



MODL5107

HfUbg`Uhjcb'HYWkbc`c[m

7ci fgY[·]Cj Yfj]Yk

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

'7cbj Ybcfg'

BUa Y	9a U]`	5j U]`UV]`]m	@cWUhjcb	D∖cbY
GYUb [.] 7\Yb[gYUb"₩4 i bgk "YXi "Ui			

: cf`YggYbhJU``ghi XYbh`]bZcfa UhJcb`fY`UhJb[`hc.`fYei Yghg`Zcf`YI hYbg]cb/fYj]Yk `cZa Uf_g/cVWV dUhJcbU``\YU`h UbX`gUZYhm'YI Ua]bUhJcb`dfcVWXi fYg/gdYVJU``Vcbg]XYfUhJcb`]b`h\Y`Yj YbhcZ]``bYgg`cf`a]gUXj Ybh fY/ ghi XYbhYei]hmUbX`X]gUV]`]hm'UbX`ch\Yf`YggYbhJU``UVUXYa]W]bZcfa UhJcbž gYY`<u>\hhdg.##k k k "Ufhg"i bgk "YXi "Ui #W ffYbhIgh XYbhg#UVUXYa]W]bZcfa UhJcb#dfchcVc`g![i]XY`]bYg#</u>

7ci fgY[·]8YHJ]`g

7 fYX]hDc]bhg***

Gi a a UfmcZh\Y'7ci fgY

5 hih Y WobWi g]cb cZih]g Woi fgY h Y ghi XYbhik]``VY UV Y hc

- %"]XYbhjZmUbX`cj YfVca Y`hYVXbc`c[]WU``VXU``Yb[Yg`]b`hfUbg`Uhjcb`VUgYX`cb`fYgYUfVX`UbX`]bXi ghfm VYghidfUVMjVW
- &" Udd`mdfUWJWU``g_]``g`]b`d`Ubb]b[ži g]b[žUbX`UXj]g]b[`cb`HfUbg`UH]cb`HYW\bc`c[]Yg
- '" i gY WebhYI hi U``_bek `YX[Y'he'gi WWggZ ``mik ef_`k]h\ 'hfUbg`Uhjeb'hYW\be`e[mi]b'h\Y``Ub[i U[Y gYfj]WYg']bXi ghfm
- ("kcf_`YZYWfjY`m`]b`U`Wc``UVcfUhjY`ai`hj`]b[iU``hYUa
-)"YjU`iUhY`h\Y`fc`Y`cZaUVX]bY`hfUbg`Uh]cb`]b`h\Y`WcbhYI hcZh\Y``Ub[iU[Y`gYfj]WYg`]bXighfm

HYUW]b[GhfUhy[]Yg

H\Y'WcifgY']g'HUi[\hVmkUmcZcbY!\c% d!YjU+`iUhY'h\Y'fc`Y'cZaUWX]bY'HU

‰

5ggYgga Ybh

5ggYgga YbhHUg_g

5ggYgga YbhˈtJg_	K Y][\h	8iY'8UHY	GhiXYbhi@YUfb]b[CihWcaYgʻ5ggYggYX
AcW_`lfUbg`Uh]cb`dfc∕YWh	(\$1	k YY_`%	%ž&ž ž(
AUWX]bY`lfUbg`Ulr]cb`dfc∕Y₩i	(\$1	k YY_`%	%ž&ž ž)
Ei]n'	&\$I	k YY_`‰	&ž

5ggYgga Ybh8YHJ]`g

5ggYgga Ybh'% A cW_'hfUbg`Uh]cb'dfc'YWh

GHJfh'XUHY. kYY_*&

8YHU]`g. '5 'a cW_'HUbg`UHcb'dfc'YWiWcbHU]b]b[`]bX]j]Xi U``UbX`[fci d!VUgYX'Y`Ya Ybhg.D\UgY'%'; fci d! VUgYX'dfc'YWid`Ub'f&\$i &D\UgY'&.; fci d!VUgYX'dfc'YWiXY`]j Yfmk]h\`cfU``dfYgYbHUHcb'f%\$i &UbX]bX]j]Xi U``fYZYWi]cb'f%\$i & fci d!VUgYX'ZYYXVUW_`]g'dfcj]XYX`]b'k f]HY'b'UbX'cfU``Zcfa 'Zcf`D\UgY'%'UbX'&" #bX]j]Xi U``fYZYWi]cb'f%\$i & fci d!VUgYX'ZYYXVUW_`]g'dfcj]XYX']b'k f]HY'b'UbX'cfU``Zcfa 'Zcf`D\UgY'%'UbX'&"

5XX]h]cbU``XYHJ]`g.

D`YUgY`WXYW_`AccX`Y`Zcf`h\Y`XYhU]`g`cZh\Y`dfc*'*YWh'

Gi Va]gg]cb`bchYg.H\Y`]bX]j]Xi U``Wca dcbYbhk]``VY`gi Va]hhYX`j]U`Hi fb]hjb

Hi fb]h]b gYh]b[. H\]g]g bchU Hi fb]h]b Ugg][ba Ybh

5ggYgga Ybh'& 'A UW]bY hfubg`Uh]cb dfc YWh

Ghufh'XUhY. "k YY_"

@Yb[h\.`&\$\$\$`k cfXg

8YHJ]`g. 5b`Ya d]f]\WD`a UVX.]bY`HfUbg`UH]cb`ZYUg]V]`]hmdfc^YVNi]b`h\Y`Zcfa `cZU`&Z\$\$\$!k cfX`fYdcfH5b`U`][bYX UggYgga Ybhfi Vf]W]g`i gYX`hc`Yj U`i UHY`h\Y`dfc^YVN``=bX]j]Xi U``k f]hHYb`ZYYXVUW_`]g`[]j Yb`cb`YUVX`dfc^YWh i g]b[`h\]g`fi Vf]\WH\]g`]g`h\Y`Z]bU``UggYgga YbhZcf`UHYbXUbV\Y`di fdcgYg''

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

D`YUgY`WXYW_`AccX`Y`Zcf`XYHU]``]bZcfaUh]cb"

Hi fb]h]b`gYh]b[.`H\]g`Ugg][ba Ybh]g`gi Va]hYX`h\fci [\`Hi fb]h]b`UbX`gh XYbhg`WUb`gYY`Hi fb]h]b`g]a]`Uf]hm fYdcfhg"

5ggYgga Ybh' . Ei]n

GHJfh'XUHY. "k YY_"%

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

Gh XYbhg UfY YI 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

Zmci YbWci bhYfU'dfcV'Ya k∖Yb'UhYa dh]b['hc'gi Va]hmci f'Ugg][ba Ybhih∖fci [∖'Hi fb]h]bž'd'YUgY hY'Yd\cbY'9I hYfbU'`Gi ddcfhcb'-',)'''' %cf'Ya U]`th\Ya cb'<u>YI hYfbU'hY'hgi ddcfh4 i bgk "YXi "Ui</u> ł `G][b]Z]WUbhmUZYWimci f`dYfZcfa UbWi`]b`UggYggUV`Y`k cf_ž`VY`]hU`Zcfa U``YbX!cZigYa YghYf`YI Ua]bUh]cbž`U WUgg`hYghž`U``UVcfUhcfmhYghž`U`gYa]bUf`dfYgYbhUh]cb`cf`Ubmich\Yf`Zcfa `cZUggYgga Ybh'

: cf'Z fh\Yf'XYHJ]`g`]b`fY`UH]cb`rc`GdYW]U``7 cbg]XYfUH]cb`]bWi X]b[`''K \Yb`rc`5dd`mf'Z''<ck`rc`5dd`mf'UbX "Gi ddcfh]b[`8cW a YbHJh]cb"'d`YUgY`fYZYf'rc'h\Y`GdYW]U``7 cbg]XYfUH]cb`rk YVgh]Y.` \hhdg.##gh XYbH'i bgk "YXi "Ui #gdYW]U`!Wcbg]XYfUH]cb

5WUXYa]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"`=hWUb`hU_Y`a Ubm Zcfa gžZca `XY`]VYfUhY`W\YUh]b[`hc`UWW]XYbhU``mWcdm]b[`Zca `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[.ih,Y`gUa Y`cf`j Yfmig]a]`Uf`k cfXg`hc`h,Y`cf][]bU``hYI h`cf`]XYU'k]h\ci hUW_bck `YX[]b[`h\Y gci fWF`cf`i g]b[`ei chUh]cb`a Uf_g"`H\]g`U`gc`Udd`]Yg`hc`]a U[Ygž`Ufh`UbX`XYg][b`dfc´YWgž`Ug`k Y```Ug dfYgYbhUh]cbg`k \YfY`gca YcbY`dfYgYbhg`Ubch\Yf`g`]XYUg`cf`k cfXg`k]h\ci hWfYX]h"

=bUddfcdf]UhY'dUfUd\fUg]b[.'W\Ub[]b['U'ZYk 'k cfXg'UbX'd\fUgYg'k \]Y'a cghmfYhU]b]b['h\Y'cf][]bU' ghfi Whi fY'UbX']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]h''=hU`gc'Udd`]Yg'hc'd]YW]b['hc[Yh\Yf'ei chYg'UbX dUfUd\fUgYg']bhc'U'bYk 'k \c`Yž'k]h\ci hfYZYfYbW]b['UbX'U'gh 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 hdUgg]b['cZIh\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'gh XYbhVYZcfY'h\Y'Xi Y'XUhYžcf'Zcf'h\Y'di fdcgY'cZh\Ya d`U[]Uf]g]b['UhUbmih]a Yž'dUm]b['Ubch\Yf'dYfgcb'hc'dYfZcfa 'Ub'UWUXYa]WhUg_žghYU`]b['cf'UV&i]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_"

=ÐUddfcdf]UhY`W]hUh]cb. 7]h]b[`gci fWYg`k∖]WX`\Uj Y`bchVYYb`fYUXžk]h\ci hUW_bck`YX[]b[`h\Y`″gYWcbXUfm´ gci fWY`Zfca`k∖]W\`_bck`YX[Y`cZh\Ya`\Ug`VYYb`cVhU]bYX"

8id`]WUhjcbffgY`ZId`U[]Uf]ga "Ł`giVa]hhjb[`mcifickbikcf_ži]bik\c`Y`cfi]bidUfhžk\YfY`]h\UgidfYj]cig`m VYYbidfYdUfYX`cf`giVa]hhYX`Zcf`Ubch\\$f`UggYggaYYbhicf`Wcif%gaY`Uhil BGK icf`Ubch\Yf`i%gaj] Yfg]hm'

‰

7 cffYWhfYZYfYbW]b[dfUWf]WYg.

• DUfUd\fUg]b[žigi a a Uf]g]b[žYggUmk f]h]b[iUbXih]a Yia UbU[Ya Ybh

• VYHYfa UbU[Y'mcifh]a Y

	A UVX.]bY`HfUbg`Uh]cb.
	@]b[i]gh]WDfY!dfcWYgg]b['ŽAH`DcgHYX]h]b[
	A U_Y!i d`hi hcf]U``Zcf`k YY_`, `Xi Y`hc`5bnUW8Umi]b k YY_`, "`: f]XUmhi hcf]U`g`k]``U`gc`bYYX`hc`VY`fi b`]b h\]g`k YY_"`fbi VYWhhc`W\Ub[Y`Xi Y`hc`fcca `Vcc_]b[`! d`YUgY`Zc``ck `h\Y``UhYghUbbci bWYa Ybhcb`A ccX`YŁ • @]b[i]gh]WdfY!dfcWYgg]b[`k]h\`Wcbhfc``YX

F Ygci fWg

DfYgWf]VYX F Ygci fWfg

7 c fY fYUX]b[g.

8c\YfmžG"f&\$%*E"H\Y`]adUWicZlfUbg`Uh]cb'HYW\bc`c[]Yg`cb'H\Y`dfcW/gg`UbX`dfcXiWicZlfUbg`Uh]cb"` ;`fWd Sf[a` S^<agd S^aX5a__g`[USf[a` ž'%% %-'&' "

9ggY`]b_ž6"`f&\$\$\${"5`DfUWjWU``; i]XY`hc`@cWU`]nUhjcb"`>c\b`6Yb*Ua]bg"

<YUfbYžA "/ K Umž5" f&\$%/2" GHJhjghjWU``A UWX]bY HfUbg`Uhjcb. 5; i]XY Zcf`@jb[i]ghg`UbX HfUbg`Uhcfg" @Ub[iU[Y`UbX`@jb[i]ghjWg`7 ca dUggž) židd" &\$)!&&*"

? Ybbnž8"/ '8c\YfmžG"'f&\$%(L''GHUH]gH]WU`a UW\]bY`HfUbg`UH]cb`]b`H\Y`HfUbg`UH]cb`W ff]W`i a .`cj YfWca]b[cVgHUWYg'UbX`Ya dck Yf]b['HfUbg`Uhcfg"'H\Y`=bHYfdfYHYf'UbX`HfUbg`Uhcf`HfU]bYfž', ž&ždd"`&+*`=`&- ("

C'<U[UbžA"f&\$% Ł"H\Y =a dUWicZBYk HYW bc`c[]Yg`cb`HfUbg`Uh]cb`Gh X]Yg" =b. 7 Ufa Yb`A]`½o`UbX : fUbW gWU 6 Ufhf]bU`fYXg"Ł"H\Y`F ci hYX[Y`<UbXVcc_cZHfUbg`Uh]cb`Gh X]Yg"

 $\label{eq:constraint} \begin{array}{l} K & Um \cite{2}5"\cite{2}d" \cite{2}d \cite{2}d$

K]`_gž'M"`f&\$\$- Ł"`A UW\]bY`HfUbg`Uh]cb.`≢g`GWcdY`UbX`@]a]hg"`@cbXcb.`Gdf]b[Yf"

>ci fbU`g.

DYfgdYWfj Yg. Ghi X]Yg']b'HfUbg`Uhc`c[m'<u>\htd.#k k k "HUbXZcb`]bY"Wca #hcW#fa dg&\$#J 7 md]Ga GI \$5</u>

A UVX]bY`HfUbg`Uh]cb`>ci fbU``!`<u>\hd.##]b "gdf]b[Yf"Vca #ci fbU`#%\$) - \$</u>

FYWca a YbXYX⁻FYgci fWYg

K YVg]hYg.

A UVX]bY 'HfUbg`Uhjcb '5 fVX]j Y. '<u>\htd.#k k k "a h UfVX]j Y "]bZc#</u>

GłułjgłjWU``A UWX]bY`HfUbg`Ułjcb. <u>\htd.#k k k "głUha h'cf[#</u>

95A H. <u>htd. #k k k "YUa h"cf[</u>

5A H5. <u>htt.#k k "Ua HJk YV"cf[#</u>

7 ci fgY 9j U`i Uhjcb UbX 8Yj Y`cda Ybh

H\Y'Wci fgY'k]``'VY'Zcfa U``mYj U`i UHYX'j]U'a m91 dYf]YbWY'gi fj YmUhH\Y'YbX'cZh\Y'gYa YgHYf'

∋a U[Y[·]7fYX]h

: fcbhdU[Y'd\chc'VmC`]jYf'H\caUg'?`Y]b'cb'I bgd`Ug\.

\hhdg.## bgd`Ug\"Wca #d\chcg# S)6B@BZDb(

7F=7CG

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