'ei Ygh'cbg" H\Y'Yb]fY
WUgg'k]"dUfh]W]dUhf'k]h' h'Y]f'W'a a Ybh'g'UbX'cd]b]cbg'z'a U]bh]b]b['U'W'e"Y[]U'UbX'YbW'e i fU[]b['Z'fa 'Z'f
XYVUH""H\Y'gh XYbh'g'UfY YI dYW'X'h'c'dfcj]XY'U'a]b]a i a 'cZ'h'c']bh'fUW]cbg'UbX'&\$'k cfXg'dYf'h'd]W
H\Y'h'd]W'a cXYfUhc'f'k]"U'gc'VY'UggYggYX'cb'h'Y]f'UV]]h'hc'a U]bh]b]U'j]VfUbhUbX'fYgdYW'W' "XYVUH
Ybj]f'cba Yb'h'

5""a Uf_g'UfY'dUgg#Z]`UbX']bX]j]Xi U""

A Uf_g'k]"VY'fYh' fbYX'UhfY'YUgY'cZ]bU'fYgi 'rg"

8YUX']bY'Z'f'UVgc'i h'Z]j'. B #5

5ggYgga Ybh' . 'ei]nnYg

GHUfhXUH'. 'Bch5dd']WV'Y

8YHU]`g.hk c'cb`]bY'ei]nnYg

5XX]h]cbU'XYHU]`g.

H\Y'ei]nnYg'h'gh'g'UbU'm]W'UbX'W]h]W'h']b_]b['UbX'[YbYfU' i bXYfghUbX]b['cZ'h'Y'W'e i fgY'a Uhf]U']b'U
W'e'b'f'c"YX'Z]g\]cb"E i Ygh'cbg'a UmVY'XfUk b'Z'ca 'UbmUgdYW'h'cZ'h'Y'W'e i fgY'W'e j YfYX' i bh' 'h'Y'k YY_
dfYWX]b['h'Y'h'gh'z' i b'Ygg'gdYW]Z]W'm]bX]W]h'X'c'h'Y'fk]gY'Vm'h'Y'Y'W'h' fYF"A Uf_g'k]"VY'Ugg][bYX
UW'e'fX]b['hc'h'Y'W'e'ffY'W'b'Ygg'cZ'h'Y'fYgd'cbgYg"

H\YgY'UfY']bX]j]Xi U'h'ghg

A Uf_g'k]"VY'fYh' fbYX'k]h']b'cbY'k YY_'cZYUW' 'ei]n'W'e a d'Y'h]cb"

8YUX']bY'Z'f'UVgc'i h'Z]j'. B #5

5ggYgga Ybh' (. 'Ugg][ba Ybh

GHUfhXUH'. 'K YY_;

8YHU]`g.hU_Y!\ca Y'Ugg][ba Ybh

5XX]h]cbU'XYHU]`g.

H\Y'Z]bU'Ugg][ba Ybhk]h']bj c'j Y'U'W]gY'gh XmiUbX'h'Y'gh XYbh'k]"bYX'h'c'dfcj]XY'h'Y]f'UbU'm]g]]b'h'Y

5 hYbXUbW F Yei]fYa Ybhg

Gh XYbhg UfY gfcfb[mYbWci fU[YX'hc UHhYbX U''WUggYg UbX'fYj]Yk ''YWhi fY'fYWcfX]b[g"

7 ci fgY'GWXYXi `Y

[J \]Yk WUgg'ha YhUVY](#)

H]a YhUV`Y`

8UhY	HmdY	7cbhYbh
C`K YY_` , : YVfi Ufm!`%& : YVfi Ufm	Hcd]W	K Y`Wta YzUbX`UXa]b]gfhUhj Y`fci V`Y!g\cch]b[
K YY_`%`%& : YVfi Ufm!`%& : YVfi Ufm	Hcd]W	C j Yfj]Yk `cZhY`bi WYUf`Z Y`WwWY"A]b]b[`UbX a]`]b[
K YY_`&.`&&: YVfi Ufm!`&`* : YVfi Ufm	Hcd]W	7 cbj Yfg]cb`hc`l : *`UbX`Ybf]W]a Ybh
K YY_`" .`%A UfW `!`.) : YVfi Ufm	Hcd]W	7 cbj Yfg]cb`hc`l C &`UbX`bi WYUf`Z Y`ZUf]W]h]cb
K YY_`(. ; `A UfW `!`%& A UfW	Hcd]W	7 i ffYbhUbX`Z hi fY`bi WYUf`Z Y`g"
K YY_`) .`% `A UfW `!`%& A UfW	Hcd]W	l gYX`Z Y`ghcfU[Y`UbX`fydfcW]gg]b[
K YY_`*.`&&`A UfW `!`&`* A UfW	Hcd]W	B i WYUf]nU]h]cb`cZdfcW]ggYg
K YY_`.+.`&-`A UfW `!`& 5df]`	Hcd]W	G YdUfU]h]cb`cZk UghY
K YY_`(. ;) `5df]`!`-`5df]`	Hcd]W	K UghY`Zcfa g`UbX`ghcfU[Y
K YY_`-.`%&`5df]`!`%`* 5df]`	Hcd]W	K UghY`WcbX]h]cb]b[žghcfU[Y`UbX`X]gdcgU`
K YY_`%\$.`%`5df]`!`&` 5df]`	Hcd]W	8 YWta a]gg]cb]b[ža cb]hcf]b[`UbX`fYa YX]U]h]cb

Gi Va]gg]cb'cZ'5ggYgga YbhiHUg_g

5ggYgga Ybhgi Va]gg]cb'UbX'a Uf_]b['Wf]hYf]U

G\ci 'X'hY'Wci fgY'\Uj Y'Ubmcbcb!Y'YWfcb]WUggYgga Ybhgi Va]gg]cbž'hYg'g\ci 'X'\Uj Y'U'ghUbxUfX
GWcc'Wcj Yf'g\YYH'

5`gi Va]gg]cbg'UfY'YI dYWYX'hc'VY'bYUhbX'WYUfmgYhici H'Mci f'fYgi 'hg'UfY'hY'd]bbUWY'cZU`mci f'\UfX
k cf_'UbX'g\ci 'X'VY'hYUhx'k]h'Xi Y'fYgdYWf'DfYgYbh]b['fYgi 'hg'WYUfm[]j Yg'hY'a Uf_Yf'hY'VYghWUbw
cZi bXYfgtUbx]b['mci f'a YhcX/Yj Yb']ZhY'bi a Yf]WU'fYgi 'hg'UfY']bVc'ffYWf'

UggYgga YbhdYfZcfa UbWžmci 'UfY'Y'[J]V'Y'rc'Udd'mZcf'GdYWU'7 cbg]XYfUhc'b'df]cf'rc'gi Va]h]b['Ub
UggYgga Ybhcf'g]h]b['Ub'YI Ua "

I BGK 'bck '\Ug'U': [Jhrc'G\]h#Gi Va \]hfi_Yžk \\]W'a](#) YUbg'hUh]Zmci 'UthYa dhUb'YI Ua 'cf'gi Va]hU'd]YW'cZ
UggYgga Ybhž'mci 'UfY'XYWUf]b['mci fgY'Z]hYbci [\ 'rc'Xc'gc'UbX'Wbbch'Uthf'Udd'mZcf'GdYWU'
7 cbg]XYfUhc'b"

: cf'XYHU]g'cZUdd'm]b['Zcf'GdYWU'7 cbg]XYfUhc'b'UbX'WcbX]h]cbg'Zcf'hY'Uk UfX'cZgi dd'Ya YbhUfm
UggYgga Ybhž'd'YUg'gYY'hY'jbZcfa Uhc]b'cb'I BGK 'g' [GdYWU'7 cbg\]XYfUhc'b'dU\[Y](#)"

D'YUgY'bc'hY'hUhighi XYbhg'k]'bchVY'fYei]fYX'rc'dfcj]XY'UbmXcW a YbhUfmYj]XYbW'rc
gi ddcfhUVgYbW'g'Zca 'UbmWUggYg'a]ggYX'VYWU]i gY'cZ7CJ -8!%- 'di V']W\YU'h'a YUgi fYg'gi W'Ug
]gc'Uh]cb" I BGK 'k]'bchVY']bg]gh]b['cb'a YX]W'Wf]h]W]hYg'Zca 'UbmcbY'XYYa YX'rc'VY'U'dcg]h] Y'WUgYž
cf'k \Yb'hYm\Uj Y'fYVčj YfYX" 'Gi W'Wf]h]W]hYg'UfY'X]Z]W 'hrc'cVHU]b'UbX'di hUb'i bbYW'ggUfm]gh]U]b'cb
gh XYbhg'UbX'a YX]W'ghUZZ'

5dd']W]h]cbg'Zcf'gdYWU'Wcbg]XYfUhc'b'k]'VY'fYei]fYX'Zcf'UggYgga YbhUbX'dUfh]W]dUhc'b'UVgYbW'g'—
Vi hbc'XcW a YbhUfmYj]XYbW'Zcf'7CJ -8'%']'bYgg'cf']gc'Uh]cb'k]'VY'fYei]fYX"

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

I BGK `Ug`Ub`cb[c]b[`Wca a]ha Ybhlc`ZcghYf]b[`U`W`hi`fY`cZ`YUfb]b[`]bZcfa YX`VmiUWUXYa]W]bhY[f]m`5`
I BGK `gh`XYbthg`Uj`Y`U`fYgdcbg]V`]mhc`UX\YfY`hc`h`g`df]bW]d`Y`cZUWUXYa]W]bhY[f]m`D`U[]Uf]ga
i bXYfa]bYg`UWUXYa]W]bhY[f]mUbX`]g`bchlc`YfUHX`Uhl`BGK`"B`SY[Sde_`SfG@E|`[e VWX`W`Se ge[`Y`
fZWi`ad/e`ad[VWSe`aXafZWde`S`V`bSee[`Y`fZW_`aXSe`kagdai`ž

D`U[]Uf]ga`]g`U`mdY`cZ]bhY`YWi`U`h`Y`Z`h`h`W]b`hU`_Y`a`UbmiZcfa`gž`Zca`XY`]VYfUHX`WXYU]b[`hc`UWUXYbH`m`
Wcdm]b[`Zca`U`gci`fW`k`]h`ci`hUW`bck`YX[`Ya`Ybh`I`BGK`Ug`dfcXi`W`X`U`k`YVg]h`k`]h`U`k`YU`h`cZ`
fYgci`fW`g`hc`gi`ddcfhgh`XYbthg`hc`i`bXYfgHUbX`UbX`Uj`c]X`d`U[]Uf]ga`ž`]g]h`[gh`XYbth`i`bgk`"YXi`"Ui`#d`U\[\]Uf\]ga`"](#)
H\Y`@YUfb]b[`7`YbhfY`Ugg]ghg`gh`XYbthg`k`]h`i`bXYfgHUbX]b[`UWUXYa]W]bhY[f]mUbX`ck`bchlc`d`U[]Uf]gY"

5 WUXYa]W<Zcfa Uh]cb

7 fYX]hdc]bHg

7 ci fgY WfYX]h]g'WU'W'UH'X']b' l b]hg! C Z 7 fYX]hfl C 7 E' H\Y'bcfa U'k cf_cUX'YI dYWWUh]cb'Zc'f'cbY'I C 7]g'Uddfc]]a UH'm&) \ci fg'dYf'hYfa "H\]g]bW' XYg'WUgg'W<bH'UW'h\ci fg'zdf]j UH' gh' Xn'z'ch'Yf'YUfb]b[UW]j]h]Yg'zdfYdUfU]cb'UbX'h]a Y'gdYbhc'b'U' UggYggUV'Y'k cf_"

A cghW<i fgYk cf_W<i fgYg'Uhl BGK 'UFY'*'I C 7 'UbX']b] c] j Y'Ub'Ygh]a UH'X'%) \$ \ci fg'hc'W<a d'YH'z'Zc'f'Vch' fY[i 'Uf'UbX']b]h]bg] Y'hYfa g''9UW' W<i fgY']bW' XYg'U'dfYgW]VYX'bi a VY'f'cZ\ci fg'dYf'k YY_'f'k# E'cZ gW'YXi 'YX'ZJW'!hc!ZJW'UbX#cf'cb']bY'W<bH'UW'h'5bmUXX]h]cb'U'h]a Y'VYmcbX'h'Y'dfYgW]VYX'W<bH'UW'h\ci fg' g\ci 'X'VY'gdYbh]b'a U_]b['gi fY'h'Uhmci 'i bXYfg]UbX'h'Y'YW'h' fY'a UH'f]U'z'W<a d'Yh]b['h'Y'gYh Ugg][ba Yb]g'z'Z f'h'Yf'fYUX]b['z'UbX'fYj]g]b['Zc'f'UbmYI Ua]b]U]cbg"

C b!WJa di g'WUgg'UH'YbXUbW

Di V']WX]gh]UbW]b['W<bX]h]cbg'a i ghVY'Z'ck YX'Zc'f'U'ZJW'!hc!ZJW'WUggYg''Hc'Ybgi fY'h']g'z'cb'migh' XYbHg Ybfc'YX']b'h'cgY'WUggYg'k]'VY'U'ck YX']b'h'Y'fcca "7'Ugg'fcgh'fg'k]'VY'UH'UW'YX'hc'W<ffYgdc]b]b[fcca'g'UbX'W]fW'UH'X'Ua'cb['UV'XYa'cbgh'Uhc'fg" B'c'c] Yf]Ybfc'a Ybh]g'U'ck YX']b'ZJW'!hc!ZJW'WUgg" Gh'XYbHg'Ybfc'YX']b'cb']bY'WUggYg'W]b'gk Ud'h'Y]f'Ybfc'a Ybh]Zca'cb']bY'hc'U']a]h'YX'bi a VY'f'cZcb! WJa di g'WUggYg'VmGi bXUn'z'k YY_'%'D'YUgY'fYZf'hc'mci f'W<i fgY]A]W'cgcZiHYUa'g'UbX'A'ccX'Y'g]h]g'Zc'f' a'cfY']b]Zc'fa Uh]cb'UVci h'WUgg'UH'YbXUbW'Zc'f']b!dYfgcb'UbX'cb']bY'WUgg'gYW]cbg#UW]j]h]Yg"

Mci f'YU'h'UbX'h'Y'YU'h'cZ'h'cgY']b'mci f'WUgg']g'W]h]W'm]a d'cftUbh'Mci 'a i ghghUmUh\ca Y']Zmci 'UFY' g]W'cf'\Uj Y'VYb'UXj]gYX'hc'gY'Z']gc'UH'Vm'BGK '\YU'h' 'cf['c] Yfba Ybh]Ui h'cf]h]Yg''7i ffYbh'U'Yf]g'UbX'U']ghcZ'ch]gdc]g'W]b'VY'Zci bX'\YfY'"Mci 'k]'b'chVY'dYbU']gYX'Zc'f'a]gg]b['U'ZJW'!hc!ZJW'UW]j]h]miXi Y'hc']'b'Ygg'cf'U'fYei]fYa Ybh]hc'gY'Z']gc'UH'"K'Y'k]'k'cf_'k]h'mci 'hc'Ybgi fY'W<b]h]bi]h]mciZ'YUfb]b['Xi'f]b[mci f']gc'Uh]cb'UbX'\Uj Y'd'Ubg']b'd'UW'Zc'f'mci 'hc'W]h'W' i d'cb'UbmW<b]h]b]h'cf'YUfb]b['UW]j]h]Yg'mci 'a Um'a]gg"K '\YfY'h'g'a]['h'bh'chVY'dcgg]V'Y'z'Ub'Udd']W]h]cb'Zc'f'Z'Y'fYa]gg]cb'a Um'VY'X]gW'ggYX'": i f'h'Yf']b]Zc'fa Uh]cb']g'Uj U]UV'Y'cb'UbmW<i fgY'A'ccX'Y'cf'HYUa'g'g]h'Y"

W'f]U]b'WUgg'fcca'UbX'UV'cf'Uhc'fmg]h'Uh]cbg'k '\YfY'd'ng]W]X']g]h]UbW]b['W]bb'chVY'a U]b]U]bYX'cf'h'YfY']g'U'\]['\f]g_'h'Uh]h'W]bb'chVY'a U]b]U]bYX'z'ZJW' 'a Ug_g'k]'VY'W<bg]XYfYX'a UbXUhc'fmiDD9'Zc'f'gh'XYbHg'UbX'ghUz'

: cf'a cfY']b]Zc'fa Uh]cb'z'd'YUgY'fYZf'hc'h'Y
: 5E g. [\h\]dg_#k k k "W<j \]X!%"i bgk "YXi "Ui #gUZY'fYh'fb!WJa di g!ZJeg](#)

; i]XY']bYg

5''gh'XYbHg'UFY'YI dYWW'X'hc'fYUX'UbX'VY'ZJa]]Uf'k]h' l BGK '[i]XY']bYg'UbX'dc']W'g" W'd'Uf]h'W'Ufz'gh'XYbHg'g\ci 'X'VY'ZJa]]Uf'k]h' h'Y'Z'ck]b[.

- [5H'YbXUbW](#)
- [I'BGK'9a U\]'5XXfYgg](#)
- [GdYW\]U'7cbg\]XYfU\]h\]cb](#)
- [9I'Ua'g](#)
- [5ddfcj'YX'7U'W'Uhc'fg](#)
- [5WUXYa \]W<cbYghmUbX'D'U\[\]Uf\]ga](#)

⇒ dcfhUbh@]b_g

- [A ccX`Y](#)
- [@UV`5WV`gg](#)
- [<YU`h`UbX`GUZYhm](#)
- [7ca`di`hb\[`:UW`hYg](#)
- [Gh`XYbhF`Ygci`fW`g](#)
- [7ci`fgY`Ci`h\]bYg](#)
- [9b\[\]bYYf\]b\[`Gh`XYbhGi`ddcfhGYfj`_W`g:7YbhfY](#)
- [A`U`YfgdUW`](#)
- [I`BGK`H\]a`YhUV`Y](#)
- [I`BGK`<UbXVcc`](#)
- [I`BGK`A`YWXUb\]W`UbX`A`Ubi`ZUW`f\]b\[`9b\[\]bYYf\]b\[](#)
- [9ei`\]hUV`Y`@YUfb\]b\[`GYfj`_W`g](#)

⇒ U[Y`7`fYX]h

GmbYf[]Yg`]b`Gci`bX`&\$%*`

7F ⇒ CG

7F ⇒ CG`Dfcj`]XYf`7`cXY.`\$\$\$-`,`;

5W_bck`YX[Ya`YbhcZ`7`ci`b]fm

K`Y`UW_bck`YX[Y`h`Y`6YXY[U`d`Ycd`Y`k` \c`UFY`h`Y`fUX]h]cbU`W`g]hX]Ubg`c`Z`h`Y`UbXg`cb`k` \]W`I`BGK`
?`Ybg]b[]cb`W]a`di`g`]g`c`W]h`Y`X`"

5ddYbX]l . '9b[]bYYfg'5i ghfU`U'f95E'DfcZYgg]cbU`'9b[]bYYf'7ca dYhYbWm
GHUbXUfX

Dfc[fUa 'hYbXYX'@YUfb]b['Ci hWta Yg	
? bck `YX[Y'UbX'g_]`VUgY	
D9%"%7 ca dfY\Ybg]j YzhYcfmVUgYX'i bXYfghUbX]b['cZhY'i bXYfd]bb]b['bUh fU`UbX d\mg]WU`gWYbWg'UbX'hY'Yb[]bYYf]b['Z bXUa YbH'g'Udd']WUV'Y'hc'hY'Yb[]bYYf]b['X]gWd`]bY	
D9%"&'7 cbWdh U`i bXYfghUbX]b['cZhY'a UhYa Uh]Wg'z'bi a Yf]WU`UbU'mg]g'ghUhg]Wg'z'UbX Wta di h'f'UbX']bZ'fa Uh]cb'gWYbWg'k \]W' i bXYfd]b'hY'Yb[]bYYf]b['X]gWd`]bY	
D9%" " 'h!XYdh'i bXYfghUbX]b['cZgdYWU`]ghVcX]Yg'cZ_bck `YX[Y'k]h]b'hY'Yb[]bYYf]b[X]gWd`]bY	
D9%"('8]gWfba YbhcZ_bck `YX[Y'XYj Y`cda YbhUbX'fYgYUfW'X]fYW]cbg'k]h]b'hY Yb[]bYYf]b['X]gWd`]bY	
D9%") ? bck `YX[Y'cZYb[]bYYf]b['XYg][b'dfUW]W'UbX'WcbhYI h U`ZUW'c'fg]a dUW]b['hY Yb[]bYYf]b['X]gWd`]bY	
D9%"* 'i bXYfghUbX]b['cZhY'gW'cdY'z'df]bW]d'Yg'z'bcfa g'z'UW'W'ci bHUV']h]Yg'UbX'Vci bXg'cZ gi gh]bUV'Y'Yb[]bYYf]b['dfUW]W']b'hY'gdYW]ZWX]gWd`]bY	
9b[]bYYf]b['Udd']WU]h]cb'UV']]m	
D9%"%5dd`]WU]h]cb'cZYghUV]g\YX'Yb[]bYYf]b['a Yh'cXg'hc'Wta d'YI'Yb[]bYYf]b['dfcV'Ya gc']b[
D9%"&'&'i YbhUdd']WU]h]cb'cZYb[]bYYf]b['h'W]b]ei Yg'z'hc'g'UbX'fYgci fW'g	
D9%" " '5dd`]WU]h]cb'cZgmg]Ya Uh]WYb[]bYYf]b['gmb'hYg]g'UbX'XYg][b'dfcW'ggYg	
D9%"('5dd`]WU]h]cb'cZgmg]Ya Uh]WUdd'fcUW]Yg'hc'hY'WcbXi W]UbX'a UbU[Ya YbhcZYb[]bYYf]b[dfc'YW'g	
DfcZYgg]cbU`UbX'dYfgcbU`Uhf]Vi hYg	
D9' "%9h]WU`WcbXi W]UbX'dfcZYgg]cbU`UW'W'ci bHUV']]m	
D9' "&'9ZYW]j Y'cfU`UbX'k f]hYb'Wta a i b]WU]h]cb']b'dfcZYgg]cbU`UbX`UmXca U]bg	
D9' "' '7fYUh]j Y'z]bbcj Uh]j Y'UbX'dfc!UW]j Y'XYa YUbcif	
D9' "('DfcZYgg]cbU`i gY'UbX'a UbU[Ya YbhcZ]bZ'fa Uh]cb	
D9')" 'C'fXYf'ma UbU[Ya YbhcZgY'z'UbX'dfcZYgg]cbU`WcbXi W]	
D9' "*" '9ZYW]j Y'hYUa 'a Ya VYfg\]d'UbX'hYUa ``YUXYfg\]d	