

$GWX i gg^{M}h']b'; chVU.'A cgYg'7UZÅgWX ^]Y » h'bUWX 'gWX k YfYb'NY]hYb$

8 Ug` A cgYg`7 UZÅ `]b`; ch\U`gW\`]Y» h`Ua `' %"`5 i [i gh`&\$&(Ui Z[fi bX`ghY][YbXYf`? cghYb`i bX`: `ÀW\Ybj Yf_`Y]bYfi b[` Y]b`J Yf`i gh`ZØf`X]Y`7 ca a i b]hm"

±0.H\Øf]b[Ybžk c.a Ub.g]W\nfUX]h]cbY``; Ya Øh`]W_Y]hi bX; Ybi gg j YfV]bXYhžk i fXY XUg 9bXY ZØfY]bYb VY`]YVhYb HfYZZdi b_h Y]b[Y`Ài hYh"8Ug AcgYg 7UZÅ / KY]bVUf]b; ch\UžY]b CfhžXYf ZØfj]Y`Yni Y]bYa nk Y]hYb Ni \Ui gY [Yk cfXYb]ghžk]fX Ua '' %" 5i [i gh'&\$&(YbX[Ø`h]['gW\`]Y» Yb" 8]Y 6YhfY]VYf \UVYb X]YgY 9bhgW\Y]Xi b['gW\k YfYb < YfnYbg'j Yf_ØbXYhi bX XUVY]'Ui Z'X]Y < YfUi gZcfXYfi b[Yb'j Yfk]YgYbža]h'XYbYb'; Ughfcbca]YVYhf]YVY]b`XYf FY[]cb \Yi hni hU[Y'_cbZfcbh]Yfh'g]bX"

 $5a \ "A \ cbhU[\ a \ cf[\ Ybž'XYa\ "%-""5i \ [i \ ghž'hY]`hY "XUg"7 UZÅ" @VYf"gY]bY : UWYVcc_!GY]hY "a \]hž'XUgg"a Ub "Ui Z[fi bX"j cb "ghUf_"[Ygh]Y[YbYb 6Yhf]YVg_cghYb "i bX"Y]bYf"j ca "J Yfa]YhYf"Ub[Y_@bX][hYb : `AWXYbj Yf_`Y]bYfi b['_Y]bY"UbXYfY"K U\``\UVY""GY`Vgh"VY]"Y]bYa dcg]h]j Yb "6Yhf]YVgYf[YVb]g"g]bX"X]Y"k]fhgWX UZh`]WXYb <math display="block">F \ U\ a \ YbVYX]b[i \ b[Yb "gc "VY"UghYbXž"XUgg"Y]bY": cfhZ@\ fi b["XYg 7 UZÅg"b]WX h'a Y\f"hfU[VUf"]gh"" 8]YgY"9bhgWXY]Xi b["Z]Y`"i bg"U``Yg UbXYfY"U"g"Y]WX h ž"gWX fY]VYb"X]Y"6YhfY]VYf"$

K Y]hYfY 9f]bbYfi b[YbibX 5VgWX]YX

5`g`_`Y]bYg`HfcghdZUghYf`\UVYb`X]Y`6YhfY]VYf`VYgWX`cggYbž'bUWX XYf`cZZ]n]Y``Yb`GWX`]Y»ib[`bcWX`Y]b``YhnhYg`AU``ZØf`]\fY; ÀghY`ni ÒZZbYb"`5a `+"`GYdhYa VYf`gc```Y]b`: Ua]`]YbZfØ\ghØW_`ghUhhZ]bXYbž Y]b`5b`Uggž'XYf`ZØf`j]Y`Y`GhUaa[ÀghY`jcb`6YXYihib[`]gh'ibX 9f]bbYfib[Yb`kYW_h"`K]f`k]ggYbž'XUgg`X]Y`GWX`]Y»ib[`XYg $A cgYg`7UZÅg`Y]bY`@W_Y`\]bhYf`UggYb`k]fX"`8cW`X]Y`gW\ObYb \\ 9f]bbYfib[Ybz`X]Y`\]Yf`[YgW\UZZYb`kifXYbz`kYfXYb`]b`ibgYfYb \\ <YfnYb`kY]hYf`YVYb z`Yf_`ÀfhYb`q]Y`kY]hYf"$

 $8]Y `B UWX f]WX h'j cb `XYf `GWX `]Y `> i b[`]gh'b]WX h'bi f' ZØf' X]Y `6YhfY]VYf Y]b `gWX k YfYf `GWX `U[ž'gcb XYfb `VYfØ\ fh'Ui WX `X]Y `< YfnYb `XYf ; ÀghY" ?ca a YbhUfY `Ui Z'gcn]U`Yb `A YX]Yb `nY][Yb `X]Y `6Yhfc ZZYb\Y]h XYf ; ch\UYf. `8 Ug `hi h'i bg `gY\f `Y]X" `K]f' k ØbgWXYb `=\ bYb `U``Yg ; i hY `ZØf' =\ fY `Ni _i bZh ž'gWXf]YV `Y]b `I gYf" `8]YgY `F ØW_a Y`Xi b[Yb j YfXYi h`]WXYbž'k]Y `k Yfhj c```XUg' 7 UZÅ `ZØf' X]Y `; Ya Y]bgWX UZh'k Uf i bX `k Y`WXY'6YXYi hi b[`Yg'U`g' HfYZZdi b_h'ZØf' gcn]U`Yb `5i ghUi gWX \UhhY"$

a ?cbhYl h'XYf'; Ughfcbca]YgnYbY']b'XYf'FY[]cb']gh'XUg' A cgYg Y]b'k Y]hYfYg'6Y]gd]Y`'ZØf'X]Y'GWkk]Yf][_Y]hYbž'a]h'XYbYb 6YhfY]VYf''Yhnh'ni '_Àa dZYb'\UVYb'''8Yf'JYf'i gh'Y]bYf'gc`WkYb ₺gh]hi h]cb'VYhcbh'X]Y'8f]b[`]Wk_Y]h'j cb'A U» bU\a Yb'ni f l bhYfghØhni b['XYf'; Ughfcbca]Yž'XUa]h'b]Wkh'bi f'dYfgÒb`]WkY HfU[ÒX]Ybž'gcbXYfb'Ui Wk'XUg'_i `hi fY``Y'@YVYb']b'GhÀXhYb'`Y]XYh'' ≯XYg'[YgWk`cggYbY'@c_U``Vf]b[h'X]Y'; YZU\f'a]h'g]Wkž'XUgg BUWk Zc`[Yb'ZY\`Yb'i bX'X]Y'_i `]bUf]gWkY'J]Y`ZU`h'UVb]a a h''

8]Y'<YfUi gZcfXYfi b[Yb'XYf'; Ughfcbca]Y']b H\Øf]b[Yb

8]Y'[Y[Ybk Àfh][Yb'FU\a YbVYX]b[ib[Yb'ghY``Yb'j]Y`Y']bbcjUh]jY; Ughfcbca]YdfcY_hY'jcf'Yf\YV`]W\Y'<ØfXYb"'8]Y'9f\Ò\ib[XYfAUhYf]U`!'ibX'6Yhf]YVg_cghYbž'[Y_cddY`h'a]h'XYa'8fiW_'UiZ'X]YA]YhYbž'\UVYb'_Uia'bcW\'Gd]Y`fUia'ZØf'9fZc`['ibX'KUW\ghia''9g'ghY``h'g]W\'X]Y':fU[Yž'k]Y'gc`W\Y'CfhYž'X]Y'Y]bYf'GhUXh']\fYb7\UfaY'jYf`Y]\Ybž']b'Ni_ibZh'Yf\U`hYb'V`Y]VYb'_ÒbbYb"'8]Y9fZU\fib[Yb'jca'7UZ\A'AcgYg'_ObbhYb'U`g'6Y]gd]Y``ZØf'UbXYfY6YhfY]VYf'X]YbYbž'X]Y'g]W\'YVYbZU``g']b'Y]bYf'dfY_AfYb'G]hiUh]cbVYZ]bXYb"

: Øf'X]Y'6Yhcbi b['XYf'K]W\h][_Y]h'gc`W\Yf'@c_U`]h\hYb']gh'Yg i bYf\hgg`]W\ž'XUgg'X]Y'; Ughfcbca]YVfUbW\Y']bg[YgUa h'gh\hf_Yf i bhYfghØhnh'k]fX"'8]Y'; Ughfcbca]Y'gcf[h'b]W\h'bi f'ZØf'XUg `Y]V`]W\Y`K c\`ž'gcbXYfb`Ui W\`ZØf`Y]b``YVYbX][Yg`Gcn]U``YVYb`i bX\Uh`Y]bYb`i bj Yfn]W\hVUfYb`GhY``Ybk Yfh`]b`XYf'; Ya Y]bgW\UZh"

 $\label{thm:converse} Hfchn: XYfigWk YfYb: 9bhgWk Y]Xib[:V`]W_Yb:X]Y: 6YhfY]VYf: XYg \\ AcgYg: j:c``Yf: 8Ub_VUf_Y]h'UiZ:X]Y: J\fY: nif@W_ž: X]Y: g]Y: a]h \\]\fYb:; AghYb: j:YfVf]b[:Yb:XifZhYb::8]YgY:, VYf`Y[:ib[:Yb:`UggYb:Yf_YbbYbž: XUgg:Yg:b]Wk: h'bif: a:Y]b: 7UZA: [:Y\hž:gcbXYfb::a:Y]bY \\ 5fh: @YVYbg[:YZØ\`ž:XUg:]b:; ch\U'j:Yf`cfYb::[:Y\h":Ni:a:]bXYgh:V`Y]Vh \\ XYb:; ch\UYfb:X]Y: < cZZbib[:ž:XUgg:VU'X:Y]b:bYiYg:?cbnYdh:cXYfY]bY:bYiY:=XYY:X]Y: @W_Y:ZØ``hž:X]Y:XUg::AcgYg::\]bhYf`Aggh"$

9]b 9fVY XYf; UghZfYi bXgWX UZh

8]Y; YgWX]WXhY; XYg; A cgYg; 7 UZÅg; k]fX;ghYhg;]b; XYb
9f]bbYfi b[Yb; XYf; A YbgWXYb; kY]hYf; YVYbž; X]Y; Xcfh; VYgcbXYfY
A ca YbhY; Yf; YVh; \UVYb; 9]bY; GWX;]Y» i b[; _ca a h; cZh; UVfi dh; i bX \]bhYf; Aggh; fU[Yb; bUWX; XYf; Ni _i bZh; K c; k]fX; XYf; bAWX; ghY; D; Uhn
ni a '9bhgdUbbYb; i bX; Yb]Y; Yb; gY]b3;8]Y; GY\bgi WXh; bUWX
; Ya Y]bgWXUZh; i bX; Ya Øh;]WX_Y]h; V; Y]Vh; i b[YVfcWXYbž; i bX
j]Y; Y]WXh; k]fX; X]YgY; 9fZU\fi b[; 5bfY]n; ZØf; ni _ØbZh][Y
I bhYfbY\a Yf; gY]bž; bYi Y; Ughfcbca]Y_cbnYdhY; ni Ybhk]W_Y; bž
X]Y; Ui WX;]b; X]YgYb; \YfUi gZcfXYfbXYb; NY]hYb; Ui ZV; Ø\Yb; _ObbYb;

9]b 'VYgcbXYfg'VYa Yf_Ybgk YfhYf'5gdY_h'X]YgYf'9bhk] W_i b[']gh X]Y 'F YU_h]cb 'XYf'J YfVfUi W\Yf'Ui Z'X]Y 'DfY]gghY][Yfi b[Yb"'C Zha U`g \UVYb'X]Y'?i bXYb'Ui Z[fi bX'XYf'\O\YfYb'DfY]gY'i bX'XYf Z]bUbn]Y``Yb'I bg]W\Yf\Y]hYb'VY]']\fYa ': fY]nY]hj Yf\U`hYb'[YgdUfhž

k Ugʻni 'Y]bYa 'FØW_[Ub['XYf'; ÀghYnU\`Yb']b'j]Y`Yb'FYghUi fUbhg i bX'7UZÅg'ZØ\fhY"'@Ui h'XYa 'GhUh]ghU'g]bX'X]Y'l a gÀhnY'XYf; Ughfcbca]Y']b'8Yi hgW\`UbX']b'j YfgW\]YXYbYb'GY[a YbhYb'&\$&&i a 'V]gʻni '&\$'DfcnYbh']a 'JYf[`Y]W\'ni 'XYb'Jcf'U\fYb'[Ygi b_Yb"

< YfUi gZcfXYfi b[Yb`ZØf`X]Y`H\Øf]b[Yf ; Ughfcbca]Y</pre>

8]YgY'gWkk]Yf][Yb'6YX]b[ib[Yb'\UVYb'VYfY]hg'ni a Y\fYfYbGW\] [Yb']cb'7UZÅg'ibX'FYghUifUbhg']b'H\Øf]b[Yb'[YZØ\fh''8Yf'FØW_[Ub['jcb'bYiYb'; Ughfcbca]Y[fØbXib[Yb']gh'YVYbZU``gU`Ufa]YfYbX''KÀ\fYbX']a'\\\f'&\\$%-'bcW\'fibX'''\\$\\$\'bYj\Y\']b'8YihgW\`UbX'YfÒZZbYh'kifXYbž'kUfYb'Yg]a'\\\f'\&\\$\&\`YX][`]W\'YhkU'\\"+\\$\\"8]Yg']gh'Y]b'6YkY]g'ZØf'X]YGWk\]Yf][_Y]hYbž'X]Y'9I]ghYbn[fØbXib[Yb']b'X]YgYa'GY_hcfacaYbhUb'\UVYb''

² _cbca]gWX Y i b X 'gcn]U `Y '5 i gk]f_i b[Yb

→W. `\cZZY ž'XUgg'X]Y `GhUXhj Yfk U`hi b[`]b'; ch\U'A U» bU\a Yb
Yf[fY]Zhži a `X]Y ``c_U`Y'; Ughfcbca]Y `ni `i bhYfghØhnYbž'XYbb'k]f
VfUi W. Yb'X]YgY `CfhYž'i a `i bg'ni `hfYZZYb'i bX'XUg
; Ya Y]bgW. UZhg[YZØ\``ni `ghÀf_Yb ž'Ài » YfhY'Y]b `5bk c\bYf']b
Y]bYa `Cb`]bY!? ca a YbhUf"'8]Y `6YXYi hi b[`gc`W. Yf`6Yhf]YVY `ZØf
XYb `gcn]U`Yb `Ni gUa a Yb\U`h'_Ubb'b]W. h'\cW. `[Ybi [`Y]b[YgW. Àhnh k YfXYb"

8]Y', VYfbU\a Y'j cb'`YYfghY\YbXYb': `ÀWXYb'Xi fWX'bYi Y I bhYfbY\a Yb'k ÀfY'Y]b'dcg]h]j Yg'NY]WXYb'ZØf'X]Y'GhUXh'i bX k ØfXY`\Y`ZYbž'X]Y`k]fhgW\UZh`]W\Y`G]hi Uh]cb'j cf'C fh'ni ghUV]`]g]YfYb"`K]W\h][']ghž'XUgg'X]Y`bÀW\ghYb'6YhfY]VYf'j cb`YYfghY\YbXYb'7UZÅg'i bX'FYghUi fUbhg'X]Y'bchk YbX][YbI bhYfghØhni b[Yb'Yf\U`hYbž'i a 'YfZc`[fY]W\': i »'ni 'ZUggYb"

8 Y hU]`g

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