

MDIA5005

GdcftgžA YX]U UbX 7 i `h fY

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

7ci fgY⁻Cj Yfj]Yk

'GhJZZ'7cbhJWh'8YhJ]`g'

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`] m	@cWUhjcb	D\cbY
GWcMG\UbYf	g"g\UbYf4 i bgk "YXi "Ui	H\i fgXUm %)'\$!%*'\$'fbf'Vm Uddc]bhaYbhŁ	FcVYfh KYVgHYf 6i]`X]b[ž Fcca'' %%9	-',)*,\$(fbfYZYf Ya U]'Ł

GWXcc`7cbHJWh ≠bZcfa Uh]cb

Fcca " %&ž~Yj Y`" FcVYffiK YVghYf~6i]`X]b[

D\cbY. 'f\$&Ł'-',) '(,) *

9a U]`. 'gUa 4 i bgk "YXi "Ui

K YVg]hY. \hdg.##gUa "Ufhg"i bgk "YXi "Ui

 $\label{eq:hammer} $H\Y`GW\&cc``cZhY`5ftg`UbX`AYX]U`kci`X``]_Y`tc`FYgdYWMZ``m'5W$

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‰

5 WUXYa]W = b Zcfa Uh cb.

: cf`YggYbh]U``ghi XYbh`]bZcfa Uh]cb`fY`Uh]b[`hc.`fYei Yghg`Zcf`Yl hYbg]cb/fYj]Yk `cZa Uf_g/cWW dUh]cbU``\YU`h\UbX`gUZ/hm'Yl Ua]bUh]cb`dfcWXi fYg/gdYW]U``Wcbg]XYfUh]cb`]b`h\Y`Yj YbhcZ]``bYgg`cf`a]gUXj Ybhi fY/ghi XYbhYei]hmUbX`X]gUV]`]hm'UbX`ch\Yf`YggYbh]U``UWUXYa]W]bZcfa Uh]cbž gYY`\hdg.#k k k "Ufhq"i bqk "YXi "Ui #W ffYbhqhi XYbhq#UWUXYa]W]bZcfa Uh]cb#dfchcWc`q![i]XY`]bYq#

7ci fgY 8YHJ] g

7 fYX]hDc]bhg *

Gi a a UfmcZh\Y 7ci fgY

H\]g`Wci fgY`]bhfcXi WYg`ghi XYbhg`hc`h\Y`W`hi fU`ž'dc`]h]WU``UbX`YVcbca]Wfc`Y`d`UmYX`Vmgdcfhi[`cVU``m''=h U]a g`hc`XYj Y`cd'h\Y]f`i bXYfghUbX]b[`cZh\Y`fc`Y`d`UmYX`Vmh\Y`a YX]U`]b`Wca a YfW]U`]g]b[`gdcfhiUbX`]b [`cVU`]g]b[`Ui X]YbWYg`Zcf`gdcfh''=hk]```U`gc`XYj Y`cd'ghi XYbhgfii bXYfghUbX]b[`cZgdcfhg`a YX]U`UbX'di V`]W fY`Uh]cbg'dfUWf]WY"

'Hcd]Wg']bWi XY.'h\Y`W`hi fU`z'dc`]h]WU`'UbX'YWcbca]Wfc`Yg'cZgdcfh/[`cVU`]gYX'gdcfhg'UbX'gdcfhg UbX'gdcfhg UbX'gdcfhg'ZJbg/bYk 'a YX]U']a dUWg'cb'gdcfhg'fYdcfh]b['UbX'di V`]WfY`Uh]cbg/[YbXYf']b'gdcfhg'UbX gdcfhg'a YX]U'UbX'di V`]WfY`Uh]cbg/gdcfhg'VfUbX]b[z'dfca ch]cb'UbX'a Uf_Yh]b[/UbX'fYgYUfW\'UbX']bhYfj]Yk hYW\b]ei Yg'Zcf'gdcfhg'k f]h]b["

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

%" 8 Ya cbglfUlY 'U'Wf]h]WU`i bXYfglUbX]b['cZgdcfha YX]U'UbX'dfca ch]cb" &" 8 Ya cbglfUlY 'U'Wf]h]WU`i bXYfglUbX]b['cZgdcfhWca a i b]WUh]cb'[YbfYg" ' " 8 Ya cbglfUlY 'dfUW]WU`g_]``g']b'a i `h]d'Y'[YbfYg'cZWca a i b]WUh]cb

HYUWX]b[GhfUhY[]Yg

"H\]g`]g`U`6`YbXYX`XY`]j Yfm#Z]ddYX`Wci fgYž`Wca V]b]b['k YY_`mcb`]bY`YWi fYg`fXY`]j YfYX`j]U`A ccX`YŁ`k]h\]bhYbg]j Y`ZJWW!hc!ZJWW`k cf_g\cdg"'=ifYZYWfg'a mdcg]h]cb`h\Uh[fUXi UhY'g'dfUWf]\W`k]h\]b'h\Y`Z]Y`X`k]``fYei]fY`Ub`UXj Ub\W`X`h\YcfYh]\W\``UbX`dfUWf]\W\``i bXYfgHUbX]b['cZh\Y`Yj c`j]b['gdU\W`cZgdcffg'a YX]U`k]h\]b h\Y`Z]Y`Xg'cZ'ci fbU`]ga 'UbX`\Wca a i b]\Wh]cbg"'`H\]g`\Wci fgY`k]```Ugg]ghighi XYbhg`]b`XYj Y`cd]b['\Wf]h]\W\`fYgYUf\W.`UbX`\Wca a i b]\Wh]cb'UbX`hYUa !k cf_'g_]``g`h\Uhk]``Yb\Ub\W`h\Y]f`dfU\M]\W`Ug'a YX]U dfcZ\gg]cbU`g"'``

5ggYgga Ybh

H\]g`Wci fgY`]g`XY`]j YfYX`]b`fW`YbXYX#Z]ddYXfia cXYž'k\]W\`a YUbg`t\Y``YWi fYg`UfY`cb`]bYž'Zcf`mci 'fc``]ghYb hc`]b`mci f`ck b`hJa Y'''K\Yb`k Y`UfY`hc[Yh\Yf`]b`ci f`'!\ci f`gYa]bUfg`k Y`k]```gdYbX`A CGH`cZci f`hJa Y UWJj Y`mk cf_]b[`cb`[fci d`UbX`]bX]j]Xi U``UggYgga YbhHUg_g"`H\]g`a YUbg`mci 'bYYX`hc`Wca Y`hc`WUgg dfYdUfYX`hc`Vch\``]ghYb`UbX`Wcbhf]Vi hY`hc`ga U```UbX``Uf[Y`[fci d`X]gW gg]cbg`UbX`UWJj]hJYg`fUbX`hc`Xc gca Y`k f]hJb[`VUgYX`cb`mci f`i bXYfgHUbX]b[`cZWci fgY`fYUX]b[g`UbX`cb`]bY``YWi fYgŁ"`D`YUgY`VYUf`]b`a]bXž mci k]``bYYX`hc`VY`gY`Za chJj UhYX`hc`[Yhh\Ya cghci hcZh\]g`WUgg*

D`YUgY'bchY. '5hhYbXUbWY'Uh'U```Zci f'gYa]bUfg']g'7 CA DI @GCF M''5b 'CDH€B5@'ZUWY!hc!ZUWY'9ggUm 7`]b]Wk]``VY'cZZYfYX']b'K YY '% "

Zmci k Ubhrc X]gW ggʻUggYgga YbhgʻVYhk YYbʻZUWY!hc!ZUWY k cf_g\cdgžd`YUgY`UhhYbX`GWchfig Wcbgi `hUh]cb`\ci f. `H\i fgXUmg'' .' \$!(.' \$da `]b`FcVYfhK YVghYfʻ6i]`X]b[žFcca '' %%9"`Bc Uddc]bha Ybh]gʻbYWyggUfmZcfʻUʻa YYh]b[`Uhh\]gʻh]a Y"

5ggYgga Ybh'HUg_g'

5ggYgga Ybh'HJg_	K Y][\h	8i Y'8UHY	Gh XYbh@YUfb]b[Ci hWca Yg 5ggYggYX
FYZYW¶jY'ćifbU`	&\$I	&) #\$) #&\$% `\$(.(\$`DA	%
F YgYUfWX '9ggUm'	')	\$, #\$*#&\$% `\$(.(\$`DA	%ž&Ž
Gdcfh'>ci fbU']ga '[fci d'V'c['	()	\$-#\$(#&\$% `\$(.(\$`DA	%ž&Ž

5ggYgga Ybh8YhJ]`g

5ggYgga Ybh'% FYZYWhjj Y''ci fbU'

GHJfhXUhY.

@Yb[h\. %\$1 %) \$!&\$\$ k cfXg

8 YHJ]`g. '%) \$\$`k cfXg"Ghi XYbhg`k]```fYWY]j Y`Zcfa Uhjj Y`ZYYXVUW_`fJ YfVU`Łž'UbX`gi a a Uhjj Y`ZYYXVUW_ fk f]hhYbŁ"

5XX]h]cbU`XYhU]`q.

Mci 'k]```bYYX'hc'a U_Y'U'ĉi fbU``YbhfmYUW\'k YY_žX]fYWhmfY`UhYX'hc'Ub'UgdYWhcZ`YWh fYg'UbX#cf'Wci fgYfYUX]b[g'Zca 'k YY_g'%]) 'UbX'+!%'fk Y'\Uj Y'bc'WUgg'K YY_'*Ł'9UW\'ĉi fbU``Ybhfmg\ci `X'Vf]YZm

8 YgWf]VY 'h\ Y 'Yl Ua d'Y 'mci '\Uj Y 'W\cgYb 'Zfca "YVWi fY 'WcbhYbhcf'Wci fgY 'fYUX]b[gž'UbX'Yl d`U]b'k \mmci W\cgY 'h\]g'Ug'mci f'ci hghUbX]b["YUfb]b['UfYU 'Zcf'h\]g'k YY_"'8]X ']h'W\ U``Yb[Y#gi fdf]gY#bZ f]UhY#bgd]fY 'mci 3 K \m3':]bU``mž'mci 'g\ci `X 'ghUhY 'k \Uhmci '\Uj Y 'dYfgcbU``m`YUfbYX 'Zfca 'h\ Y 'YWi fY 'cf'fYUX]b["

Mci 'k]``'VY'UggYggYX'UW\cfX]b['hc'h\Y'Zc``ck]b['\\f\]h\f]U.

- 5V]]|mm/hc~Wf|h/WU~mUbU~mqY~UbX~fYZYWhcb~Wci fqY~Wcbh/bhfUq~ci h]bYX~UVcj YŁ
- 5V])mhckflhYWYUfmUbXWcbWqYm

H\]g`UggYgga Ybhk]``VY`X]gW ggYX`]b`@YWi fYg`UbX`K cf_g\cdg"`Mci `UfY`]bj]hYX`hc`gi Va]h`U`< 5F 8 '7 C DM cZmci f`ci fbU`Ybhf]Yg`Zcf`K YY_g`% (`Xi f]b[`gYa]bUf`&"`Mci `k]``fYWY]j Y`K f]hhYb`ZYYXVUW_fj]U`Ya U]`EVm h\Y`YbX`cZK YY_'*"`D`YUgY`bchY`mci `k]```BCH`fYWY]j Y`U`a Uf_`Zcf`mci f`XfUZhž'UbX`gi Va]hh]b[`U`XfUZh`]g BCH`Wca di `gcfm"

H\Y: \B5@XiYXUhYZcf5@@H9B^cifbU`YIhf]Yg']g': f]XUm'&) 'A Umz') da "'Mci 'g\ci `X'gi Va]hh\Y Wca d`YhY^cifbU`Ug'Ug]b[`Y'k cfX'XcW a Ybhcf'dXZj]U'Hifb]h]b"

Gi Va]gg]cb bch/g. D'YUgY gi Va]hmci f'ci fbU`'Ug'U'K cfX'XcWcf'D8: 'Z'Y"

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

5ggYgga Ybh& FYgYUfW 9ggUm

GHJfhXUhY.

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

8YHJ]`g. '&\$\$\$`k cfXg"`H\]g`]g`h\Y`Z]bU``UggYgga YbhHJg_": cfa Uh]j Y`ZYYXVUW_cb`YggUmXfUZngžgi a a Uh]j Y ZYYXVUW_fk f]hYbE`]b`Yl Ua 'dYf]cX"

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

H\]a'YaqUmU``ck g'mci 'hc'fYaYUfW\'U'hcd]WcZmci f'ck b'W\ccq]b['fWYUf'mi`]b_YX'hc'h\Y'WcbhYbhZcf'h\]a

Ui X]YbWY"

 $\label{eq:limit} $$Mci 'k]```gi Va]$$hmci f`dfcdcgU``Ug`U`k cfX`XcW a Ybhcf`dXZcb`Hi fb]h]b"$$

.

Gi Va]gg]cb bchYg.bi ``

 $\label{thm:continuous} \mbox{Hi fb]h]b"gYh]b[."H\]g"Ugg][ba Ybh]g"gi Va]hhYX"h\fci [\ \ 'Hi fb]h]b"UbX"gh XYbhg"Xc"bchgYY"Hi fb]h]b$

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

 $Gh\ XYbhg\ UfY\ YI\ dYWMYX\ hc\ di\ hih\ Y]f\ bUa\ Yg\ UbX\ gh\ XYbhbi\ a\ VYfg\ cb\ Yj\ YfmdU[\ Y\ cZh\ Y]f\ Ugg][\ ba\ Ybhg\ bug\ Ybhg\ bug\ Yhhg\ Yhhg\ bug\ Yhhg\ Yhhg\ bug\ Yhhg\ bug\ Yhhg\ bug\ Yhhg\ bug\ Yhhg\ bug\ Yhhg\ Yhhg\ bug\ Yhhg\ Yhhg\$

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

⊋mci 'YbWci bhYf'U'dfcV'Ya 'k \Yb'UhhYa dhjb['hc'gi Va]hmci f'Ugg][ba Ybhh\fci [\ 'Hi fb]hjbž'd'YUgY hY'Yd\cbY'9| hYfbU''Gi ddcfhcb'-' ,) '' ' '%cf'Ya U]'hXYa 'cb'<u>Yl hYfbU'hY'hgi ddcfh4 i bgk "YXi "Ui</u> 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 i]gii g]b[ih\Yik cfXgicfi]XYUgicZch\YfgiUbXidfYgYbh]b[ih\Ya iUgimci fick b"i\in\WbihU_Yia Ubm Zcfa gžZfca iXYi]VYfUhYiW\YUh]b[ihciUVW]XYbhU`mWcdm]b[iZfca iUigci fWlik]h\ci hiUW_bck iYX[Ya Ybh'i

 $I BGK `[fci dg'd`U[]Uf]ga `]bhc'h\Y'Zc``ck]b[`WUhY[cf]Yg.$

7 cdm]b[.'i g]b['h\Y'gUa Y'cf'j Yfmg]a]`Uf'k cfXg'hc'h\Y'cf][]bU`h\I hcf']XYU'k]h\ci hUW_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]hY[cf]Yg.

- VYMYfa UbU[Y'mci f'h]a Y
- i bXYfgHUbX mci f'f][\hg`UbX`fYgdcbg]V]`]h]Yg`Ug`U`gh XYbh'UhI BGK
 VY`Uk UfY`cZd`U[]Uf]ga žWcdmf][\hz`I BGK 'Gh XYbh'7 cXY`cZ7 cbXi Wh'UbX`5VWWdhUV`Y`I gY`cZ IBGK '=7 H'F Ygci fWYg'Dc`]Wm

7ci fgY GWXYXi `Y

J]Yk 'WUgg'ha YHUV'Y

H]a YtUV`Y

8 UHY	Hmd Y	7 cbhYbh
K YY_'%'&*': YVfi Ufm!'(A UfVX	K YV	@YWNifY`fcb`AccX`YŁ7cifgY`+bhfcXiWh]cb`UbX cjYfj]Yk
		9ggYbh]U``fYUX]b[`fbYY``]b_g`]b`A ccX`YŁ
		B]W.c`gcbžA"žN]cbž@"UbX'@ckXYbž8f&\$%\£'5 DfcZ]Y'cZ5ighfU`]Ub'Gdcfhg'>cifbU`]ghg'fFYj]g]hYXŁ' ?W[S;`fWtSf[a`S^3gefcS[St;`UacbacSf[`Y5gfgdW S`VBa{Uk'Bc'%(\$ž5i[igh,(!-*
		6cmYžF f&\$\$*E'9b[U[]b[ik]h\gdcfhg'cifbU`]ga. WcbhYIhUbXi]ggiYg'i]bEbadfe <agd 5a`fwjf<br="" sfe_,="">S`V;eegWez@cbXcb.GU[Yiddi+!&-ifY!Vcc_ UjU]'UV'YZfca IBGK @JVfUfmŁ</agd>
	GYa]bUf	GYa]bUf'%fk%+5Ł'' ' <cif': uwy!hc!:="" uwy<br="">+bhYbg]jY'K cf_g\cd</cif':>
		K \Yb. H\i fgXUm'%ghA UfW\')!, da 'K \YfY. A Uh\Yk g'6i]X]b[F cca '%\$+
		3Uf[h[f[We [`UgVW
		±blfcXi Wjcbg
		91 YfWlgYgʻ]Yʻgdcfhgʻ]bhYfj]Yk]b['/ 'k f]h]b[žʻ]ggi Ygʻ]b WcbhYa dcfUfmigdcfha YX]U
		±bHfcXiWMjcb'hc'[fcid'V`c[[]b['UggYggaYbh
		9gHJV`]g\]b['VUg]WK cfXdfYgg'V`c[g']b'[fci dg
		F9A -B89F. '5 HYbXUbWY'Uh'U```gYa]bUfg']g 7 CADI @GCFM''5 b'CDH-€B5@'ZUWY!hc!ZUWY 9ggUm'7`]b]Wk]``'U`gc'VY'cZZYfYX']b'KYY_''&"
K YY_'&.') 'A UfW\'!'%% A UfW\	K YV	@YWn fY`fcb`AccX`YŁ!`Gdcfmg`^ci fbU`]ga `UbX dfcach]cb.`gcaY`Wf]h]WU`fYZYWh]cbg
		9ggYbh]U``FYUX]b[gʻfl]b_gʻ]b`A ccX`YŁ
		6cm`YžF`f&\$\$*E'Gdcftg`čifbU`]ga`]b`U`dfcact]cbU` U[Y']b`Ebadfe <agd 5a`fwjfs`v;eegwež<br="" s{e_,="">@cbXcb.`GU[Y`dd`%\$&!%&+`fY!Vcc_'UjU]`UV`Y`Zfca</agd>

		I BGK '@]VfUfmŁ
		Gi [XYbž'>"/ 'Hca`]bgcbž'5"'f&\$\$+Ł"''Ghcf]Yg'Zfca D`UbYh: cch/U``'UbX'Gdcfhgk cf`X'ž' <agd`s'[e_ BdSUf[UWž'%%ž'((!*%</agd`s'[e_
		FckYž8":f&\$%' Ł'CbigWUbXU`'UZhYfigWUbXU`žgdcfhg cifbU`]ghgiXfcdih\Y'VU``'ZFZW5a`hWdeSf[a`
	GYa]bUf	GYa]bUf%fk%+6Ł'' ' <cif': td="" uwy!tc!:="" uwy<=""></cif':>
1	I	·

		5i glfU`]Ub`gdcfh'EbadfS`VEaU[Wfk, 5g/fgdWel5aWdUW1?WW[SlBa/[f[Ue`%&ff*E-''!-(*
		8 nUb_]Wz'>"'f&\$\&\t"@cbXcbfg'C`mad]Wg'g\ck'h\Uhh\Y'`]b_g'VYfk YYb'gdcffgz'WjfjnYbg\]dz'dc`]fjWg'UbXbUfjcbU``]XYbfjmiUfY'Ug'fUb[]V`Y'Ug'Yj Yf"'>a`Va` EUZaa^aX7Ua`a_[Ue 4'aY
		Fck Yž8":f&\$%&E'H\Y'V]Xžh\Y'`YUX i džh\Y'Yj Ybh UbX'h\Y'`Y[UWh'[`cVU``W`hifU``dc`]h]Wg'UbX'\cgh]b[h\Y'C`mad]Wg'žFZW4d[f[eZ <agd`s^axeau[a^ayk'*' f&&ž&,)'!'\$)</agd`s^axeau[a^ayk'*'
	GYa]bUf	GYa]bUf & fk %+5 k! ' ' < ci f : UWY!hc!: UWY \$hYbg]j Y K cf_g\cd ff C A DI @GC F MŁ
		K \Yb. `H\i fgXUm&- `A UfVX `&!) da ``K \YfY. A Uh\Yk g`6i]`X]b[`F cca `%\$+
		3Uf[h[f[We [UgVW
		; fci d'V'c['k cf_!]b'dfc[fYgg'dfYgYbHJh]cb"
		Mci f'dfYgYbhUh]cb'g\ci `X.
		UŁ + hrcxi W mci f'V`c[fg'W brfu`hcd]Wf]Y GcWW f'UgU; `cVU`Gdcfhz'UbX Vf]YZmYld'U]b mci f']bX]j]Xi U`dcghg" Mci 'g\ci `X`bchhY``i g'5@UVci hmci f'V`c[ž fghh\Y`a cgh]a dcfhUbhUgdYWg"
		VŁG\ck 'h\Y'WUgg'mci f'W ffYbhj Yfg]cb'cZmci f [fci d'K cfXdfYgg'V`c['fUbX'Ubm'UggcW]UhYX'gcW]U` a YX]U'UWWci bhgŁ
		WE'HY```i g`k \Uhmci 'UfY'd`Ubb]b['hc'bYl h''Mci 'k]``fYWF]j Y'j YfVU``ZYYXVUW_']b'h\]g'gYgg]cbžgc'mcig\ci `X'U`gc'Ug_'Zcf'gca Y'gi ddcfhUhh\]g'dc]bh]ZmcibYYX']h'
		CDH+CB5@'=Zmci 'k ci 'X'`]_Y'gca Y'k cf_!]b! dfc[fYgg'ZYYXVUW_'cb'mci f'Z]fghZci f'FYZYWf] Y >ci fbU`'Ybff]Ygž'd'YUgY'Vf]b['U'\UfX'WcdmcZmci f 'ĉi fbU`'hc'WUgg'h\]g'k YY_"'Mci f'XcW a Ybhg\ci 'X]bWi XY. 'Mci f'bUa Yž'mci f'ghi XYbhbi a VYfž'h\Y'XUm UbX'h]a Y'cZmci f'WUgg'f]Y'H\i fgXUm)!, da Łž'UbX mci f'ĉi fbU`'Ybff]Yg'Zcf'K YY_g'%('fbc'a cfY'h\Ub &\$\$'k cfXg'dYf'YblfmŁ"
		K Y'k]``'U`gc'X]gW gg'fYUX]b[g'UbX'ch\Yf']ggi Yg Uf]g]b['Zfca''h\Y'Z]fgh('kYY_g'cZ`YWifYg']b'h\]g gYgg]cb"
K YY_") . "&* "A UfVX "! "%	K YV	HY``]b['ghcf]Yg'UVci h'Uh\ `YhY g'UV]`]h]Yg'UbX

5df]`	X]gUV]`]h]Yg
	9ggYbhJU``fYUX]b[`fl]b_g`]b`A ccX`YŁ
	7 cff][Ubž:H"ž:YhiU`":f&\$%\$Ł":8]gWti fgYg:cZh\Y:"hcc UV`YX".:7 cbhYghYX:VcXm\]YfUfW\]Yg:UbX:h\Y:CgWUf D]ghcf]i g:WUgY":
1	

		mci f'^ci fbU``Yblf]Yg'Zcf'K YY_g'% ('fbc'a cfY'h\Ub &\$\$`k cfXg'dYf'YblfmŁ"
		K_Y`k_]```U`gc`X]gW_gg`fYUX]b[g`UbX`ch\Yf`]ggi_Yg Uf]g]b[`Zfca_'h\Y`Z]fgh(`k_YY_g`cZ`YWi_fYg`]b`h\]g gYgg]cb"
K YY_'*.'- '5df]`'!'%) '5df]` K	YV	DCGH; F58L5H9F958-B; 'K 99? ! BC @97HLF9'H<-€'K 99?
K YY_'+.'%* '5df]`'!'&&		

	GYa]bUf	GYa]bUf" fk%+5½"!"H\fYY" <cif": uwy!hc!:="" uwy<br="">+bHYbg]jY"K cf_g\cd"f17CADI@GCFM2</cif":>
		K \Yb.`H\i fgXUm&*`5df]``)!, da ``K \YfY.`A Uh\Yk g 6i]`X]b[`F cca `%\$+
		3 Uf[h[f[We [` UgVW
		flk f]hY`Mcif'Ckb'9ggUmEiYgh]cbfikcf_g\cd
		8]gWi gg]cb cZfYUX]b[g UbX ``YWi fYgžK YY_g) !,
		; YbYfU``ZYYXVUW_`cb`fYZYW¶jY`^cifbU``XfUZmg`UbX [fcid`V`c[g
K YY_'" \$"5df]"!"*"A Um	K YV	GdcfhžWYYVf]lmUbXgWUbXU`.Wf]g]g Wcaaib]WUh]cbjgWcaaib]lmYb[U[YaYbh
		7cbhYbhiUXj]gcfm h\]gkYY_fg``YWhifY`UbX

		; YbYfU``ZYYXVUW_`cb`fYZYWfjY`&ifbU``XfUZrg`UbX [fcid`V`c[g
K YY_'%\$.'+'A Um'!'%	K YV	Gdcfh]b[ZUb W `h fYg UbX ZUb a YX]U
A Um		9ggYbhJU``fYUX]b[`fl]b_g`]bA ccX`YŁ
		6]W_bY``ž?`f&\$%&'Gdcffž9bhYffU]ba YbhUbX'h\Y @j YfXE9I dYf]YbW\`cZ7\YYf]b['žDcdi `Uf 9bhYffU]ba YbhGh X]Yg`ž&fVEdd'-*!`%%%
		<pre><cdk "'<cdk="" '="" 'f&\$%\$l'h\y'di="" :="" ?=""]hw\]bž="" c`y'cz="" ccxža="" ccxžd"="" ddcfhyf';="" dg'']b'a="" fci="" ubg'ubx'gi="" v']wf="" y`uh]cbg'f="">'G_]bbYf'fYXgL"'Gdcfhdi V`]WfY`Uh]cbg UbX'Wca a i b]WUh]cb"'GmXbYm'6i hhYfk cfh\! < Y]bYa Ubb"'Dd'% -!'%) &fY!Vcc_'UVWYgg'j]U'l BGK @]VfUfmL</cdk></pre>
		<pre>< i hW.]bgz̃6"'UbX'F ck Yz̃8"'f&\$%(Ł"'7\UdhYf') 'C b`]bY'7fck Xg'UbX': UbXca 'i]b'Gdcfh6YmcbX HY`Yj]g]cb. H\Y'±bhYfbYhz̃8][]hU`A YX]U'UbX'h\Y'F]gY cZBYhk cf_YX'A YX]U'Gdcfh'@cbXcb. F ci hYX[Y'dd %\$\$!''&('fY!Vcc_z̃UWWgg'j]U'I BGK '@]VfUfmŁ</pre>
K YY_^%%	K YV	8][]hu`a YX]u'ubX'bYhk cf_YX'gdcfh'W `hi fYg
A OIII		9ggYbhJU``fYUX]b[`fl]b_g`]b`A ccX`YŁ
		F YUX]b[g.
		<pre>< i h/W.]bgž6"f&\$%%E'H\Y'UWWY`YfUh]cb'cZa YX]U gdcfh'W `hi fY.'Hk]hhYfžhY`YdfYgWYbWY'UbX'cb`]bY a YggU[]b['z';` Xad_ Sf[a` + 5a g` [USf[a` * E aU[Wfk'%(f&E&' +!&) + f]b'Zc`XYfE</pre>
		<pre>< i hW.]bgz~6"'UbX~F ck Yz~8"'f&\$%(Ł7\UdhYf'' ž 'BYhk cf_YX~A YX]U~Gdcfh']b~E badf 4Wka`V FWMh[e[a`, FZW;`fWd Wh 6[Y[fS^? WW[S S`V fZWD[eW aX@Wfi ad] VW? WW[S E badf''@cbXcb.~F ci hYX[Y~dd %&)!~%)\$~ffY!Vcc_z~UWWYgg~j~]U~l~BGK~@]VfUfmŁ</pre>
	GYa]bUf	GYa]bUf (fk %+5 k H\fYY < ci f : UWY!tc!: UWY =btYbg]j Y K cf_g\cd ff C A DI @GC F Mz
		K \Yb. H\i fgXUm&(A Um&!) da K \YfY. A Uh\Yk g 6i]X]b[F cca
		5 WAji JAJY gʻ]bWi XY.
		9ggUmiXfUZhik cf_g\cd`fd`YUgY`Vf]b[`mci f`cbY!dU[Y ci h]bY`hc`WUgg`!`XYhU]`g`k]```VY`]bWi XYX`]b``YWhi fYg Zcf`K YY_g`%\$`UbX`%%Ł
		8]gWigg]cb:UbX:UWjjjjhjYg:VUgYX:cb:fYUX]b[g:UbX

		`YWn fYg`K YY_g`-!%%
K YY_''&.' &%'A Um! '&+ A Um	K YV	7 cbWig]cbg'UbX'ZihifY'X]fYWh]cbg
		9ggYbhJU``fYUX]b[g`fl]b_g'j]U`A ccX`YŁ
		6cmYžFUmacbXif&\$\$*Ł'7cbWig]cb. Gdcfhž ćifbU`]ga 'UbX'gcWjYmi']b'Ebadfe \agd S{e_, Ua`fWjfS`V [eegWe'@cbXcb#H\cigUbX'CU_g#BYk 8Y`\]. GU[Y'DiV`]WUh]cbg'dd'%++!'%' 'fY!Vcc_ž UWWYgg'j]U'IBGK '@JVfUfmŁ
		<pre>< i hW\]bgz~6"'UbX`FckYz~8"'f&\$%(Ł~7\UdhYf'*z 'Gdcfhg'>ci fbU`]ga. 7cbjYf[YbWY'UbX`U'@YU_]b[7fUZh']b'Ebadf4Wka`VFWWh[e[a`,FZW;`fWd Wh 6[Y[f\$^? WW[SS`VfZWD[eWaX@Wh ad] WW? WW[S Ebadf"'@cbXcb. Fci hYX[Y'dd'%&)!'%)\$'fY!Vcc_z UWWYgg'j]U'IBGK'@]VfUfmŁ</pre>
		H\cfdYž'<"'UbX'K\YUhcbž'6"ž'&\$\\"'; YbYfUh]cb'L; Ua Yg'ž'UW]cb'gdcfhg'UbX'h\Y'C`mad]WAcjYaYbhibXYfghUbX]b['h\Y'W`hifU`'dc`]h]Wg'cZ]bWcfdcfUh]cb"'EaU[a'aYkž'&'f]\zdd",'\$!,(+"
	GYa]bUf	GYa]bUf'('fk%+6Ł'H\fYY' <cif': uwy!hc!:="" uwy<br="">+bhYbg]jY'K cf_g\cd'f7'CADI@GCFMŁ</cif':>
		K \Yb. H\i fgXUm' %A Um&!) da K \YfY. A Uh\Yk g 6i]X]b[F cca
		5WAj JAJYg JoWi XY.
		9ggUmXfUZnikcf_g\cd^fd^YUgY^Vf]b[^mcif^cbY!dU[Ycih]bY^bc^WUgg^!^XYhU]`g^k]```VY^]bWiXYX^]b^YWifYg Zcf^KYY_g^%\$^UbX^%&
		8]gWigg]cb`UbX`UWf]j]h]Yg`VUgYX`cb`fYUX]b[g`UbX `YWfifYg`KYY_g`-!**
K YY_'% . '&, 'A Um'!''	Hi hcf]U`	% <ci 9ggum7`]b]wfcdh£b5@l<="" f':="" td="" uwy="" uwy!c:=""></ci>
>i bY		8 c 'mci '\Uj Y'ei Yghjcbg'UVci hifYZYfYbWjb[3'5fY'mci ghfi [[`]b['hc'Wca d'YhY'mci f'fYgYUfW\'YggUmL3
		8 c 'mci 'bYYX'ZJWY!hc!ZJWY'gi ddcfh3
		H\]g`cbY`\ci f`WUgg`k]```ZcW`g`cb`f\Y`Z]bU``fYgYUfW\ YggUm'`8UfY`UbX`fjaY`fc`VY`XYWJXYX`]b`GYa]bUf`("

FYgci fWyg

DfYgWf]VYX F Ygci fWYg

DfYgWf]VYX F Ygci fWYg

BchY. h\Y'Zc``ck]b['dfYgWf]VYX'fYgci fWYg'UfY'Y!Vcc_g'Uj U]`UV`Y'Zfca 'h\Y'I BGK '`]VfUfm

 $<ihWX]bgž6"`UbX`FckYž8"`f&$\%(\pm Ebadf 4Wka`VFWWh[e[a`,FZW;`fWd Wh 6[Y[fS^? WW[SS`VfZWD[eWaX@Wf ad] WW? WW[SEbadf"@cbXcb.Fci hYX[Y] WW[SEbadf"]$

FYWca a YbXYX FYgci fWyg

Ch\YffYWca a YbXYX fYgci fWYg]bWi XY.

 $5bXfYk\ gžD"'f\&\$\$)\ E\ badfe\ \ \ agd\ S'[e_\ ,\ S\ bdSUf[US^[\ fdaVgUf[a\ `\ @cbXcb\#I\ ci\ gUbX'C\ U_g\#BYk\ `8Y`\]. \ `GU[\ Y\ Di\ V\]WUflcbq$

6cmYžF "'UbX' < UmbYgžF 'f&\$\$-ŁBai WdB'Sk, 'Ebadf FZW? WW[S S` V Babg'Sd5g'fgdWfgYWcbX'YX]h]cbŁ 9X]bVi f[\'I b]j Yfq]mmDfYgq

 $\label{thm:ckyz8} F\ ck\ Y\ z\&\$(\ E\ 5\ df[US^dMSV[\ Ye,\ ebad\ Ug\ fgdWS\ V\ fZW_\ WW[S\ A\ U]XYb\ YUX\ z\ 6Yf_g\]fY.\ C\ dYb\ I\ b]j\ Yfg]hm\ DfYgg$

7 ci fgY 9j U'i Uhcb UbX 8 Yj Y'cda Ybh

⇒a U[Y'7fYX]h