

MDIA1004

BYkg: i bXUa YbHJ`g

HYfa 'Hk c''##'&\$&%

7ci fgY 8YHJ] g

7 fYX]h'Dc]bhg '* '

Gi a a UfmcZh\Y 7ci fgY

 $K \Yh Yf mci \ "UfY "U" \'ci fbU"] ghža YX] U" UXj \] gcf cf "WcbhYbhdfcXi WYfžk f] h Yb "UbX" Ui X]c "bYk g"g_] "g" UfY "\] [\m j U"i YX" "BYk g"] b Zcfa g"Yj Yfm UfY U" cZa YX] U ž Z ca "VfY U_] b ["bYk gž Wf] a Yž gdcfhgž dc"] h W gž Vi g] b Y gg ž g W Yb W UbX "\YU"h "hc "Z Ug\] c b ž Yb HYfhU] ba Yb hž h\Y "Ufhgž" h Y W bc "c [m UbX "gc W U" a YX] U"j] f U"] m " \Nci \" "XYj Y "cd "g_] " g$

5ggYgga Ybh

H\Y'YI Ua 'k]``VY'HU_Y'\ca Y'cdYb'Vcc_"'Mci 'k]``\Uj Y'&('\ci fg'hc'Wca d'YhY']h'

Hi hcf]U`g`UfY`Wca di `gcfm''C b`mik c`WUb`VY`a]ggYX"`D`YUgY`gYY`h\Y`Wcbj Ybcf`cf`mci f`h hcf`]Zmci `UfY i bgi fY"`GdYW]U``Wcbg]XYfUh]cb`fYei]fYX`]b`WUgYg`cZa cfY`h\Ub`k c`UVgYbWkg"`D`YUgY`bchY`h\YmUfY`&")\ci fg`UbX`k]```VY`cb`]bY"`5\WWfgg`j]U`7c``UVcfUhY``]b_g`cb`A ccX`Y"

GdYW]U`Wcbg]XYfUh]cb'j]U'a mi bgk "YXi "Ui ']g'fYei]fYX`Zcf'Ubm`UhY`UggYgga Ybhgžch\Yfk]gY']h']g')
ı 'dYf'XUm''D`U[]Uf]ga k]``VY'fYZYffYX'hc'h\Y'GW\cc`fg'Yh\]Wg'cZZ]WYf"

7 cbgi `h]b['\ci fg'k]``'VY'Uj U]`UV`Y'ci hg]XY'hi hcf]U``h]a Yg'! 'Ya U]`'? Yff]Y'_"XUj]Yg4 i bgk "YXi "Ui 'Zcf'U'h]a Y hc'UffUb[Y'U'j]fhi U``a YYh]b[']Zmci 'bYYX'\Y`d'k]h\'h\Y'Wci fgY"'

@YWn fYg'k]``VY`]j Yž']bhYfUWnjj Yž'UbX'gca Yhja Yg'\Uj Y'k f]hjb['Yl YfWjgYgž'\ gh`]_Y'Ug']Zk Y'k YfY'cb WUa di g"'Mci fi`VY']bj]hYX'nc'g\UfY'bYk g``]b_gž'Ug_'ei Ygh]cbg'UbX'Wca a Ybhj]U'h\Y'W\UhUfYU'cf'mci 'WUb i gY'mci f'a]Whc'hU`_'UbX'Ug_'ei Ygh]cbg"'

5ggYgga Ybh HUg_g

5ggYgga Ybh'hUg_	K Y][\h	8i Y'8UHY	Gh XYbh@YUfb]b[Ci hWca Yg 5ggYggYX

hc 'h\ Y 'Vf]YZ[]j Yb ']b 'WUgg"

Gi Va]gg]cb bchYg.]b WUgg

Hi fb]hjb gYhjb[. H\]g]g bchU Hi fb]hjb Ugg][ba Ybh

5ggYgga Ybh& K f]h]b[UbX fYgYUfVX HJg_

GHJfhXUhY. Bch5dd`]WUV`Y

@Yb[h\.'% \$\$"k cfXg"fhcHJ\"h\fYY"dUfhgŁ

8YHJ]`g.

% \$\$ k cfXg

 $\label{eq:charge} Ghi XYbhg`XYj Y`cd`U`fYgYUfW\`UbX`k f]hjb[``hUg_`dUW_U[Yž`Wca df]g]b[``&`l``BYk g`Ghcf]Yg`UbX`%'l``g\cfhUWUXYa]WfYZYWhjcb`VUgYX`cb`gi dd`]YX`a UhYf]U``UbX`Wci fgY`fYUX]b[g"$

DYfWYbHJ[Y. '&) 'I

H\Y`YI Ua `k]```VY`cb`]bY`]b`h\Y`Zcfa U``WYbHfU``YI Ua `dYf]cX"`Mci `k]```VY`bchJZJYX`cZmci f`YI Ua `hJa Y`j]U`mci f YI Ua `hJa YhUV`Y"

.

 $\label{thm:condition} \mbox{Hi fb]h]b"gYh]b" Label Label$

5 https://bxubwww.Fyei]fya Ybhg

Gh XYbhgʻa i ghʻUhhYbXʻ, \$`i 'cZh hcf]U`gʻhcʻa YYhʻUhhYbXUbWYʻfYei]fYa YbhgʻcZh\]gʻWci fgY"

7ci fgY'GWXYXi `Y

J]Yk 'WUgg'ha YhUV'Y

H]a YtUV`Y

8UHY	HmdY	7 cbh/bh
K YY_`%`' %`A Um!`(`>i bY	@YVVni fY	±bhfcXiWh]cb hc h\Y WcifgY UbX bYk g k f]h]b[Ug U hfUbg`UhUV`Y a YX]U g_]``
		@afWfgfad(S^e SdWZWW fZ[eiWW] 478AD7 fZW WUfgdWSeiW^SeSXWOZ
		DWSV[Ye, DWWWdfa?aaVWZ
		@afWfZWMUfgdWUa`fWfVaWe`af`WUWeeSd(kS{Y` i [fZ fgfad(S^Ua`fWf[fZWeS_WiWW]-Se fgfad(S'e SdWdg``[YTWAdWfZWMUfgdW'
	Hi hcf]U`	MYgžhi hcf]U`gʻghUfhih\]gʻk YY_°
		DfUW]WU`fgfadS'e Ž4KA VWh[UWfa U'See [X[`bWdea`ž3 bZa`W`afWSbbłSfST'Wfad'Sbfab adh[`fSYW`afWbSVS`VbW'SdWS^a]ž
		5ZWU] [Xkag SdWa` 1; Wad [bWdea` ~
		;Xkag ZShWdWY[efWdWW Xad[bWdea` SffWVVS`UW/kag SdWWJbWUfWW fa SffWVV[bWdea` U'Seež5ZWU] kagd f[WfSTWZ
		>WUfgdWUa`fWfVaWe`af`WUWeeSd(1kdWSfWfafZWi www.jiww.jiww.jadw.jadw.jadw.jadw.jadw.jadw.jadw.ja
K YY_`&.`+`>i bY`!`%% >i bY	@YWhi fY	5i X]c BYk g UbX DcXWUghg
		FYUX]b[g. 'GYY'A ccX'Y
		>WUfgdWUa`fWfVaWe`af`WUWeeSd(kdWSfWfafZWidWfgdWziWW) ie fgfad(S^ZSefgfad(S^edg`TWAdWfZWWUfgdWzi
	Hi hcf]U`	BYkg'K f]h]b['5bU'mg]g'k cf_g\cd'UbX'a cV]'Y a YX]U
		DfUWNWU`fgfadS&Ž4KA VWh[UWfaU'See[X[bWdea`ž3bZa`W`afWSbbłSfSTWfad'Sbfabadh[fSYW`afWbSVS`VbW`SdWS^a]ž

		5ZWU] [Xkag SdWa` 1 Wad [bWdea`
		@YWhifYg`XcbfhiWcffYgdcbX`hc`hihcf]U`g`]b`gUaY kYY_"
K YY_'' .'%) '>i bY'!'% >i bY	@YWn fY	BYk 'A YX]U'UbX BUffUh]j Y'bYk g'ghm`Yg']bWi X]b[`]j Y'V`c[[]b[
		F YUX]b[g. 'F YZYf'hc'A ccX`Y
		@afWfZW^WUfgdWUa`fWfVaWe`af`WUWeeSd(1k UaddWeba`Vfafgfad(S^Ua`fWf[fZWeS_WiWW]-Se fgfad(S1eSdWdg``[YTWAdWfZW^WUfgdW'
	Hi hcf]U`	5i X]c 'G_]``g'k cf_g\cd'
		DfUWNJWU`fgfadS&Ž4KA VWh[UWfa USee [X[bWbea`ž3 bZa`W`afWSbbłSfSTWfadSbfab adh[fSYW`afWbSVS`V bW SdWSAa]ž
		5ZWU] [Xkag SdWa` (`Wad [`bWdea` `
		Ea_WU'SeeWe SdWIVgS^_aVW ŽTgf [Xkag ZShW dW [efWdW Xad [bWdea`SffW VS`UW kag SdW W bWUfW fa SffW V [bWdea`U'Seež5ZWU] kagd f[_WfST^Wz
		>WUfgdWUa`fW`f VaWe`af`WUWeeSd(1k dWSfWfa fZW i WW] ie fgfad(S^ZSe fgfad(S1e dg`TWadWfZW1WUfgdWz
K YY_^(.^&%'>i bY^!^&) >i bY	@YWi fY	GcWJU``a YX]U`Ug`BYk g`UbX`GcWJU``a YX]U GlfUhY[m
		4d/WXXad8[def3eeWee_Wf[fZ[e WUfgdW
		F YUX]b[g. F YZYf hc A ccX`Y
		@afWfZWWUfgdWUa`fWfVaWe`afUaddWeba`Vfa fgfad(S^Ua`fWf[`fZWeS_WiWW]-Sefgfad(S'eSdWdg``[YTWadWfZWWUfgdW'
	Hi hcf]U`	BYk a YX]U UbX bUffUhjj Y bYk g a YX]U k cf_g\cd. hYl hUbX Ui X]c ghm`Yg
		DfUWNJWU`'hi hcf]U`g` '4KA VWh[UWfa U'See [X[`bWbea`ž3 bZa`W`afWSbbłSfSTWfad'Sbfab adh[`fSYW`afWbSVS`VbW SdWS^a]ž
		5ZWU] [Xkag SdWa` (`Wad (`bWdea` `
		Ea_WU^SeeWeSdWiVgS^_aVWZTgf[XkagZShWdW[efWdWWXad[`bWdea`SffWVS`UWkagSdW

		Ua`fW`f[`fZWeS_WiWW]ž
K YY_''&*'>i `m'!'' \$'>i `n	n@YWnifY	Cb`]bY'@YWhifY.'7cbghfiWh]jY'>cifbU`]ga 'jYfgig Gd]b'
		FYUX]b[g, DWWdfa?aaV↑VŽ
		@afWfZWMUfgdWUa`fWfVaWe`af`WUWeeSd(1k UaddWeba`Vfafgfad(S^Ua`fWf[fZWeS_WiWW]-Se fgfad(S1eSdWdg``[YTWadWfZWMUfgdW'
	Hi hcf]U`	@Y[U`=ggi Y`Ghcfm'K cf_g\cdg` A d(Y[`S^Efack BcbVgUf[a` UZWU] Ž(`ž
K YY_"%\$."&"5i [i ghi!"*	@YWhifY	F Yj]g]cb UbX 9I Ua 'dfYdUfUh]cb'
5i [i gh	Hi ltcf]U`	9X]hjb[Kcf_g\cdg' Cf][]bU`GhcfmDfcXi Whjcb'

FYgci fWfg

DfYgWf]VYX F Ygci fWYg

H9LH6CC?.

FZW@W'@W'efHUggY`ž'Aifd\m'/`GW\a]m`&\$&\$E' UjU]`UV`Y`j]U'h\Y`IBGK`Vcc_g\cd`#J]h'J``GcifW'@b_'!'gYY'AccX`Y`Zcf``]b_"

=mci 'UfY'dfcXi W]b['Ui X]cž5I 857 +IM']g'U'=ZfYY'cb']bY'Ui X]c'YX]h]b['gcZk UfY'cf'h\Y'a cfY'UXj UbW'X 5I 8 +I = B ']g'UWW'gg]V'Y'j]U'58C69'7 fYUh]j Y'7'ci X'cb'h\Y'I b]j Yfg]m'`UV'Wca di hYfg''

FYWca a YbXYX FYgci fWfg

H\Y`Wci fgY`fYei]fYg`Vch\`bUhJcbU``UbX`]bhYfbUhJcbU``W ffYbhUZU]fg`_bck `YX[Y`k]

bUffUhjj Y'bYk gžgcWjU`a YX]U'fYdcfhjb[ža cV]'Y'ĉi fbU`]ga 'UbX'\Ug'U'[fYUhYf'ZcW g'cb'fUX]c'k f]hjb["'H\]g mYUf'k Y'UfY'UXUdhjb['h\Y'YI Ua 'Zcf'cb']bY'UbX'U`gc'cZYf]b['h\Y'cddcfh b]hmhc'dfcXi WY'Ui X]c'Ug'mci f a U'cf'Ugg][ba Ybh'

 $5g^{A} = 5\%$ \$& ZcW gYg^cb^ffUX]f]cbU^bYk g^k f]f]b['g_]`g^th\]g^g_]``]g^cb`mVf]YZmWcj YfYX^]b^h\]g^Wci fgY"^Hc Ugg]ghghi XYbhg^k \c^\Uj Y^bchdfYj]ci g`mghi X]YX^bYk g^k f]f]b[z^k Y^YbWci fU[Y^mci hc^UWWgg^fYj]g]cb fYgci fW'g^cb^A ccX^Y^UbX^hc^a U_Y^Ub^Uddc]bha Ybhk]h\^h\YWci fgY^Wcbj YbYf^f? "XUj]Yg4 i bgk "YXi "Ui Ł"

.

Gi Va]gg]cb cZ5ggYgga YbhHUg_g Hi fb]h]b Gi Va]gg]cb

-Zmci 'YbWci bhYf'U'dfcV`Ya 'k \Yb'UhhYa dh]b['hc'gi Va]hmci f'Ugg][ba Ybhh\fci [\'Hi fb]h]bž'd`YUgY hY`Yd\cbY'9I hYfbU``Gi ddcfhcb'-',)'''' %cf'Ya U]`'h\Ya 'cb'YI hYfbU`hY`hgi ddcfh4 i bgk "YXi "Ui '"'Gi ddcfh

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]XYbhJ``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.

 $7 \text{ cdm}b[...i g]b[...h\Y.gUa Y.cf.j Yfmig]a] \Uf'k cfXg'hc'h\Y.cf][]bU''hYl h'cf']XYU'k]h\ci h'U\V_bck `YX[]b[...h\Y.cf][]bU''hYl h'cf']XYU'k]h'cf']$

- 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 ž'ch\Yfg'k]``VY'bYk"'; U]b]b['U'gc`]X'i bXYfgHJbX]b['cZU``h\YfY`UhYX'UgdYWng'cZ9@+69'k]``\Y`d'mci 'a U_Y'h\Y'a cghicZmci f'ghi X]Yg'UhI BGK "'\\hd.##qi VYWfi |XYg"`]VfUfm'i bqk "YXi "Ui #\`]qY#JVci hY`]qY

5WUXYa]W±bZcfaUhjcb

: cf'YggYbhJU`ghi XYbh]bZcfa UhJcb'fY`UhJb['lc.