



9]b 'gdY_hU_i `ÀfYf '5 VYb X ']b '6 Yf `]b ° 8]Y 'DfYa]YfY 'XYf 'bYi Yb ?ca ÒX]Y '5 @H9F 'K 9 €G9F 'A 5BB '\Uh'X]Y '< Ui dhghUXh ']a 'Ghi fa YfcVYfh 'FY[]ggYi f 'G]a cb 'J Yf\cYj Ybž 'XYf a]h 'gY]bYa Y]bn][Ufh][Yb '; YgdØf 'ZØf' < i a cf 'i bX 'H]YZ[Ub['Vf]``]Yfhž dfÀgYbh]YfhY 'gY]b 'bYi YghYg 'A Y]ghYfk Yf_'Y]bYf 'VY[Y]ghYfhYb A Yb[Y"'6Y] 'ZfYbYh]gWXYa 'GnYbYbUdd`Ui g'i bX 'Yi d\cf]gWXYf

Gh]a a i b['ZY]YfhYb'U``Y'5bk YgYbXYb'Y]b'i bj Yf[Ygg`]W\Yg ?]bcYfY][b]g $^{\circ}$

8 Ug:]`a hYUa 'k i fXY'[YVØ\fYbX'[YZY]Yfh°Ni 'XYb'GhUfg'XYg 5VYbXg'[Y\OfhYb'b]W\h'bi f'\Jb'\&gYZ'@]YZYfg'i bX'BUX'U'I\`ž gcbXYfb'Ui W\'X]Y'?i `ha i g]_Yf'H\ca Ug'8'i bX'Ga i Xc'j cb'XYb: UbhUgh]gW\Yb'J]Yfž'X]Y'XYa':]`a 'XYb'_fUZhj c``Yb'H]hY`gcb[KYY_YbXZYY`]b[VY]ghYi YfhYb"'8Ug'Di V`]_i a 'VY`c\bhY'XUg 9bgYa V`Y'a]h``Ub[Ub\U`hYbXYa ž'VY[Y]ghYfhYb'5dd`Ui g''Y]b_`_`UfYf'6YkY]g'ZØf'X]Y'\c\Y'9fk Ufhi b['i bX': fYi XY'Ui Z'XYb':]`a '

DUW_YbXY`<UbX`i b[ž'X]Y`ni a `BUWXXYb_Yb UbfY[h

 $8]Y ; YgWX]WX hY j cb : 5@H9F K 9 \\ \oplus G9F A 5BB VYgWX AZh][h rg]WX ra]h Vf]gUbhYb : [YgY ``gWX UZh`]WX Yb `H\Ya Yb ZX]Y ii bg `U``Y `VYhfY ZZYb" : Ua]`]Ybj UhYf < Y]bn < Y``a]WX rg]Y\h rg]WX rd `Ohn`]WX ra]h XYa Xfc\Yb XYb `J Yf`i gh rgY]b Yg : <math>\\ \times Vg _{-}cb Zfcbh]Yfh ii b X : XUg : Xi f WX Y][YbY A]gg[YgWX]W_Y ^* I a : XYf '6YnY]WX bi b[ii U`hYf k Y] * Yf 'A Ubb ni 'Ybh_ca a Yb Z cf[Ub]g]Yfh 'Yf 'Y]b '8]bb Yf Z ii a 'rg]WX 'j cb 'rgY]b Yf VYghYb 'GY]hY 'ni 'nY][Yb " 8 c WX 'g WX cb : XYf '6Y[]bb : XYg '5 VYb Xg '[Y\h gWX]YZ 'I bfi \Y']b : XYf : Ua]`]Y Z rd Y]b`]WX Y : Ui I d Ug 'i b X i b Ub[YbY\a Y : K U\f\Y]hYb 'VfY WX Yb ']b : X]YgYf 'hi fVi `YbhYb ? ca OX]Y 'Ubg '@]WX h"$

8]Y'JYfk]W_`i b[Yb'fi bX'i a 'XUg'5VYbXYggYb'Ybhdi ddYb'g]W\'U`g Y]b'W\Uch]gW\Yg'Gd]Y`ž'VY]'XYa 'X]Y'ZUa]`]ÀfY': UggUXY'fUgUbh VfÒW_Y`h"'5i Z'\i a cfj c``Y'K Y]gY'k]fX'Ui Z[YnY][hž'k]Y'gW\kYf'Yg gY]b'_Ubbž'XYb'[YgY``gW\UZh`]W\Yb'5bgdfØW\Yb'[YfYW\h'ni kYfXYb"'<]Yf'k]fX''YXYf'ni a '@UW\Ybž'UVYf'Ui W\'ni a BUW\XYb_Yb'Ub[YfY[h'

9]b hU`Ybh]YfhYg HYUa a]h VYY]bXfi W_YbXYa <]bhYf[fi bX

G]a cb'JYf\cYjYbž'a Y\fZUW\'Ui g[YnY]W\bYhYf'FY[]ggYi fž'Vf]b[hgY]bY'_fYUh]j Y'J]g]cb'Ui Z'X]Y'@Y]bk UbXž'i bhYfghØhnh'j cb

 $DfcXi \ nYbhYb \ k \]Y \ E \ i \]f]b \ GYf[\ i \ bX \ ? \]fgh]b \ K \]b \ Yfz \ X]Y \ YVYb \ ZU \ Y \ Yfz \ X]Y \ YVYb \ ZU \ YfY \]b \ XYf \ : \]a \]b \ Xi \ ghf]Y \ [\ YZY \]Yfh \ UVYb \ UVYb \ UVYb \ Yf \ Yff \ Yf$

8]Y: ÒfXYfi b['XYg':]`a g'_Ua 'j cb'j YfgW\]YXYbYb '\dot gh]hi h]cbYbž XUfi bhYf'XYf'8 Yi hgW\Y:]`a ZÒfXYfZcbXg'i bX'XUg'A YX]YbVcUfX 6Yf`]b!6fUbXYbVi f[ž'k Ug'Y]ba U``a Y\f'X]Y'6YXYi hi b['XYg Dfc Y_hg'i bhYfghfY]W\h'''9]b'YW\hYf'J c``hfYZZYf']b'XYf'XYi hgW\Yb :]`a `UbXgW\UZhž'XYf'a]h'j]Y`Yb'9a ch]cbYbž'@UW\Yb'i bX'j]Y``Y]W\h Ui W\'Y]b'dUUf'YfbghYb'; YXUb_Yb'Ui Zk UfhYh''

.

8 YhU]`g

6Ygi WXYb G]Y i bg Ui Z a Y]b!VYf`]b bYh