

? OfdYf`]WXY'5i gY]bUbXYfgYhni b[']b'; YfU. Dc`]nY]'Yfa]hhY`h'bUWX'5b[f]ZZ

A $Y \fY fY \Dc^]nY]ghfY]ZYb fØW_hYb k Y[Yb Y]bYf'_<math>OfdYf^]WXYb = gY]bUbXYfgYhni b[']b'; YfU'Ui g''&$! Å f][Yf'U[]Yfh'[Y[Yb @UbXqa Ubb'']$

; YfU'fbhgŁ

5a `GcbbhU[bUW\a]hhU[`_Ua `Yg`]b'; YfU'ni `Y]bYa `JcfZU``ž'XYf gckc\``X]Y`Dc`]nY]'U`g'Ui W\`X]Y`² ZZYbh`]W_Y]h`]b`5`Ufa 'j YfgYhnhY" 5V`YhkU'%*.\$\$`I\f'YffY]W\hY`X]Y`Ofh`]W\Y`Dc`]nY]VY\OfXY`Y]bY A Y`Xi b[`@VYf`Y]bY`_OfdYf`]W\Y`5i gY]bUbXYfgYhni b[`]a `DUf_`Ub XYf`HU`ghfU» Y"`Dfca dh'a UW\hY`g]W\`a Y\fYfY`GhfY]ZYbkU[Yb`Ui Z XYb`K Y[ži a `X]Y`G]hi Uh]cb`ni `_`ÀfYb`i bX`X]Y`VYhY]`][hYb DYfgcbYb`ni `]XYbh]Z]n]YfYb"

Jcf'Cfh'cZZYbVUfhY'g]WX'XYb'6YUa hYb'Y]b'_ca d'Yl Yg'GnYbUf]c"
9]b'&\$!'À\f][Yf'A Ubb'UZ[\Ub]gWXYf'<Yf_i bZh'gc``'Ui g'bcWX
i b[Y_`AfhYb'; fØbXYb'Y]bYb'&*!'À\f][Yb'@UbXga Ubb'Ub[Y[f]ZZYb
i bX'XUVY]'j Yf'Yhnh'\UVYb"'8Yf'<]bhYf[fi bX'X]YgYf
5i gY]bUbXYfgYhni b['V`Y]Vh'V]g`Ub['i bVY_Ubbh'i bX'k]fZh': fU[Yb
Ui Zž'X]Y'bi b'HY]`'XYf'9fa]hh`i b[Yb'g]bX"

9fa]hh`i b['i bX 'NYi [YbUi Zfi Z

8]Y'Dc`]nY]']b'; YfU'\Uh'gcZcfh'X]Y'9fa]hhi b[Yb'Ui Z[Ybca a Ybžia 'X]Y'[YbUi Yb'I a ghÀbXY'XYg'JcfZU``g'ni 'Yfa]hhY`b"'9]bY'XYfhmd]gWXghYb'A Yh\cXYb'XYf'Dc`]nY]']b'gc`WXYb': À``Yb']gh'X]Y
6Y]n]Y\i b['j cb'NYi [Yb"'CZh'_ÒbbYb'i bVYhY]`][hY'8f]hhYž'X]Y'g]WXni f'HUhnY]h'j cf'Cfh'VYZUbXYbž'YbhgWXY]XYbXY'\Dzcfa Uh]cbYb
`]YZYfb"'8U\Yf'k i fXYb'U``Y'DYfgcbYbž'X]Y'a Ò[`]WXYfk Y]gY'NYi [Yb

8 UgʻDc`]nY]dfÀg]X]i a `\UhʻX]Yʻ6Øf[YfʻUi gXfØW_`]W\`XUni
Ui Z[Yfi ZYbžʻ±bZcfa Uh]cbYbʻi bhYfʻXYfʻHY`YZcbbi a a Yfʻ\$'*) '#, &'\$`k Y]hYfni [YVYb"'8]YgYʻ5fh'j cbʻ5i Zfi Zʻ]gh'b]W\hi b[Yk Ò\b`]W\ž
i bX`X]Y`Dc`]nY]'Yf\cZZhʻg]W\`XUXi fW\ž'?`Uf\Y]h']b`X]Y'; YgW\Y\b]ggY
ni 'Vf]b[Yb"

8YhU]`gʻni a 'J cfZU``

 $8 \ Ug^{9}fY][b]g^{k}]fZh^{y}]bY^{F}Y]^{Y}j^{c}b^{c}fU[Yb^{u}UiZ^{u}K]Ufia^{u}ua^{u}Yg^{u}ni^{u}X]YgYf^{5}i^{u}gY]bUbXYfgYhni^{u}b[^{u}hk]gWkYb^{u}XYb^{u}YY]XYb^{u}h^{u}b[^{u}hk]gYf^{5}i^{u}gY]bUbXYfgYhni^{u}b[^{u}hk][^{u}hkyb^{$

8 Yf'j Yf`YhnhY'A Ubbž'XYf'g]W\'ni a 'NY]hdi b_h'XYg'J cfZU``g'a]h a Y\fYfYb'DYfgcbYb']a 'DUf_'Ui Z[Y\U`hYb'\UhhYž'k i fXY a Ò[`]W\Yfk Y]gY'dYfgÒb`]W\'VYhfcZZYbž'k Ug'X]Y'?ca d`Yl]hÀh'XYf G]hi Uh]cb'k Y]hYf'Yf\Ò\h'' +b'gc`W\Yb'GnYbUf]Yb'_Ubb'Yg YbhgW\Y]XYbX'gY]bž'X]Y'8 mbUa]_'nk]gW\Yb'XYb'VYhY]`][hYb DYfgcbYb'ni 'j YfghY\Ybž'i a 'X]Y'J Yf\À`hb]ggY'_`Uf'XUfni ghY``Yb''

 $Gc`WXY`JcfZA``Y`g]bX`b]WX h`bi f`hfU[]gWX`ZØf`X]Y`6YhfcZZYbYbž gcbXYfb`g]Y`_ObbYb`Ui WX`]a `[fO`*YfYb`FU\aYb`5b`Ugg`ni `Gcf[YbVYnØ[`]WX`XYf`G]WXYf\Y]h`]b`OZZYbh`]WXYb`FAi aYb`[YVYb"`8]Y 9]b\Y]a]gWXYb`bY][Yb`XUni ž`g]WX`bUWX`Y]bYa `gc`WXYfUfh`JcfZU```]b]\fYf`BUWXVUfgWXUZh`ibkc\``ni `ZØ\`Ybž`Ui WX`kYbb`X]Y`Dc`]nY] gWXbY```fYU[]Yfh`\Uh`ibX`X]Y`9fa]hh`ib[Yb`Y]b[Y`Y]hYh`g]bX"$

K]WX h][ghY 'Di b_hY 'i b X 'ni $_$ Øb Zh][Y 9b hk]W_\`i b [Y b

 $: \varnothing f^*X]Y^*Ofh^*]WXY^*OYj^*O^*_Yfi^*b[^*]b^*; YfU^*]gh^*Yg^*j^*cb^*[^fc "Yf OYXYi^hi^b [^z^Y]bY^*n\varnothing [^g][Y^*?^*Afi^b [^xYg^*J^cfZU^*]g^*ni^* ^cZZYb''$

Gc`WXY'JcfZÀ``Y'_ObbYb'XUg'JYfhfUiYb']b'X]Y'OZZYbh`]WXYG]WXYf\Y]h'VYY]bZiggYb"'AUb'aigg'g]WX'XUfUiZ'jYf`UggYb_ObbYbž'XUgg'X]Y'Dc`]nY]']b'XYf'@U[Y']ghž'gWXbY``'ibX'YZZ]n]Ybh'ni\UbXY`b"

Ni gUa a YbZUggYbX`V`Y]Vh`ni `gU[Ybž`XUgg`X]Y`U_hi Y``Yb 9fa]hh`i b[Yb`nY][Ybž'k]Y`k]W\h][`Yg`]ghž`XYf`Dc`]nY]`i bX`XYb 9fa]hh`Yfb`_ccdYfUh]j Y`I bhYfghØhni b[`ni `V]YhYb"`8]Y Ni gUa a YbUfVY]h`nk]gW\Yb`XYf`Dc`]nY]`i bX`XYf`² ZZYbh`]W_Y]h`]gh XYf`GW\`ØggY``ni f`5i Z_`Àfi b[`i bX`JYf\]bXYfi b[`gc`W\Yf`JcfZÀ``Y]b`XYf`Ni _i bZh"

9g'V`Y]Vh'UVni k UfhYbž'k]Y'X]Y'9fa]hh`i b[Yb'j cfUbgW\fY]hYb'i bX cV'X]Y'Dc`]nY]'a O[`]WYfk Y]gY'ni 'k Y]hYfYb'9f_Ybbhb]ggYb'_ca a hž X]Y'ni f'5i Z_`Àfi b['XYf'I a ghÀbXY'VY]hfU[Yb'_ObbYb"

<]bhYf[fi bX]bZcfa Uh]cbYb ni f ? f]a]bU`]hÀhgYbhk]W_`i b[]b; YfU</pre>

9]b 'VYgcbXYfYg'5i [Yba Yf_'`]Y[h'Ui Z'XYb'[Yk U`hgUa Yb 5i gY]bUbXYfgYhni b[Yb'nk]gW\Yb'; fi ddYb'a]h'i bhYfgW\]YX`]W\Yb <]bhYf[fØbXYb"'8Yf'J cfZU```]b 'XYf'HU`ghfU» Y']gh'b]W\h']gc`]Yfhž gcbXYfb'HY]``Y]bYg'[fÒ» YfYb'Di nn`Ygž']b 'XYa 'A][fUbhYb'i bX']\fY \\
\DhY[fUh]cb']b 'X]Y'; YgY``gW\UZh'Y]bY'nYbhfU`Y'Fc``Y'gd]Y`Yb"'8Yf I a [Ub['a]h'gc`W\Yb'?cbZ]_hYb'YfZcfXYfh'j cb'XYb'6Y\ÒfXYb b]W\h'bi f'gW\bY``Yg' < UbXY`bž'gcbXYfb'Ui W\'`Ub[Zf]gh][Y

GhfuhY[]Yb'nif': ÒfXYfib['XYg']bhYf_i `hifY``Yb'8]U`c[g'ibX'XYfgcn]U`Yb'=bhY[fUh]cb"

GhUh]gh]_Yb'ni f'; Yk U`h_f]a]bU`]hÀh']b 8Yi hgWX`UbX

8]Y; Yk U`h_f]a]bU`]hÀh`]b`8Yi hgW\`UbX`V`Y]Vh`Y]b`VYXYi hYbXYg
H\Ya U`ZØf`X]Y`Dc`]nY]UfVY]hii bX`X]Y`ÒZZYbh`]W\Y`G]W\Yf\Y]h"`@Ui h
XYa `6i bXYg_f]a]bU`Ua h`fb? 5½[UV`Yg`&\$&&`]bg[YgUa h`fi bX
%*) "\$\$\$ fY[]ghf]YfhY`: À``Y`j cb`; Yk U`h_f]a]bU`]hÀhž`k Ug`Y]bY
`Y]W\hY`Ni bU\a Y`]a `JYf[`Y]W\`ni `XYb`Jcf^U\fYb`XUfghY``h"`8]YgY
NU\`Yb`nY][Ybž`XUgg`; Yk U`hXY`]_hY`bUW\`k]Y`j cf`Y]bY
<YfUi gZcfXYfi b[`ZØf`X]Y`G]W\Yf\Y]hgVY\ÒfXYb`XUfghY``Yb"

=b]h]Uh]j Yb ni f ; Yk U`hdfAj Ybh]cb]b ; YfU

I a 'XYf'ghY][YbXYb'; Yk U'h_f]a]bU']hÀh'Ybh[Y[Ybni k]f_Ybž
UfVY]hYb'j YfgWk]YXYbY' \(\Delta \text{gh}]hi h]cbYb']b'; YfU'Ub
DfÀj Ybh]cbgdfc[fUa a Yb"'8 Uni '[Y\OfYb'i bhYf'UbXYfYa 'Dfc'Y_hY ni f': OfXYfi b['XYf'gcn]U'Yb' \(\Delta \text{bhY}[fUh]cb'j \cb' A][fUbhYb'gck]Y
\(\Delta Zcfa Uh]cbgj YfUbghU'hi b[Ybz'X]Y'a]h'XYb''c_U'Yb
\(\text{Ya Y]bgWk UZhYb'Xi fWk[YZØ\fh'k YfXYb"'Gc'WkY'A U\(\Delta \text{bU\} a Yb n]Y'Yb'XUfUi Z'UVz'GdUbbi b[Yb'ZfØ\nY]h]['ni 'Yf_YbbYb'i bX']\bYb dfcU_h]j 'Ybh[Y[Ybni k]f_Yb"'8]Y'; YfUYf'?ca a i bY'\Uh']b
\(\Ni gUa a YbUfVY]h'a]h''c_U'Yb'Cf[Ub]gUh]cbYb'i bX'XYf'Dc']nY] \(\gd Yn)Z]gWkY'A U\(\Delta \text{bU\} a Yb']a d'Ya Ybh]Yfhz'X]Y'XUfUi Z'UVn]Y'Ybz'X]Y \(\ge Gn)U'Y'?c\\\ \Ag]cb'ni 'gh\Af_Yb'i bX'Y]b'g]WkYfYg'I a ZY'X'ZØf'U'`Y \(6\Off Yf'ni 'gWk UZZYb'' \)

 $8\,Uf@VYf^{`}\backslash]b\,Ui\,g^{`}gd]Y^h^{`}X]Y^{'}GW\lambda i\, ^{`}V]^{`}Xi\,b\,[\, ^{`}Y]bY^{'}Yb\,hgW\lambda Y]XYbXY^{'}F\,c\, ^{``}Y$

VY] XYf GhÀf_i b['XYg 'gcn]U 'Yb 'Ni gUa a Yb \ U 'hg " GW\ i 'Yb ']b 'XYf FY[]cb 'Yb[U[]YfYb 'g]W\ 'ni bY\a YbX ']b '5i Z_`Àfi b[g! 'i bX 5i ghUi gW\ dfc[fUa a Ybž X]Y 'XUg 'J Yfgh\ bXb]g 'nk]gW\ Yb 'XYb j YfgW\]YXYbYb 'Yh\ b]gW\ Yb'; fi ddYb 'Z\ OfXYfb 'i bX 'gc '`Ub[Zf]gh]['ni Y]bYa 'F \ ØW_[Ub['j cb '? cbZ]_hYb 'VY]hfU[Yb 'gc ``Yb"

8 Y hU]`c

6Ygi WXYb G]Y i bg Ui Z b!U["XY