

Gc`]b[Yb']b'GWkcW_. A YggYfUb[f]ZZ k À\fYbX'*)\$!>U\f!: Y]Yf'ZcfXYfh'XfY] HcXYgcdZYf

5b[fY]ZYf'hÒhYh'XfY]'A YbgW\Yb'VY]'A YggYfUbgW\`U['Ui Z Gc`]b[Yf'GhUXhZYgh"'Dc`]nY]'Yfa]hhY`hž'HÀhYf'k Y]hYf\]b Z'ØW\h]["

5a : fY]hU[UVYbXž'k À\fYbX'XYf': Y]Yf`]WX_Y]hYb'ni a '*) \$! 'À\f][Yb 6YghY\Yb'XYf'GhUXh'Gc`]b[Ybž'[YgWXU\ 'XUg'I bZUggVUfY. '9]b 5b[fY]ZYf'ghUWX 'a]h'Y]bYa 'A YggYf'Ui Z'U\bi b[g`cgY': YghVYgi WXYf Y]b'i bX'\]bhYf`]Y» 'XfY]'HchY'gck]Y'ZØbZ'GWXk Yfj Yf`YhnhY''' \dangle a]hhYb Y]bYf'ZYgh`]WXYb'5ha cgd\ÀfYž'X]Y'j cb'A i g]_'i bX'?i bgh'[YdfÀ[h k Ufž'Ybhk]W_Y`hY'g]WX'Y]b'GnYbUf]c'XYg'GWXfYW_Ybgž'U`g'XYf'HÀhYf VY]'&%"' + I\f'k U\``cg'Ui Z'A YbgWXYb'`cg[]b["

8 Yf J cfZU```YfY][bYhY g]W `Ua : fcb\cZYY]bYa 'nYbhfU`Yb
A Uf_hd`Uhn']b'Gc`]b[Yb" 5i g'XYa 'B]W hg'gh]W h'Ya UbX'k U\``cg
Ui Z'A YbgW Yb'Y]b ž'Ài » YfhY g]W 'XYf BcfXf\Y]b!K YghZÀ`]gW Y

\$\DYba]b]ghYf' < YfVYfh'FYi ``VYhfcZZYb'VY]'gY]bYa '6Ygi W 'Ua
HUhcfh" 8]Y '6Y\OfXYb'gdfYW Yb'j cb'Y]bYa '5bgW `U[žXU'XYf'HÀhYf
cZZYbVUf'[Yn]Y`h'j cf[]b['i bX'Yg']\a '[Y`Ub[ž'g]W ']a '7\Ucg'XYf
G]hi Uh]cb'Ui g'XYa 'GhUi V'ni 'a UW Yb"

: `ØWAh][Yf'5b[fY]ZYf'i bX'YfghY'9fa]hh`i b[Yb

 X]Y'Dc`]nY]'K i ddYfhU`'X]Y'6Yj Ò`_Yfi b['Ui Z[YZcfXYfhž'X]Y =bYbghUXh'j cb'Gc`]b[Yb'ni 'a Y]XYb"

a : fØ\gca a Yf`ghfÒa hYb`hUi gYbXY`j cb`6Ygi WXYfb`]b`X]Y`GhUXhži a `Ub`XYa : Ygh`hY]`ni bY\a Ybž`XUg`Y]bY`J]Y`ZU`h`Ub`_i `hi fY``Yb 5b[YVchYb`j YfgdfUWX"'8 Ugʻi fgdfØb[`]WXY`Dfc[fUa a ž`XUg`Ui WX ZØf`GUa ghU[`i bX`GcbbhU[`[Yd`UbhY`JYfUbghU`hi b[Yb`i a ZUggYb gc``hYž`k i fXY`gcZcfh`UV[YgU[h"`Gc`]b[Ybg`CVYfVØf[Yfa Y]ghYf`H]a ?i fnVUWX`nY][hY`g]WX`YfgWXØhhYfh`i bX`Yf_`ÀfhYž`XUg`[YgUa hY GhUXh[YV]Yh`gY]`]b`Y]bYa `Ni ghUbX`j cb`GWXcW_`i bX`HfUi Yf"

; YgY``gW\UZh`]W\Y`FYU_h]cbYb'i bX'dc`]h]gW\Y FYU_h]cbYb

 $\label{eq:local_problem} Dc`]h]gWXY`FYU_h]cbYb`Ui~Z`XYb`J~cfZU```Zc`[~hYb`gWXbY``"\\ A~]b]ghYfdfAg]XYbh`<YbXf]_`K~Øgh`VYnY]WX~bYhY`X]Y`HUh`U`g`~5_h~Vfi~hU`ghYf`i~bX`g]bb`cgYf`;~Yk~U`h~i~bX`ghY``hY`ZYghž`XUgg`X]Y~[~YgUa~hY`FY[~]cb`YfgWX~ØhhYfh`gY]"`5i~WX~6i~bXYg[~Ygi~bX\Y]hga~]b]ghYf`?~Uf``@Ui~hYfVUWX~Ài~~YfhY`g]WX~Ui~Z`XYf~D`UhhZcfa~L~i~bX`ghY``hY`X]Y`<cZZbi~b[~i]b`XYb`J~cfXYf[~fi~bXž`XUgg~X]Y`FYhhi~b[~g_fAZhY`X]Y`j~Yf`YhnhYb~DYfgcbYb~fYhhYb~_ObbhYb~i~bX~X]Y`Dc`]nY]`XYb~HAhYf`Ui~ZgdØfYb~k~]fX"~$

9]b k Y]hYfYg Vf]gUbhYg H\Ya U]gh'X]Y 8]g_i gg]cb i a 'X]Y G]W\Yf\Y]h]a I a [Ub[a]h A YggYfb " 6i b XYg]bbYba]b]ghYf]b B Ub Wm: UYgYf \ UhhY \ _Øfn \]W\ Y]bY \ J YfgW\ AfZi b [\ XYg K \ UZZYbfYW\ hg Ub [Y_ØbX][hž gc XUgg]b \ XYf \ ^2 \ ZZYbh \]W\ _Y]h bi f \ HUgW\ Yba YggYf a]h Y]bYf ? \]b [Yb \ Ab [Y 'j cb \ V]g 'ni 'gYW\ g \ NYbh]a YhYfb \ Yf \ Ui \ Vh'gY]b gc \ Yb " 8]YgY \ 5b \ _ØbX][i b [\ YfZ\ \ fh bi b ini g\ hn \]W\ Y \ 6f]gUbn \]a @]W\ h \ XYg 'gW\ fY \ \ \ _\ \ Y \ bb \ Y \]b \ : fU[Y \ ghY\ h"

5i [YbnYi [Yb'VYgWkfY]VYb'X]Y'G]hi Uh]cb'U`g'[YgdYbgh]gWk"'D\]`]dd A Ø``YfžY]bYf'XYf'A]hcf[Ub]gUhcfYb'XYg': Yghgž'VYf]WkhYhYž'X]YGh]a a i b['\UVY'g]Wk']bbYf\U`V'_ØfnYghYf'NY]h'j cb'Ui g[Y`UggYbYf'Y]Yf`Ui bY']b'Y]bYb'GWkcW_'j Yfk UbXY`h'' 8]Y'A YbgWkYb'g]bX [YgWkcW_hž'UVYf'Zf]YX`]Wk'j ca 'D`Uhn ž'gc'A Ø``Yf'k Y]hYf'''J]Y`Y6Ygi WkYf'\ÀhhYb'XYb': fcb\cZ'a]h'HfÀbYb']b'XYb'5i [Yb

j Yf`UggYbž'U`g'g]Y'fYU`]g]YfhYbž'XUgg'XUg': Ygh']b'Y]bYb'5`VhfUi a i a gW\`i ["

9]b 'gc `WX Yg 'J YfVfYWX Yb 'k]fZh': fU[Yb 'Ui Z

8]YgYf`gWkfYW_`]WkY`JcfZU```k]fX`X]Y`8]g_i gg]cb`ØVYf`G]WkYf\Y]h i bX`; Yk U`hVYfY]hgWkUZh`]b`XYf`; YgY``gWkUZh`bYi `YbhZUWkYb"`8]Y : fU[Yž'k Ufi a `^Ya UbX`]b`XYf`@U[Y`]ghž'c\bY`Jcfk Ufbi b[`Ui Z I bgWki `X][Y``cgni [Y\Ybž'V`Y]Vh`XfÀb[YbX"`9g`]gh`Y]b`5i [YbV`]W_ž]b`XYa `X]Y`; YgY``gWkUZh`]bbY\U`hYb`a i ggži a `ØVYf`X]Y`I fgUWkYb gc`WkYf`HUhYb`bUWkni XYb_Yb`i bX`k]Y`a Ub`À\b`]WkY`5b[f]ZZY`]b XYf`Ni _i bZh'j Yfa Y]XYb`_Ubb"

8]Y'HfU[OX]Yž'X]Y'g]W\']b'Gc`]b[Yb'UVgd]Y`hYž'k]fX'bcW\'`Ub[Y']bXYb'?OdZYb'XYf'AYbgW\Yb'V`Y]VYb"'CV']b'XYf'Dc`]h]_ž'VY]'XYbG]W\Yf\Y]hgVY\OfXYb'cXYf']b'XYf'; YgY``gW\UZh']a'5``[YaY]bYb'Yg'k]fX'bOh]['gY]bž'g]W\'a]h'XYf'H\YaUh]_'UigY]bUbXYfnigYhnYbžia'Y]b'g]W\YfYg'IaZY`X'ZØf'U``Y'ni'[YkÀ\f`Y]ghYb"'8]Y'9fY][b]ggYjca':fY]hU[UVYbX'g]bX'b]W\h'bif'Y]b'AU\baU``ZØf'X]YJYf`Yhn`]W_Y]h'XYg'aYbgW\`]W\Yb'@YVYbgž'gcbXYfb'UiW\'Y]b5iZfiZ'nif'<UbX'ib[ž'ia'_ØbZh][Y';YZU\fYb'ni'a]b]a]YfYb"

5_hi Y``Y`FYU_h]cbYb`i bX`gc`]XUf]gW\Y 6Y_i bXi b[Yb

8 Yf '5 bg W `U[']b 'Gc `]b [Yb `\ Uh'Y]b Y 'K Y ``Y 'XY f 'Hf Ui Yf i b X Gc `]X Uf]h Àh `Ui g[Y `Ogh" 'J]Y `Y '6 Øf[Yf i b X '\ gh]h i h]c b Yb '\ UV Yb ']\ f Y 6 Yh f c ZZY b \ Y]h `Ø V Y f `X]Y ; Yk U `h `V Y_i b X Yh" '\ b `X Y b 'gc n]U `Yb 'A Y X]Y b g]b X 'n U\ `f Y] W X Y '6 Y] `Y] X g V Y_i b X i b [Yb 'i b X '5 i Zf i ZY 'n i f '9]b][_Y]h n i 'Z]b X Y b " '8]Y 'Gh U Xh `\ Uh 'gc [Uf 'Y]b Y 'Hf Ui Y f V Y Z U[[i b [Ub [Y c f X b Y h ž' i a 'X Y b 'C d Z Y f b 'F Y g d Y_h n i 'n c ``Y b "

GdYn]Y````c_U`Y`Cf[Ub]gUh]cbYb`i bX`BUW\VUfgW\UZhg]b]h]Uh]j Yb\UVYb`gW\bY```fYU[]Yfhži a `I bhYfghØhni b['ZØf'X]Y
<]bhYfV`]YVYbYb`i bX`JYf`YhnhYb`Ubni V]YhYb"`JYfgW\]YXYbY
; fi dd]Yfi b[Yb`\UVYb`ni XYa `_i fnZf]gh]['A U\bk UW\Yb`i bX
; YXYb_j YfUbghU`hi b[Yb`[Yd`Ubhži a 'XYf`CdZYf`ni '[YXYb_Yb`i bX

[Y[Yb; Yk U`h'ni 'dfchYgh]YfYb"'8]YgY'JYfUbghU`hi b[Yb'hfU[YbXUni 'VY]žXYb; Ya Y]bgWXUZhgg]bb']b'XYf'GhUXh'ni 'ghÀf_Yb"

8Yf'fYW\h`]W\Y'FU\a Yb'i bX'A U»bU\a Yb'XYf Dc`]nY]

a 'bUW\Zc`[YbXYb'?f]gYba UbU[Ya Ybh'\Uh'X]Y'Dc`]nY]'K i ddYfhU` i a ZUb[fY]W\Y'9fa]hh`i b[Yb'Y]b[Y`Y]hYh"'6Y]'A cfX'cXYf 5bgW\`À[Yb'_ca a Yb']b'8Yi hgW\`UbX'VYgcbXYfg'ghfYb[Y [YgYhn`]W\Y'FU\a YbVYX]b[i b[Yb'ni f'5bk YbXi b["'8]Y'9fa]hh`Yf VYZfU[Yb'b]W\h'bi f'5i [YbnYi [Ybž'gcbXYfb'dfØZYb'Ui W\j cf\UbXYbY'J]XYcØVYfk UW\i b[Yb']b'XYf'I a [YVi b['XYg'HUhcfhg"

 $8]Y `Dc`]nY] `Yf\cZZh`g]W `Xi fW `X]Y `Ni gUa a YbUfVY]h`a]h`gdYn]Y``Yb 9fa]hh`i b[g[fi ddYbž`X]Y `i bhYf`UbXYfYa `a]h`?f]a]bU`hYW b]_Yfb i bX`DgmW c`c[Yb`UfVY]hYbž`gW bY``gha Ò[`]W `<]bk Y]gY`Ui Z`XYb Z`ØW h][Yb`HÀhYf`ni `Yf\U`hYb"`6]g`Ub[`\UVYb`G]W Yf\Y]hg_fÀZhY nU\`fY]W Y`<]bk Y]ga Y`Xi b[Yb`Ui g`XYf`6Yj Ò`_Yfi b[`Yf\U`hYbž`X]Y YXcW `gcf[ZÀ`h][`[YdfØZh`k YfXYb`a ØggYb"$

JcfUb[Y[Ub[YbY'JcfZÀ``Y'i bX [YgY``gWXUZh`]WXY'8YVUhhYb

8 Ugʻ[Yk UʻhgUa Yʻ; YgWXY\YbʻfY]\hˈg]W\ʻ]bʻY]bYʻJ]YʻnU\``À\b`]WXYf J cfZÀ``Yʻ]a 'XYi hgWXYbʻF Ui a 'Y]bžʻX]YʻÀ\b`]WXYʻ[YgY``gWX UZh`]WXY 8]g_i gg]cbYbʻUi g[YʻÒghʻ\UVYb"ʻ6YgcbXYfgʻbUWXʻXYbʻ9fY][b]ggYb XYfʻ`YhnhYbʻ*J\fYžʻk]YʻXYa '5bgWX`U[ʻ]bʻ<U``YʻcXYfʻXYbʻJcfZÀ``Yb]bʻ<UbUi žʻk i fXYbʻG]WXYf\Y]hgZfU[Ybʻi bXʻXYfʻI a [Ub[ʻa]h; Yk Uʻh_f]a]bU`]hÀh'YfbYi hʻ]bʻXYbʻ: c_i gʻXYfʻ² ZZYbh`]WX_Y]h [YfØW_h"

8]YgY'JcfZÀ``Y'\UVYb'gckc\``dc`]h]gW\Y'U`g'UiW\'[YgY``gW\UZh`]W\YFYU_h]cbYb'\Yfjcf[YfiZYbž'X]Y'Y]bY'JYfgW\ÀfZib['XYfG]W\Yf\Y]hg[YgYhnY'gck]Y'Y]bY'_f]h]gW\Y'6YhfUW\hib['XYgKUZZYbfYW\hg'VY]b\U`hYb"'5iW\'8YVUhhYb'ØVYfDfÀjYbh]cbgaU»bU\aYb'ibX'XYb'gcn]U`Yb'NigUaaYb\U`h'g]bXYbhqhUbXYbžia'ni_ØbZh][Y';YkU`hhUhYb'ni'jYf\]bXYfb"

6 Ygi WX Yb 'G]Y 'i bg 'Ui Z. 'b!U["XY