

D]fa UgYbg`YbhXYW_Yb.`BUhi fž'?i `hi f`i bX _i `]bUf]gW\Y`<][\`][\hg

9bhXYW_Yb^G]Y^X]Y^BUhi fk i bXYfž'_i `]bUf]gWXYb^; YbØggY i bX^_i `hi fY``Yb^GWXÀhnY^j cb^D]fa UgYbg"^H]ddg^ZØf 5_h]j]hÀhYbž^J YfUbghU`hi b[Yb^i bX^I bhYf_ØbZhY^Yfk UfhYb G]Y^

K]``_ca a Yb]b D]fa UgYbgžY]bYf W. Ufa UbhYb GhUXh]a

GØXk YghYb 8 Yi hgW. `UbXgžX]Y b]W. h'bi f Xi fW. ']\fY Y]bXfi W_gj c ``Y

; YgW.]W. hYžgcbXYfb 'Ui W. Xi fW. ']\fY 'UhYa VYfUi VYbXY BUhi f

i bX ``YVYbX][Y ?i `hi f 'VYgh]W. h" '9]b[YVYhhYh nnk]gW. Yb `XYb

a U`Yf]gW. Yb '< Ø[Y`b `XYg DZÀ`nYfk U`XYgž]gh D]fa UgYbg Y]b 'C fhž XYf

j]Y`ni 'V]YhYb `\Uhi bX cZh]a 'GW. UhhYb 'gY]bYf 'VY_UbbhYfYb

B UW. VUfb 'ghY\h" '=b 'X]YgYa '5fh]_Y` bY\a Yb 'k]f 'X]W. 'a]h 'Ui Z'Y]bY

9bhXYW_i b[gfY]gY Xi fW. 'X]Y 'ZUgn]b]YfYbXYb B Uhi fk i bXYfž

_i `]bUf]gW. Yb '? Ògh]W. _Y]hYb ii bX `\]ghcf]gW. Yb 'GW. AhnY 'X]YgYf

GhUXh" '9[U`ž`cV Xi 'Y]b '5VYbhYi Yf]a : fY]Yb 'gi W. ghža Y\f ØVYf X]Y

_i `hi fY``Yb '< Ò\Ydi b_hY 'YfZU\fYb 'a ÒW. hYghcXYf 'H]d dg 'ZØf 'X]Y

dYfZY_hY I bhYf_i bZhVYbÒh][gh `]b 'D]fa UgYbg 'k UfhYh'Y]b

i bj Yf[Ygg`]W. Yg '9f`YVb]g 'Ui Z'X]W. "'@Ugg 'i bg '[Ya Y]bgUa 'X]Y

j]Y`gY]h][Yb : UWYhYb 'X]YgYf Y]bn][Ufh][Yb 'GhUXh'Yf_i bXYb '

9bhXYW_i b['XYf'D]fa UgYbgYf'BUhi fk i bXYf

D]fa UgYbgžY]b[YVYhhYh]b'X]Y'gUbZhYb'< \emptyset [Y`'XYg'DZÀ`nYfk U`XYgž]gh'Y]b'k U\fYg'B Uhi fdUfUX]Ygž'XUg'nU\`fY]WXY'A \mathring{O} [`]WX_Y]hYb'Z \emptyset f B Uhi f`]YV\UVYf'V]YhYh"'8]YgY'GhUXhž'X]Y'cZh'U`g'XUg' Hcf'ni f'DZU`n VYnY]WXbYh'k]fXž'VYY]bXfi W_h'Xi fWX']\fY'UVk YWXg`i b[gfY]WXY @UbXgWXUZh'i bX'X]Y'bU\Y[Y'Y[YbYb'B Uhi ffYgYfj UhY"'9[U`ž'cVa Ub'Y]b'`Y]XYbgWXUZh`]WXYf'K UbXYfYfž'Y]b'FUXZU\fYf'cXYf'Y]bZUWXY]b'; Yb]Y»Yf'XYf'B Uhi f']ghž'D]fa UgYbg'\Uh'Z \emptyset f'YXYb'Yhk Ug'ni

9]b UVgc i hYg' <][\'][\h']gh'XYf'DZÀ `nYfk U`Xž'XYf'ni `XYb'[fÒ» hYb ni gUa a Yb\Àb[YbXYb'K U`X[YV]YhYb'8 Yi hgW\`UbXg'nÀ\`h"'A]h gY]bYb'X]W\hYb'K À`XYfbž'_`UfYb'6ÀW\Yb'i bX'nU\`fY]W\Yb K UbXYfk Y[Yb']gh'Yf'XYf'dYfZY_hY'Cfhž'i a 'X]Y'GYY`Y'VUi a Y`b'ni `UggYb'' <]Yf'Z]bXYh'a Ub'U``Ygž'j cb'gUbZhYb' < Ø[Y`b'V]g'\]b'ni ghY]`Yb': Y`gYbž'X]Y'Yg'ni 'Yf_`]a a Yb'[]`h"'6YgcbXYfg Ya dZY\`Ybgk Yfh']gh'XYf'8U\a Yf'K Y[ž'Y]b'[i h'Ui g[YgW\]`XYfhYf K UbXYfk Y[ž'XYf'VYY]bXfi W_YbXY'5i gV`]W_Y'Ui Z'X]Y'i a `]Y[YbXY@UbXgW\UZh'V]YhYh"

8]Y: `cfU'i bX: Ui bU'XYg'DZÀ`nYfk U`XYg']gh'gck c\`j]Y`ZÀ`h]['U`g Ui WX 'gWX ØhnYbgk Yfh" 'F ca Ubh]gWX Y'K U`Xk Y[Y ``UXYb 'XUni 'Y]bž'X]Y\Y]a]gWX Y'H]Yfk Y`h'ni 'VYcVUWX hYb"' <]Yf'`YVYb'j]Y`Y 'VYXfc\hY 5fhYbž'XUfi bhYf'XYf'GWX k Ufna]`Ub'i bX'j YfgWX]YXYbY GdYWX hUfhYb" 'BUhi fVYcVUWX hYf'k YfXYb'VY[Y]ghYfh'gY]b'j cb'XYb i bVYfØ\fhYb'9W_Ybž']b'XYbYb'a Ub'a]h'Yhk Ug'; `ØW_'FY\Yž K]`XgWX k Y]bY'i bX'gc[Uf': ØWX gY'UbhfYZZYb'_Ubb"

 $: \emptyset f `F U X Z U \setminus f Y f `[] V h `Y g `n U \setminus `f Y] W Y `[i h `U i g [Y V U i h Y `F U X k Y [Y \check{z} X] Y X] Y `F Y [] c b `X i f W n] Y \setminus Y b " 8] Y `6] c g d \setminus Å f Y b f Y [] c b `D Z Å `n Y f k U `X `] g h V Y g c b X Y f g `V Y _ U b b h `Z Ø f `] \ f Y `F U X k U b X Y f k Y [Y \check{z} X] Y `X i f W `f Y] n j c ``Y 8 \ O f Z Y f `i b X `U h Y a V Y f U i V Y b X Y `B U h i f `Z Ø \ f Y b " `J c b ``Y] W \ h Y b `F c i h Y b Z Ø f `X] Y `[U b n Y : U a] `] Y `V] g `\] b `n i `U b g d f i W \ g j c ``Y f Y b `G h f Y \ W _ Y b `[] V h Y g `Z Ø f `Y X Y b `F U X Z U \ f Y f `X] Y `d U g g Y b X Y `< Y f U i g Z c f X Y f i b [" `9] b V Y `] Y V h Y f `F U X k Y [`] g h `X Y f `J c [Y g Y b ! < O \ Y b k Y [<math>\check{z}$ `X Y f `[f U b X] c g Y 5 i g V `] W _ Y `U i Z `X] Y `I a [Y V i b [`V] Y h Y h `i b X `X] f Y _ h `X i f W `D] f a U g Y b g Z Ø \ f h "

9]b'k Y]hYfYf'Y]bn][Ufh][Yf'C fh']gh'XYf'GW\`cggdUf_'D]fa UgYbgžY]bgW\ObYf'DUf_ž'XYf'g]W\'dYfZY_h'ZØf'Y]bYb'YbhgdUbbhYbGdUn]Yf[Ub['Y][bYh'' <]Yf'_Ubb'a Ub'X]Y'dfÀW\h][Yb'U`hYb'6Ài a Yi bX'X]Y'[YdZY[hY'DZUbnYbk Y`h'VYk i bXYfb"'8Yf'DUf_'\Uh'Ui W\Y]bYb'_`Y]bYb'HY]W\Z'XYf']a 'Gca a Yf'Y]b'VY`]YVhYf'FØW_ni [gcfh]gh"'9]b'GdUn]Yf[Ub['Xi fW\'X]YgYb'DUf_']gh'k]Y'Y]bY'_`Y]bY'5i gnY]hj ca 'GhUXh`YVYb' 'X]Y'Fi \Y'i bX'X]Y'Zf]gW\Y'@ Zh'g]bX'Y]bZUW\Yf\c`gUa"

Ni XYa ']gh'X]Y'I a [YVi b['j cb'D]fa UgYbg'fY]W\'Ub
B Uhi fXYb_a À'Yfb'i bX'W\Ufa UbhYb'B Uhi fgW\i hn[YV]YhYb"'8 Ug
< Ø[Y``UbX'i a 'D]fa UgYbg'Y][bYh'g]W\'dYfZY_h'ZØf'D]W_b]W_g'i bX
Ui g[YXY\bhY'K UbXYfi b[Yb"'8]Y'_i `hi fY``Yb'9]bf]W\hi b[Ybž'k]Y
XUg'B Uhi fZfYi bXY\Ui g'cXYf'XUg'< Ui g'XYf'B Uhi fž'g]bX
\Yfj cffU[YbXY'5b`Ui ZghY``Ybž'X]Y'gdUbbYbXY'\dzfa Uh]cbYb'ØVYf
X]Y'`c_U`Y'JY[YhUh]cb'i bX'H]Yfk Y`h'V]YhYb"

p:5 hhfU_h]cb 'p:6 YgWX fY]Vi b['p

p !p p

p:DZÀ`nYfk U`X 'p:9]bYg 'XYf'[fÒ» hYb 'K U`X[YV]YhY '8 Yi hgWX `UbXg'p

p:D]fa]b]i g!K UbXYfk Y['p'A U`Yf]gWXYf'K UbXYfk Y['a]h

5i gg]WX hgdi b_hYb 'p

p:GWX`cggdUf_'D]fa UgYbg'p'9]b 'YbhgdUbbYbXYf'GhUXhdUf_'a]h

HY]WX 'p

p:6]cgd\ÀfYbfY[]cb 'DZÀ`nYfk U`X 'p'F UXk Y[Y'Xi fWX 'a U`Yf]gWXY

@UbXqWX UZh'p

9]b'k Y]hYfYg'VYa Yf_Ybgk YfhYg'B Uhi fYf`YVb]g']b'XYf'I a [YVi b[g]bX'X]Y': Y`gYb']a 'DZÀ`nYfk U`Xž'X]Y'Y]bY'ZUgn]b]YfYbXY'; Yc`c[]Y dfÀgYbh]YfYb'i bX'g]W\'\Yfj cffU[YbX'ZØf'?`YhhYf`]YV\UVYf'Y][bYb"8]YgY': Y`gYb'V]YhYb'b]W\h'bi f'<YfUi gZcfXYfi b[Yb'ZØf'YfZU\fYbY?`YhhYfYfž'gcbXYfb'Ui W\'j]Y`gY]h][Y'A Ò[`]W_Y]hYb'ZØf'U``Yž'X]Y Y]bZUW\'bi f'X]Y'VYY]bXfi W_YbXYb': cfa Uh]cbYb'VYghUi bYb a ÒW\hYb"

Ni gUa a YbZUggYbX``Àggh`g]W\`gU[Ybž`XUgg`X]Y`BUhi f`fi bX`i a
D]fa UgYbg`Y]bY`UhYa VYfUi VYbXY`?i``]ggY`V]YhYhž`X]Y`gck c\``ni f
9f\c`i b[`U`g`Ui W\`ni f`U_h]j Yb`: fY]nY]h[YghU`hi b[`Y]b`ÀXh"`C V
VY]a `K UbXYfbž`FUXZU\fYb`cXYf`Y]bZUW\`VY]a `; Yb]Y» Yb`XYf
BUhi f` `X]Y`I a [YVi b[`\Uhij]Y``ni `V]YhYbž`i bX`Yg`[]Vh`]a a Yf
bYi Y`K i bXYf`ni `YbhXYW_Yb"`K Yf`a Y\f`ØVYf`X]YgY`k i bXYfgW\`ObY
GhUXh`i bX`]\fY`I a [YVi b[`YfZU\fYb`a OW\hYž`_Ubb`X]Y`cZZ]n]Y``Y
K YVg]hY`j cb`D]fa UgYbg`VYgi W\Yb.`D]fa UgYbg"XY"

?i`]bUf]gWXY'?Ògh`]WX_Y]hYb'XYf'FY[]cb. 9ggYb'ibX'Hf]b_Yb']b'D]fa UgYbg D]fa UgYbgž'VY_Ubbh'ZØf'gY]bY'UhYa VYfUi VYbXY'BUhi f'i bX
_i `hi fY``Yb'GW\AhnYž'V]YhYh'Ui W\ 'Y]bY'fY]W\Y'_i `]bUf]gW\Y'GnYbYž
X]Y'b]W\hij YfdUggh'k YfXYb'gc``hY"'Jcb'hfUX]h]cbY``Yb'; Yf]W\hYb
XYf'DZU`n'V]g'\]b'ni 'a cXYfbYb'\DhYfdfYhUh]cbYb'fY[]cbU`Yf'?ØW\Y
'\]Yf'_ca a Yb': Y]bgW\a YW_Yf'j c``'Ui Z']\fY'?cghYb"

8]Y `DZÀ`nYf`? ØWX Y `nY]WX bYh`g]WX `Xi fWX `]\ fY `< Yfn\ UZh][_Y]h`i bX

J]Y`ZÀ`h][_Y]h`Ui g" `9]b`UVgc`i hYg`A i gg`ZØf`YXYb`6Ygi WXYf`]gh`XUg`

DZÀ`nYf`GUi a U[Ybž`Y]b`: `Y]gWX [Yf]WX hž`XUg`c Zh`U`g`X]Y`fY[]cbU`Y

8 Y`]_UhYggY`Ub[YgY\Yb`k]fX" `9g`k]fX`Ui g`Y]bYf`A]gWX i b['j cb

GWX k Y]bYZY]gWX ž`? Ufhc ZZY`b`i bX`; Yk ØfnYb`ni VYfY]hYh`i bX`]b

Y]bYa `GWX k Y]bYa U[Yb`[Y[Ufh": Øf`j]Y`Y`9]b\Y]a]gWXY`]gh`Yg`XUg

; Yf]WX hž`XUg`X]Y`J YfVi bXYb\Y]h`ni f`FY[]cb`k]XYfgd]Y[Y`h"

9]b'k Y]hYfYg'hmd]gWkYg'; Yf]Wkhž'XUg'a Ub'b]Wkhij YfdUggYb'gc``hYž]gh'XYf'DZÀ`nYf': `Ua a _i WkYb"'8]YgYf'XØbbY'HY][VcXYb'k]fX a]h'Y]bYf'WfYa][Yb'A]gWki b['Ui g'7fÄa Y'ZfUÊWkYž'Nk]YVY`b'i bX GdYW_'VY`Y[h'i bX']a '<c`ncZYb'cXYf'Ui Z'XYa '; f]``'ni VYfY]hYh"'8]Y ?ca V]bUh]cb'Ui g'XYa '_bi gdf][Yb'HY]['i bX'XYb'Zf]gWkYb'Ni hUhYb VY[Y]ghYfh'@cWU`g'i bX'Hci f]ghYb'[`Y]WkYfa U»Yb"

K Y]b`]YV\UVYf'_ca a Yb']b'D]fa UgYbg'YVYbZU``g'Ui Z']\fY
?cghYb"'8]Y'FY[]cb']gh'HY]`'XYg'VYfØ\a hYb'DZÀ`nYf
K Y]bVUi [YV]Yhgž'XUg'ZØf'gY]bY'\Yfj cffU[YbXYb'K Y]» k Y]bYž
]bgVYgcbXYfY'F]Yg`]b[Yž'VY_Ubbh']gh''; YfbY'k]fX'Y]b'; `Ug'K Y]b'ni
XYb'hfUX]h]cbY``Yb'; Yf]W\hYb'[YbcggYbž'k Ug'XUg'_i `]bUf]gW\Y
9f`YVb]g'dYfZY_h'UVfi bXYh''K Yf'a Y\f'ØVYf'X]Y'K Y]bdfcXi _h]cb
YfZU\fYb'a OW\hYž'_Ubb'fY[]cbU`Y'K Y]b[ØhYf'VYgi W\Ybž'X]Y
: Ø\fi b[Yb'i bX'JYf_cghi b[Yb'UbV]YhYb"

: Øf'Y]bY'gØ» Y'J Yfgi W\i b['gcf[h'XYf'DZ\A`nYf'@YV_i W\Yb\Z'XYf']b
j]Y`Yb'6\A\W_YfY]Yb'XYf'GhUXh'Yf\\A`h`]W\']gh"'8]YgY'Ufca Uh]gW\Yb
; YV\A\W_Y'g]bX'cZh'a]h'Zfi W\h][Yb'cXYf'bi gg][Yb': Ø``i b[Yb
j YfgY\Yb'i bX'Y]b'VY`]YVhYg'A]hVf]b[gY``Ui g'XYf'FY[]cb"'9]b'GhØW_
@YV_i W\Yb'a]h'Y]bYf'HUggY'`c_U`'[Yf\OghYhYa'?UZZYY''Y]b
; Ybi gg\Z'XYb'a Ub'g]W\'b]W\h'Ybh[Y\Yb'`UggYb'gc``hY'°

 \pm D]fa UgYbg'[]Vh'Yg'Ui W\'Y]bY'J]Y`nU\`'j cb'F YghUi fUbhg'i bX

 $7UZÅgžX]YfY[]cbU`YibX]bhYfbUh]cbU`Y?ØWXYUbV]YhYb"
<math display="block">g]bXY]b][YXYfYadZY\\YbgkYfhYghYb5XfYggYb.$

B Ua Y	5fh:XYf:?ØWXY	6YgcbXYf\Y]h
FYghUi fUbh DZÀ`nYf	HfUX]h]cbY``Y`DZÀ`nYf	<ui g[ya="" td="" uwkhy<=""></ui>
Ghi VY	?ØWXY	GdYn]U`]hÀhYb
K Y]bghi VY ni f	FY[]cbU`Y'; Yf]W\hY	; fc»Y [*] K Y]bUi gk U\`
HfUi VY		
7 UZÅ 'Ua 'A Uf_h	7 UZÅ i bX ?cbX]hcfY]	<ui g[ya="" td="" uwkhy<=""></ui>
		?iWXYb
5g]U¨; ci fa Yh	5g]Uh]gWXY'?ØWXY	9l ch]gW\Y`5fca Yb
D]fa UgYbg		

8]Y F YghUi fUbhgʻ]bʻD]fa UgYbgʻ`Y[Ybʻ[fc»YbʻK YfhʻUi ZʻX]Y
J Yfk YbXi b[ˈj cbˈ**Zf]gWk YbžʻfY[]cbU`YbʻNi hUhYb**ʻʻJ]Y`Yʻ?ÒWkY
g]bXʻghc`nʻXUfUi Zžʻ]\fYʻF YnYdhYʻi bXʻ=XYYbʻa]hʻ`c_U`Yf
@UbXk]fhgWkUZhʻni j YfV]bXYbž'k Ugʻb]Wkhʻbi fʻX]YʻE i Uʻ]hÀhʻXYf
GdY]gYbʻYf\Ò\hžgcbXYfbʻUi WkʻX]YʻI a k Y`hʻgWkcbh''

Ni gÀhn`]W\ []Vh'Yg'nU\`fY]W\Y': YghY'i bX'A Àf_hY']b'D]fa UgYbgž'k c a Ub'X]Y'_i `]bUf]gW\Yb'? Ògh`]W_Y]hYb'XYf'FY[]cb']b'Y]bYf [Ya Øh`]W\Yb'5ha cgd\ÀfY'[Yb]Y * Yb'_Ubb"'8Yf'K U`Xk Y]bZYghž XUg'Y]ba U``]a '\\\f'ghUhhZ]bXYhž'ZY]Yfh'X]Y'K Y]b_i `hi f'XYf'DZU`n'i bX\YVh'X]Y'_i `]bUf]gW\Yb'<][\`][\hg'XYf'FY[]cb'\Yfj cf"'<]Yf'_ObbYb 6Ygi W\Yf'j YfgW\]YXYbY'K Y]bY'dfcV]YfYb'i bX'XUni ``c_U`Y GdYn]U`]hÀhYb'b]ddYb"

I a 'XUg'_i `]bUf]gWXY'9f`YVb]g']b'D]fa UgYbg'ni 'j Yfj c``ghÀbX][Ybž gc``hYb'FY]gYbXY'Ui WX'X]Y'Yhk Ug'k Yb][Yf'VY_UbbhYbž'UVYf YVYbZU``g']bhYfYggUbhYb'? Ògh`]WX_Y]hYb'XYf'FY[]cb'Yf_i bXYb'' 8 Uni 'nÀ\`Yb'i bhYf'UbXYfYa 'F]bXgfci `UXYb'i bX'
? Ufhc ZZY`gU`Uhž'X]Y'c Zh']b'XYb'< Ui g\U`hYb'ni VYfY]hYh'k YfXYb i bX'`c_U`Y'HfUX]h]cbYb'k]XYfgd]Y[Y`b''8]Y'? ØWXY'XYf'DZU`n'\Uh]\fYb'[Ubn'Y][YbYbž'\Yfn`]WXYb'7\UfU_hYfž'XYf'j cb'; YbYfUh]cb'ni; YbYfUh]cb'k Y]hYf[Y[YVYb'k]fX''

±g[YgUa h']gh'D]fa UgYbg'Y]b'Cfhž'Ub'XYa 'XUg'9ggYb'i bX'Hf]b_Yb ZYgh'a]h'XYf'?i `hi f'i bX'XYa '@YVYbggh]`'XYf'A YbgW\Yb'j YfVi bXYb $[gh''' 8]Y'_i `]bUf]gWXYb'; Yb\varnothing ggY'XYf'GhUXh'g]bX'Y]b'9f`YVb]g'Z\varnothing f'Z\varnothing f'U``Y'G]bbY'i bX'Y]b'k]WXh][Yf'HY]`''YXYf'FY]gY']b'X]YgY'WXUfa UbhYGhUXh'''D`UbYb'G]Y'\Rightarrow fYb'6Ygi WX'i bX'_cghYb'G]Y'gY`Vgh'X]Y_\Ogh`]WXYb'GdYn]U`]h\AhYb\Z'X]Y'D]fa UgYbg'ni 'V]YhYb'\Uh\$

<]ghcf]gWX Y GWX AhnY. '9]b '6`]W_ 'Ui Z D]fa UgYbg '9fVY</pre>

D]fa UgYbgžY]bY'GhUXh']a 'GØXk YghYb'8 Yi hgW\`UbXgž']gh'b]W\h'bi f ZØf']\fY'k i bXYfgW\ÒbY'B Uhi f'i bX'_Ògh`]W\Y'; Ughfcbca]Y $VY_Ubbhž'gcbXYfb'Ui W\'ZØf'] \ fY'VYY]bXfi W_YbXYb' \]ghcf]gW\Yb GW\AhnY''8]Y'GhUXh'\Uh'Y]bY'fY]W\Y'; YgW\]W\hYž'X]Y'h]YZ']b'XYf HfUX]h]cb'XYg'GW\i\UbXY`g'j Yfk i fnY`h']gh'i bX'nU\`fY]W\Y _i `hi fY``Y' <][\`][\hg'V]YhYhž'X]Y'Yg'ni 'YbhXYW_Yb'[]`h'''@UggYb'G]Y i bg'Y]bYb'[YbUi YfYb'6`]W_Ui Z'Y]b][Y'XYf'VYa Yf_Ybgk YfhYghYb \]ghcf]gW\Yb'Gh\hhYb'j cb'D]fa UgYbg'k YfZYb''$

9]b'k Y]hYfYg'<][\`][\h'XYf'GhUXh']gh'XUg'GhUXha i gYi a
D]fa UgYbgž'k Y`WXYg'h]YZ']b'X]Y'; YgWX]WXhY'XYf'FY[]cb'Y]bhUi WXh''
<]Yf'[]Vh'Yg'5i gghY``i b[Ybž'X]Y'X]Y'9bhk]W_`i b['XYf'GhUXh'j cb
Y]bYf'GWXi\a Yhfcdc`Y'ni 'Y]bYa 'a cXYfbYb'K c\bghUbXcfh
Xc_i a Ybh]YfYb''8]Y'GUa a `i b['i a ZUggh'nU\`fY]WXY'5fhYZU_hY'i bX
: chc[fUZ]Ybž'X]Y'XUg'5``hU[g`YVYb'i bX'X]Y'\DXi ghf]Y[YgWX]WXhY'XYf
GhUXh'j YfUbgWXUi `]WXYb''8Ug'A i gYi a 'V]YhYh'Ui WX']bhYfYggUbhY
K YWXgY`Ui gghY``i b[Yb'i bX'J YfUbghU'hi b[Ybž'X]Y'X]Y'6Ygi WXYf
U_h]j 'Y]bV]bXYb"

9]b'k]Wh][Yf'6YghUbXhY]`XYg'_i `hi fY``Yb'9fVYg'j cb'D]fa UgYbg g]bX'X]Y'5`hY'Dcgh'i bX'X]Y'GhUXh_]fWXY'Gh"'D]fa]b"'8]Y'5`hY DcghžY]b'\]ghcf]gWXYg'; YVÀi XY'Ui g'XYa '%- "'*J\f\i bXYfhž'nY][h X]Y'UfWX]hY_hcb]gWXY'GWXÒb\Y]h'XYf'NY]h'i bX']gh'Y]b'VY`]YVhYf'Cfh ZØf'_i `hi fY``Y'JYfUbghU`hi b[Yb"'8]Y'GhUXh_]fWXY']gh'b]WXh'bi f'Y]b Cfh'XYg'; `Ui VYbgž'gcbXYfb'Ui WX'Y]b'UfWX]hY_hcb]gWXYg A Y]ghYfk Yf_ž'XUg'X]Y'6Ygi WXYf'a]h'gY]bYf'VYY]bXfi W_YbXYb : UggUXY'i bX'XYa '`]YVYj c```[YghU`hYhYb'\DbYfYb']b'gY]bYb'6Ubb n]Y\h"

 $\begin{tabular}{ll} K Yb][Y'?]`ca YhYf'j cb`XYf'GhUXh`YbhZYfbh`ghY\h`XUg`GWX`cgg $$Nk Y]VfØW_Ybž`Y]b`k Y]hYfYg`\]ghcf]gWXYg`$i k Y`ž`XUg`Y]bYb`6Ygi WX k Yfh`]gh"`I fgdfØb[`]WX`]a '%("'$J\f\i bXYfh`YfVUi hž`X]YbhY`XUg $$GWX`cgg`U`g`FYg]XYbn`ZØf`<Yfn<math>O[Y'i bX`nY][h'Y]bY`J]Y`nU\``j cb $$UfWX]hY_hcb]gWXYb`Gh]`Yb"`8]Y`; UfhYbUb`U[Yb``UXYb`ni 'Y]bYa $$gWXObYb`GdUn]Yf[Ub[`Y]b`i bX`a Ub`_Ubb`X]Y`Fi \Y`i bX ; YgWX]WXhY`k i bXYfVUf`[Yb]Y`yb''$

<pre><]ghc f]gWX Y GhÀ hhY</pre>	6YgcbXYf\Y]hYb

D]fa UgYbg'GhUXhdUf_	GWX Òb 'Ub [Y `Y [hY '; ÀfhY bž
	< cWk UggYfXYb_a U`
GhUXha i gYi a 'D]fa UgYbg	8c_i a YbhUh]cb`XYf
	GWNi \a Yhfcdc`Yž': chcg'i bX
	5fhYZU_hY
5`hY`Dcgh	?i`hifY``Y`JYfUbghU`hib[Ybž
	\]ghcf]gW\Y`5fW\]hY_hif
GhUXh_]fWkY'Gh"'D]fa]b	6YY]bXfi W_YbXY`: UggUXYž
	∖]ghcf]gWkYgʻ±bbYfYg
GWX`cgg`NkY]VfØW_Yb	J]Y`nU\`'jcb'UfW\]hY_hcb]gW\Yb
	Gh]`Ybž'; UfhYbUb`U[Yb

D]fa UgYbg'V]YhYh'Ui W\ Y]bY'J]Y`nU\`jcb'XYb_a U`[YgW\ØhnhYb; YVÀi XYbž'X]Y'Yg'k Yfh'g]bXž'Yf_i bXYh'ni 'k YfXYb"'Jcf'U``Ya 'X]Y''GØXa Ui Yf'i bX'XYf'<cW\Vi b_Yf']a 'GhUXhnYbhfi a 'g]bX
NY]hnYi [Yb'XYf'GhUXh[YgW\]W\hYž'X]Y'k]W\h][Y'9fY][b]ggY'Ui g
j Yf[Ub[YbYb'9dcW\Yb'k]XYfgd]Y[Y`b"'8]Y'A Ui Yfb'i bX'6i b_Yf
YfnÀ\`Yb'; YgW\]W\hYb'j cb'?f]Y['i bX':f]YXYbž'j cb'JYfÀbXYfi b[
i bX'GhUV]`]hÀh'i bX'q]bX'qma Vc`]qW\ZØf'X]Y'K]XYfghUbXq fUZh'XYf

 $8]Y `GhUXh` \ Uh'ni \ XYa `Y]bY `VYY]bXfi \ W_YbXY `HfUX]h]cb `]a `GWXi \ UbXk \ Yf_<math>\check{z}$ `X]Y `V]g `]bg `%- "`\$U\f\i bXYfh'ni fØW_fY]WX h" 8]Yg k]fX `]a `GWXi \ a i gYi a `D]fa UgYbg `UbgWX Ui `]WX `XUf[Y`Y[h" 8]Y 5 i gghY ``i b[Yb `V]YhYb `Y]bYb `ZUgn]b]YfYbXYb `9]bV `]W_ `]b `X]Y 9bhk]W_`i b[`XYf `GWXi \ a UWX YfY] `i bX `X]Y `6YXYi hi b[`XYf `6fUbWXY ZØf `X]Y ``c_U`Y `K]fhgWX UZh" `6YgcbXYfY `9I dcbUhY `nY][Yb `X]Y < UbXk Yf_g_i bgh'i bX `X]Y `j YfgWX]YXYbYb `Gh]`Y `]a `@Ui Z`XYf `NY]h"

GWX`]Y»`]WX`]gh'Yg'i ba Ò[`]WXž'ØVYf'XUg'_i `hi fY``Y'9fVY'j cb
D]fa UgYbg'ni 'gdfYWXYbž'c\bY'X]Y'?i bgh'i bX'?i `hi f']a
ÒZZYbh`]WX Yb 'F Ui a 'ni 'Yfk À\bYb"'8]Y'GhUXh'\Uh'nU\`fY]WXY
G_i `dhi fYb'i bX'?i bghk Yf_Yž'X]Y']b'XYf': i » [Àb[YfncbY'i bX'XYb
DUf_g'j YfhY]`h'g]bX"'8]YgY'a UWXYb'Y]bYb'GdUn]Yf[Ub['Xi fWX'X]Y
GhUXh'ni 'Y]bYa '_fYUh]j Yb'9f`YVb]g'i bX'j YfgWXÒbYfb'X]Y'GhfU»Yb
XYf'GhUXh"

8]Y `\]ghcf]gW\ Yb `GW\ ÀhnY `j cb `D]fa UgYbg`g]bX `Y]b`k]W\ h][Yf 6YghUbXhY]``XYg`9fVYg`XYf`GhUXh" `G]Y`g]bX`b]W\ h`bi f`NYi [b]ggY`XYf J Yf[Ub[Yb\Y]hž`gcbXYfb`Ui W\ ``YVYbX][Y`9f]bbYfi b[Ybž`X]Y`X]Y ?i `hi f`i bX`\\XYbh]h\Ah`XYf`GhUXh`df\A[Yb"`9]b`6Ygi W\ `X]YgYf`CfhY V]YhYh`X]Y`A O[`]W_Y]hž`X]Y`; YgW\]W\\hY`\Ui hbU\\`ni `Yf`YVYb`i bX XUg`9fVY`j cb`D]fa UgYbg`ni `k OfX][Yb": Of`k Y]hYfY`\\DZcfa Uh]cbYb i bX` i a `\\A\\frac{1}{2}\$ fYb`6Ygi W\`ni `d`UbYbž`k YfZYb`G]Y`Y]bYb`6`]_\Ui Z`X]Y c\\Z]n]Y``Y`K YVg]hY`j cb`D]fa UgYbg.`d]fa UgYbg"XY"

: fY]nY]hU_h]j]hÀhYb i b X 5 VYbhYi Yf]a : fY]Yb

D]fa UgYbgžY]b[YVYhhYhi]b'X]Y'gUbZhYb'< \emptyset [Y`XYf'DZU`nž'V]YhYhiY]bY J]Y`nU\`ij cb': fY]nY]hU_h]j]hÀhYb'i bX'5VYbhYi Yfb']a ': fY]Yb'ZØf BUhi f`]YV\UVYf'i bX'5XfYbU`]b'i b_]Yg"'8]Y'FY[]cb']gh'b]W\h'bi f'ZØf]\fY'a U`Yf]gW\Yb'@UbXgW\UZhYb'VY_Ubbhž'gcbXYfb'Ui W\'ZØf'X]Y nU\`fY]W\Yb'A \mathring{O} [`]W_Y]hYbž'X]Y'BUhi f'\Ui hbU\'ni 'Yf`YVYb"

K UbXYfZfYi bXY'Z]bXYb']b'i bX'i a 'D]fa UgYbg'Y]bY'J]Y`nU\``j cb [i h'Ui g[YgWk]`XYfhYb'K UbXYfk Y[Yb"'8]Y'K UbXYfk Y[Y'XYg DZÀ`nYfk U`Xg'g]bX'VYgcbXYfg'VY`]YVh'i bX'V]YhYb'Fci hYb'ZØf

YXYg::]hbYgg`Yj Y`"'6Y`]YVhY'K UbXYffci hYb'i a ZUggYb.

- 8 Yf 'B Uhi fd Uf_ 'D ZÀ `n Y f 'K U`X. '9]b 'gd UbbYbXYg 'HYffU]b a]h 'UVk Y W g`i b[gfY] W Yb '@UbXg W UZhYb"
- 8 Yf: Y`gYbk Y[.'9f_i bXi b['VYY]bXfi W_YbXYf
 : Y`qZcfa Uh]cbYb'i bX'5i gq]Wkhqdi b_hY"
- 8 Yf'Gi XYhYbk Y[.'9]bY'Ubgdfi Wkgj c``YfY'Fci hY'a]h
 [fUbX]cgYb'6`]W_Yb'ØVYf'X]Y'FY[]cb"

: Øf F UXZU\fYf V]YhYh D]fa UgYbg YVYb ZU``g nU\`fY]W\Y
A O[`]W_Y]hYb" 8]Y I a [YVi b['[]`h U`g F UXZU\fYfdUfUX]Yg a]h [i h
Ui g[YVUi hYb F UXk Y[Ybž X]Y Xi fW\ X]Y fY]nj c``Y @UbXgW\UZh
ZØ\fYb" J cb [Ya Øh`]W\Yb F UXhci fYb V]g \]b ni "Ubgdfi W\gj c``Yb
A ci bhU]bV]_Y!GhfYW_Yb]gh U``Yg j cf\UbXYb" 5 VYbhYi Yf`i gh][Y
F UXZU\fYf gc``hYb i bVYX]b[h X]Y A ci bhU]bV]_Y!GhfYW_Y]a
6fY]hYbghY]bYf K U`X Ui gdfcV]YfYbž X]Y gck c\``hYW\b]gW\
\YfUi gZcfXYfbX U`g Ui W\ ``UbXgW\UZh`]W\ VYY]bXfi W_YbX]gh"

5b[`Yf'Z]bXYb']b'XYf'I a [YVi b['j cb'D]fa UgYbg'YVYbZU``g'Y]b][Y Yfgh_`Ugg][Y'; Yk ÀggYf"'8Yf'K]YgYbh\U`VUW\'i bX'XYf'
Fca a Y`gVUW\'g]bX'VY`]YVhY'CfhYž'i a 'X]Y'GYY`Y'VUi a Y`b'ni
`UggYb'i bX'Ui Z'X]Y'*J[X'bUW\'XYb'\Y]a]gW\Yb':]gW\Yb'ni '[Y\Yb" A]h'Yhk Ug'; `ØW_'_ObbYb'\]Yf': cfY``Yb'i bX'gc[Uf'K Y]» Z]gW\Y
[YZUb[Yb'k YfXYb"

: Øf:: Ua]`]Ybii bXiUVYbhYi Yf`]WkYi; fi ddYbig]bXiXYfi

K U`Xgd]Y`d`Uhni]a 'GhUXhk U`Xigck]YiXYfi5hf]i a 'DUf_ihc``Y

CfhYžii a 'XYbiHU['ni 'j YfVf]b[Yb"'8YfiK U`Xgd]Y`d`UhniV]YhYhib]Wkh

bi fi5VYbhYi YfiZØfiX]Yi?`Y]bYbžigcbXYfbiUi WkiX]YiA Ò[`]Wk_Y]hiZØf

D]W_b]W_gii bXiYbhgdUbbYbXYi5i gV`]W_Yi]biX]YiBUhi f"i8Yfi5hf]i a

DUf_i]ghiY]bi[fc» ZÀWk][Ygi: fY]nY]hUfYU`ži]biXYa 'GdcfhžiGd]Y`ii bX

GdU» ']a 'JcfXYf[fi bXighY\Yb"

9]b'k Y]hYfYg'<][\`][\h'ZØf'JYf`]YVhY'XYf'BUhi f']gh'XYf'6chUb]gWXY; UfhYb'D]fa UgYbgž'XYf'Y]bY'J]Y`nU\`'j cb'DZUbnYbUfhYb'nY][h i bX'Y]b'gWX ÒbYf'Cfh'ZØf'Y]bYb'YbhgdUbbYbXYb'GdUn]Yf[Ub[']gh" 8]Y'[YdZY[hYb'5b`U[Yb'g]bX']XYU`'ZØf'Y]b'D] W_b b] W_c CXYf'ni a 9bhgWX 'Yi b][Yb"

5_h]j]hÀh	Cfh	$GWK [Yf][_Y]hg[fUX$
K UbXYfb	DZÀ`nYfk U`X	@Y]WX h'V]g
		Ubgdfi Wigj c``
AcibhU]bV]_]b[6fY]hYbghY]bYf'KU`X	5bgdfi Wkgj c``
5b[Y`b	K]YgYbh\U`VUW\	9]bZUW
: Ua]`]YbUi gZØ[Y	K U`Xgd]Y`d`Uhn	: Øf'U``Y

D]fa UgYbg'V]YhYh'Ui W\'X]Y'A $O[`]W_Y]h'ZOf'a Y\f'gdcfh`]W\Y 5_h]j]hÀhYb'''<math>\infty$ [[Yf'k YfXYb'X]Y'k i bXYfgW\ObYb'GhfYW_Yb'Xi fW\ X]Y'GhUXh'i bX'X]Y'i a [YVYbXYb'K À`XYf'gW\ÀhnYbž'k À\fYbX'; c`ZYf XYb'bU\Y[Y`Y[YbYb'; c`Zd`Uhn'D]fa UgYbg'Ui gdfcV]YfYb _ObbYbž'XYf'Y]bY'\Yff`]W\Y'G]W\h'Ui Z'X]Y'i a `]Y[YbXY'@UbXgW\UZh V]YhYh''

 $: \emptyset f'X]Y'_i `hi fY``]bhYfYgg]YfhYb'[]VhYg']a `5i YbVYfY]W `XYf'GhUXhUi W : \emptyset fi b[Yb'Xi fW X]Y'fY]nj c``Y'@UbXgW UZh'i bX'X]Y'g]W ghÀbX]['k UbXY`bXY'5fW]hY_hi f'j cb'D]fa UgYbg''8]YgY: \emptyset fi b[Yb_ca V]b]YfYb'bUhØf`]W Yg'5VYbhYi Yf'a]h'[YgW]W h`]W Yf GY`VghYfZU\fi b['i bX'g]bX'Y]bY'dYfZY_hY'5fhž'a Y\f'ØVYf'X]Y ; Y[YbX'ni YfZU\fYb''$

5VYbhYi Yf']b'D]fa UgYbg'VYXYi hYh'Ui W\ž'bYi Y'GdcfhUfhYb Ui gni dfcV]YfYb'K]Y'k ÀfY'Yg'a]h'? `YhhYfdUf_UVYbhYi Yfb3'8Yf K U`XgY]`[UfhYb']a '< UfXhk U`X'V]YhYh'UhYa VYfUi VYbXY ?`YhhYffci hYb'ZØf'YXY'5`hYfg_`UggY'''<]Yf'_Ubb'a Ub'g]W\'Ub'GY]`Yb i bX'<]bXYfb]ggYb'\cW\'ØVYf'XYa '6cXYb'j Yfgi W\Yb' 'Y]bY 9fZU\fi b[ž'X]Y'XYb'Di `g'[UfUbh]Yfh']b'X]Y'<Ò\Y'hfY]VYb'k]fX'

CV'G]Y'bi b'X]Y'K UbXYfk Y[Yž'FUXghfYW_Ybž'5b[Y`d`ÀhnY'cXYf?`YhhYfdUf_g'Yf_i bXYb' 'D]fa UgYbg'V]YhYh'ZØf'YXYb'Ci hXccf! 9bh\i g]UghYb'gdUbbYbXY'A Ò[`]WX_Y]hYbž'X]Y'BUhi f'i bX'X]Y `ÀbX`]WXY'I a [YVi b['ni '[Yb]Y»Yb"

?i`hi f`i bX`J YfUbghU`hi b[Yb.`D]fa UgYbg `YVYbX]['Yf`YVYb

D]fa UgYbgž']a '< YfnYb'j cb'F\Y]b`UbX!DZU`n'[Y`Y[Ybž']gh'b]W\h'bi f $Z\emptyset f'gY$]bY'BUhi fk i bXYf'i bX'_i `]bUf]gW\Yb'GdYn]U`]hÀhYb'VY_Ubbhž

gcbXYfb'Ui W. ZØf'gY]bY'`YVYbX][Y'?i `hi fgnYbY'i bX
UVk YW.g`i b[gfY]W.Y'J YfUbghU`hi b[Yb"'8 Ug'GhUXhV]`X'k]fX'j cb
Y]bYf'ZUgn]b]YfYbXYb'A]gW.i b['Ui g'HfUX]h]cb'i bX'A cXYfbY
[YdfÀ[hž'X]Y'g]W.']b'nU\`fY]W.Yb': Ygh]j U`gž'?cbnYfhYb'i bX
_i `hi fY``Yb'9fY][b]qqYb'k]XYfqd]Y[Y`h"

9]b`\YfUi gfU[YbXYg`9fY][b]g`]b`D]fa UgYbg`]gh`XUg`DZÀ`nYfk U`X
: Ygh]j U`ž`XUg`YXYg`&J\f`]a `Gca a Yf`ghUhhZ]bXYh'' <]YfVY]`\UbXY`h
Yg`g]W\`i a `Y]b`A i g]_!`i bX`?i `hi fZYgh]j U`ž`XUg`gck c\```c_U`Y`U`g
Ui W\`ØVYffY[]cbU`Y`?Øbgh`Yf`Ubn]Y\h''6Ygi W\Yf`_ObbYb`g]W\`Ui Z
Y]b`Vi bhYg`Dfc[fUa a `Ui g`@j Ya i g]_ž`HUbnj cfZØ\fi b[Yb`i bX
_Øbgh`Yf]gW\Yb`8UfV]Yhi b[Yb`ZfYi Ybž`X]Y`]b`XYf`a U`Yf]gW\Yb
I a [YVi b[`XYg`DZÀ`nYfk U`XYg`ghUhhZ]bXYb"

9]bY'VYgcbXYfg'gW\ObY'A O[`]W_Y]hž'X]Y'?i`hi f'XYf'FY[]cb\Ui hbU\'ni 'Yf'YVYbž'V]YhYb'X]Y'?i`hi fUVYbXYž'X]Y'fY[Y`a À»][]a '?i`hi fnYbhfi a 'D]fa UgYbg'ghUhhZ]bXYb"'8]YgY'5VYbXYk]Xa Yb'g]W\'j YfgW\]YXYbYb'H\Ya Yb'i bX'Vf]b[Yb'?Øbgh`YfžAig]_Yf'i bX'@]hYfUhYb'ni gUa a Yb"'8]Y'6Ygi W\Yf'_ObbYb'UbgdUbbYbXYb'8]g_i gg]cbYb'hY]`bY\a Yb'i bX'X]Yi bhYfgW\]YX`]W\ghYb'?i bghZcfa Yb'[Yb]Y»Yb"'

8 Ugʻ?i bgh\Ui gʻD]fa UgYbgʻ]ghʻY]bʻk Y]hYfYfʻ_i `hi fY``Yfʻ@Yi W\hhi fa XYfʻGhUXh"ʻ9gʻdfÀgYbh]YfhʻfY[Y`a À»]['k YW\gY`bXYʻ5i gghY``i b[Ybž X]Yʻg]W\a]hʻnY]h[YbÒgg]gW\Yfʻ?i bghʻVYgW\ÀZh][Ybʻi bXʻ?Øbgh`Yf Ui gʻXYfʻFY[]cbʻgck]Yʻ]bhYfbUh]cbU`YʻHU`YbhYʻj cfghY``Yb"ʻGc V]YhYbʻg]YʻXYfʻD]fa UgYbgYfʻ6Yj Ò`_Yfi b['X]YʻA Ò[`]W_Y]hžʻ]bʻX]Y K Y`hʻXYfʻa cXYfbYbʻ?i bghʻY]bni hUi W\Yb"

JYfUbghU`hi b[8 Uhi a	Cfh

JYfUbghU`hi b[8 Uhi a	Cfh
DZÀ`nYfk U`X': Ygh]j U`	· `]	DZÀ`nYfk U`X
GhUX hZY gh	GYdhYa VYf	±bbYbghUXh
		D]fa UgYbg
?i`hifUVYbXY	A cbUh`]WX	?i`hi fnYbhfi a
		D]fa UgYbg
5i gghY``i b[Yb']a	; Ubn'À\f][?i bgh\Ui g
?i bgh\Ui g		D]fa UgYbg

: Øf'@]YV\UVYf'j cb'H\YUhYf'i bX'XUfghY``YbXYf'?i bgh']gh'XUg'
H\YUhYf'D]fa UgYbg'Y]b'a i gg"'9g'V]YhYh'Y]b
UVk YWXg`i b[gfY]WXYg'Dfc[fUa a ž'XUg'j cb'_`Ugg]gWXYb'GhØW_Yb
V]g'\]b'ni 'nY]h[YbÒgg]gWXYb' ⊕ gnYb]Yfi b[Yb'fY]WXh'i bX
fY[Y`a À»]['bUa \UZhY'?Øbgh`Yf'i bX'9bgYa V`Yg'Ui Z'X]Y'6Ø\bY
Vf]b[h"'H\YUhYfUi ZZØ\fi b[Yb'k YfXYb'cZh'j cb'8]g_i gg]cbgfi bXYb
VY[`Y]hYhž'VY]'XYbYb'XUg'Di V`]_i a ']b'XYb'_fYUh]j Yb'DfcnYgg
Y]bVYnc[Yb'k]fX"

9]b'k Y]hYfYg'9j Ybhž'XUg'X]Y'_i `hi fY``Y'J]Y`ZU`h'D]fa UgYbg
k]XYfgd]Y[Y`hž']gh'XYf'K Y]\bUW\hga Uf_h"'\XXYg'\X\f'j Yfk UbXY`h
g]W\X]Y'\DYbghUXh']b'Y]b'K]bhYfk i bXYf`UbX'a]h'ZYgh`]W\
[YgW\a ØW_hYb'Gh\AbXYb\Z'X]Y'\UbX[Y\ZYfh][hY'; YgW\Yb_Y\Z'
?i bgh\UbXk Yf_'i bX'fY[]cbU`Y'?\Ogh`]W_Y]hYb'UbV]YhYb"'8]Y
K Y]\bUW\hgUha cgd\\AfY'k]fX'Xi fW\'a i g]_U`]gW\Y'8UfV]Yhi b[Yb
i bX'Y]b'Vi bhYg'FU\a Ybdfc[fUa a \Z'XUg'A \AfW\Ybghi bXYb'\Z\Of
?]bXYf'VY]b\U`hYh\Z'\ZYgh`]W\'UV[Yfi bXYh"

: Øf:: Ua]`]Yb'i bX'?]bXYf'[]Vh'Yg'YVYbgc'nU\`fY]W\Y

J YfUbghU`hi b[Ybž'X]Y'gdYn]Y```Ui Z'i b[Y'6Ygi W\Yf'ni [YgW\b]hhYb
g]bX"'8 Ug'iÀ\f`]W\Y'?]bXYfa i g]_ZYgh']gh'Y]b'<][\`][\hž'VY]'XYa
j YfgW\]YXYbY'?]bXYfW\ÔfY'i bX'A i g]_[fi ddYb'Ui g'XYf'FY[]cb
Ui ZhfYhYb'i bX'X]Y'_`Y]bYb'; ÀghY'ni a 'A]hg]b[Yb'i bX'HUbnYb
Y]b`UXYb"'8]YgY'J YfUbghU`hi b[Yb'ZÒfXYfb'b]W\h'bi f'X]Y

A i g]WU`]hÀh'XYf'?]bXYfž'gcbXYfb'ghÀf_Yb'Ui W\'XUg
; Ya Y]bgW\UZhg[YZØ\``XYf'GhUXh"

±b`D]fa UgYbg`Z]bXYh`YXYfž`XYf`Ub`?i`hifibX`JYfUbghU`hib[Yb]bhYfYgg]Yfh`]ghž`Yhk Ugž`XUg`gY]bYb`; YgW\a UW_`hf]ZZh"`C∨'?ibghž

A i g]_ \check{z} 'H\YUhYf'cXYf'XUg': Y]Yfb'hfUX]h]cbgfY]W\Yf': YghY' 'X]Y GhUXh'V]YhYh'Y]b'fY]W\\U`h][Yg'i bX'ZUWYhhYbfY]W\Yg'_i `hi fY``Yg 5b[YVch \check{z} 'XUg'6Ygi W\Yf'i bX'9]b\Y]a]gW\Y'[`Y]W\Yfa U $_{y}$ Yb VY[Y]ghYfh'

H]ddg'ZØf'X]Y'dYfZY_hY'I bhYf_i bZh.'K c'a Ub]b'D]fa UgYbg'ØVYfbUW\hYb'_Ubb

K Ybb Xi 'D]fa UgYbg VYgi W ghž]gh X]Y 'K U\``XYf 'f]W h][Yb I bh Yf_i b Zh Ybhg W Y]XYb Xž i a 'XY]b Yb '5 i ZYbh \ U`h 'gc 'Ub [YbY\ak]Y 'a O[`]W 'ni '[Ygh U`h Yb" '8]Y 'Gh UXh 'V]Yh Yh Y]b Y 'J]Y`n U\`'j cb \ VYfb UW \ hi b[ga O[`]W _Y]h Ybž 'X]Y 'XYb 'i bh Yfg W]YX`]W Yb 6 Y X Ø f Zb]gg Yb 'j cb 'F Y]g Yb X Yb '[Yf YW h k Yf X Yb "'9[U`ž c V 'Xi 'b UW Y]b Ya '`i I i f]Og Yb '< ch Y`ž Y]b Yf '[Øbgh][Yb 'D Ybg]cb 'c X Yf 'Y]b Yf df]j Uh Yb ': Yf]Ybk c\bi b['gi W ghž'\]Yf 'g]b X 'Y]b][Y 'H]ddg'i b X J c fg W `À[Y 'ZØ f X Y]b Y' d Yf Z Y_h Y 'I bh Yf_i b Zh ']b 'D] fa Ug Ybg"

< chY`g]b D]fa UgYbg</pre>

 $\pm 0.0 \] fa \ UgYbg`[\] Vh`Yg`Y]bY`FY] \Y`j \cb`< chY`gž`X]Y`gck \c\``? ca \ Zcfh \U`g`Ui \W\`Y]bY`[i hY`@U[Y`V]YhYb"`9]b`VY`]YVhYg`< chY``]gh`XUg`< chY` @]bXYž`VY_Ubbh`ZØf`gY]bYb`\Yfj cffU[YbXYb`GYfj]\W`i bX`X]Y`\c\Y \Ni \Zf]YXYb\Y]h`XYf`; \AghY"`<]Yf`_Ubbgh`Xi `X]\W\`Ui \Z`a cXYfbY \N]a a \Yf`i bX`Y]b``Y\\\YfYg`: fØ\gh\@\\\ZfYi Yb"$

9]b'k Y]hYfYg'Ya dZY\`Ybgk YfhYg'<chY``]gh'XUg'<cW\k U`X'<chY`ž XUg'VYgcbXYfg'ZØf'; YgW\ÀZhgfY]gYbXY'i bX'I f`Ui VYf'[YY][bYh']gh" 9g'V]YhYh'5bbY\a`]W_Y]hYb'k]Y'HU[i b[gfÀi a Y'i bX'Y]b'[i hYg FYghUi fUbh"'8]Y'nYbhfU`Y'@U[Y'Yfa O[`]Wh'ni XYa 'Y]bYb'gW\bY``Yb Ni [Ub['ni 'XYb'GY\Ybgk $O[X][_Y]$ hYb'XYf'GhUXh"

$DYbg]cbYbiibX'_Y]bYIbhYf_ØbZhY$

K Ybb 'Xi 'Y]bY 'dYfgÒb`]W\YfY '5ha cgd\ÀfY 'VYj cfni [ghž·g]bX 'X]Y DYbg]cbYb ']b 'D]fa UgYbg 'Y]bY 'Ui g[YnY]W\bYhY 'K U\`" '8]Y 'DYbg]cb Ua 'GhUXhdUf_'VY[Y]ghYfh'a]h ']\fYa 'W\Ufa UbhYb '5a V]YbhY 'i bX XYf'BÀ\Y 'ni f'B Uhi f"' <]Yf'_Ubbgh'Xi 'a cf[Ybg ']a '; UfhYb

9]bY'k Y]hYfY'U`hYfbUh]j U'I bhYf_i bZh`]gh'X]Y'DYbg]cb']a 'DZÀ`nYf K U`Xž'X]Y'ZØf'K UbXYfZfYi bXY']XYU`'[Y`Y[Yb']gh'''Jcb'\]Yf'Ui g'\Ugh Xi 'X]fY_hYb'Ni [Ub['ni 'XYb'K UbXYfk Y[Yb'i bX'_Ubbgh'X]Y a U`Yf]gWXY'@UbXgWXUZh'XYf'I a [YVi b['Yf_i bXYb"

: Yf]Ybk c\bib[YbibX 5dUfha Ybhg

: Øf'Y]bYb '`Ab[YfYb '5i ZYbh\U`h'cXYf'k Ybb 'Xi 'a Y\f
I bUV\Ab[][_Y]h'k ØbgW\ghž'g]bX': Yf]Ybk c\bi b[Yb 'Y]bY
\Yfj cffU[YbXY'Cdh]cb"'9]bY'Ya dZY\`Ybgk YfhY'5XfYggY']gh
: Yf]Ybk c\bi b[']a 'NYbhfi a ž'X]Y'nYbhfU`'[Y`Y[Yb']gh'i bX'U``Y
bOh][Yb'5bbY\a `]W_Y]hYb'V]YhYh"'<]Yf'_Ubbgh'Xi 'X]f'XY]bY
A U\`nY]hYb'gY`Vgh'ni VYfY]hYb'i bX'X]W\'k]Y'ni '< Ui gY'ZØ\`Yb"</pre>

9]bY'UbXYfY'Cdh]cb']gh'X]Y'DZÀ`nYf': Yf]Ybk c\bi b[ž'X]Y'fi gh]_U` Y]b[Yf]W\hYh']gh'i bX'Y]bYb'hc``Yb'6`]W_'Ui Z'X]Y'i a `]Y[YbXYb K Y]bVYf[Y'V]YhYh"'=XYU`'ZØf'DUUfY'cXYf'_`Y]bY'; fi ddYbž'X]Y'X]Y FY[]cb'Yf_i bXYb'a OW\hYb"

7Ua d]b[i bX U`hYfbUh]j Y , VYfbUW hi b[ga Ò[`]W _Y]hYb

 $: \varnothing f'Ci hXccf! 9bh\ i g] UghYb' []VhYg'Ui W\ X]Y'A O [`]W\ Y]h'ni WUa dYb'' 8 Yf'7 Ua d]b [d`Uhn'Ua 'K U`XZfY]VUX']ghY]bY'VY`]YVhY K U\ ž'X]Y'Y]bY'bUhi fbU\Y'9fZU\fi b ['V]YhYh'' <]Yf'_Ubbgh'Xi ']a NY`h'\ØVYfbUW\hYb'i bX'XYb'bU\Y[Y`Y[YbYb'K U`X'Yf i bXYb''$

5i » YfXYa []VhYg']b XYf'I a [YVi b['j cb'D]fa UgYbg'Y]b][Y <cghY`gž'X]Y'Y]bY'[Øbgh][Y', VYfbUW\hi b[ga Ò[`]W_Y]h'ZØf FY]gYbXY'a]h'_`Y]bYa '6i X[Yh'XUfghY``Yb"'8]YgY'CfhY'g]bX']XYU`ž i a 'a]h'UbXYfYb'FY]gYbXYb']bg'; YgdfÀW\ni '_ca a Yb'i bX'bYi Y : fYi bXgW\UZhYb'ni 'gW\`]Y» Yb"

6i Wib[gh]ddg

6Y] `XYf'6i W\i b[`XY]bYf'I bhYf_i b\Zh']b `D]fa UgYbg'[]Vh'Yg'Y]b][Y

- : fØ\nY]h][Y'6i W\i b[.'; YfUXY']b'XYf'< Ui dhfY]gYnY]h']gh Yg'fUhgUa ž'ZfØ\nY]h]['ni 'Vi W\Ybž'i a 'X]Y'VYghYb'DfY]gY i bX'J YfZØ[VUf_Y]hYb'ni 'g]W\Yfb"
- Cb`]bY!6Yk Yfhi b[Yb. Bi hnY'K YVg]hYg'k]Y'Hf]d5Xj]gcfcXYf'6cc_]b["Wca ž'i a 'X]Y'A Y]bi b[Yb'UbXYfYf'; ÀghY'ni 'YgYb'i bX'Y]bY']bZcfa]YfhY'9bhgWXY]Xi b['ni 'hfYZZYb"
- GcbXYfUb[YVchY. '<U`hY`5i ggW\Ui 'bUW\'GcbXYfU_h]cbYbcXYfFUVUhhYbžia 'XUg'VYghY'DfY]g!@Y]ghib[g!JYf\À`hb]gni 'Yfn]Y`Yb"

$DfY]ghUVY``Y`ZØf'IbhYf_ØbZhY$

lbhYf_ibZh	DfY]ggdUbbY ⁻ dfc	6YgcbXYf\Y]hYb
	BUWh	
< c hY ` @]b X Y	- \$ ' '%) \$ '	; i hYgʻ: fØ\ghØW_ž
		NYbhfU`Y`@U[Y
< c W k U`X '< c hY`	, \$ ' '%' \$ '	6i g]bYgg! <i>Z</i> fYi bX`]W\ž
		FYghUifUbh
		j cf∖UbXYb
DYbg]cb 'Ua) \$ ' ', \$ '	7\Ufa UbhY
GhUXhdUf_		5 ha cgd\ÀfYž; UfhYb
: Yf]Ybk c\bi b[']a	* \$ ' '%\$ \$ '	Jc``Uig[YghUhhYhž
NYbhfi a		nYbhfU`[Y`Y[Yb
7Ua d]b[d`Uhn'Ua	%\$ · · · · \$ ·	BUhi fYf`YVb]gž
K U`XZfY]VUX		Y]bZUWXY`5b`U[Yb

9[U`ž'k]Y`Xi `X]WX`YbhgWXY]XYghž'D]fa UgYbg`V]YhYh`Y]bY`J]Y`nU\`jcb`A Ò[`]WX_Y]hYbž'X]Y`XY]bYb`5i ZYbh\U`h`i bj Yf[Ygg`]WX`a UWXYbkYfXYb"`8Yb_Y`XUfUbž'XY]bYb`5i ZYbh\U`h`]a `JcfUi g`ni `d`UbYbi bX`XUg`ZØf`X]WX`dUggYbXY`5b[YVch`ni `Z]bXYbž'i a `XY]bY`FY]gY`]bX]YgYf`VYnUi VYfbXYb`GhUXh`cdh]a U``ni `[YghU`hYb"