

## @UbXYgfY[]Yfi b['ghÀf\_h GWXi`XbYfVYfUhi b[

8]YGWiXbYfVYfUhib[gghYYb]aGUbXYfVUhYbY]bY $\O\YfY\ghUUh\]WXY: OfXYfib["8]Y 6YfUhib[gghY``Yb]$ i bhYfghØhnYb 6Øf[Yf]bbYb i bX 6Øf[Yf'Ui Z']\fYa 'K Y['Ui q  $XYf^{G}W_{i}^{Y}D^{Y}_{i}^{U}Y^{i}bX^{Y}_{j}ghYb^{X}Ua^{h}Y_{b}Yb^{K}W_{h}[Yb^{H}_{i}^{H}_{i}^{H}_{j$ 6Y]hfU[ 'ni f'5fa i hgVY\_Àa dZi b[ ž']bgVYgcbXYfY ']b 'XYf 7 cfc bU!? f] gY":  $\emptyset \text{ f'} \text{ [NY 5 fVY]} \text{ h']} \text{ a 'Ui » Yf} \text{ Yf} \text{ [WN h']} \text{ WYb}$ JYfVfUi WXYf]bgc`j Ybnj YfZU\fYb Yf\U`hYb X]Y \_ca a i bU`Yb ibX'[YaY]bb@hn][Yb'GW\i`XbYfVYfUhib[gghY``Yb']a  $GØXk YghYb Y]bY \wedge O \wedge YfY ghUUh W Y : OfXYfi b["8]Y$ YbhqdfYWXYbXY': U``dUi qWXU`Y'k ]fX'i a 'fi bX'nY\b'DfcnYbh  $Yf\\hat{O}\hi$  bX XUa ]h Ub X]Y YVYbZU``g Yf\ $\hat{O}\hY$ 5bk U`hqj Yf[ Øhi b[ 'Ub[ YdUqqh": Øf'X]Y :: U``dUi qW\U`Yb '[ UV XUg'@UbX'&\$%- 'i bX'&\$&\$']bg[YgUa h'fi bX'' ž\*'A]``]cbYb'9i fc Ui q" 8 ]Y GWX i `XbYfVYfUhi b[ gghY``Yb ]a @UbX ``Y]ghYb 'Y]bYb k | W h | [ Y b '6 Y ] h f U [ 'n i f '5 f a i h g V Y \_ A a d Z b [ " 'G ] Y 'Y f a O [ `] W Y b  $Ygža Y f 6 Øf[ Yfb Y]bYb K Y[ / Ua d \ Y^*]d/$ 

8]Y'GWXi`XbYfVYfUhi b[gghY``Yb']a '@UbX'Yf\U`hYb'Y]bY \O\YfY'ghUUh`]WXY': OfXYfi b["'8]Y'6YfUhi b[gghY``Yb i bhYfghØhnYb'6Øf[Yf]bbYb'i bX'6Øf[Yf'Ui Z']\fYa'K Y['Ui g XYf'GWXi`XYbZU``Y'i bX'`Y]ghYb'XUa]h'Y]bYb'k]WXh][Yb 6Y]hfU['ni f'5fa i hgVY\_Aa dZi b[ž']bgVYgcbXYfY']b'XYf 7cfcbU!?f]gY"

: Øf']\fY'5fVY]h']a 'Ui » Yf[ Yf]WX h`]WX Yb
J YfVfUi WX Yf]bgc`j Ybnj YfZU\fYb'Yf\U`hYb'X]Y'\_ca a i bU`Yb'i bX
[ Ya Y]bbØhn][ Yb'GWXi `XbYfVYfUhi b[ gghY``Yb']a 'GØXk YghYb'Y]bY
\O\YfY'ghUUh`]WXY': OfXYfi b[ "'8]Y'YbhgdfYWXYbXY': U``dUi gWXU`Y
k ]fX'i a 'fi bX'nY\b'DfcnYbh'Yf\O\h'i bX'XUa ]h'Ub'X]Y'YVYbZU``g
Yf\O\hY'5bk U`hgj Yf[ Øhi b[ 'Ub[ YdUggh"': Øf'X]Y': U``dUi gWXU`Yb

[ UV XUg @UbX &\$%- i bX &\$&\$ ]bg[ YgUa h'fi bX ' ž\* 'A ]``]cbYb '9i fc Ui g"

8]Y'GW\i`XbYfVYfUhi b[gghY``Yb']a '@UbX'`Y]ghYb'Y]bYb'k]W\h][Yb6Y]hfU['ni f'5fa i hgVY\_\Aa dZi b["'G]Y'Yfa \O[\`]W\Yb'Ygž'a Y\f6\Of[Yfb'Y]bYb'K Y['Ui g'XYf'GW\i`XYbZU``Y'ni 'nY][Yb"'A]h'XYfUi Z[Yghc\W\_hYb': \OfXYfi b['k c``Yb'k]f']\f'9b[U[Ya Ybh'gh\Af\_Yb'i bXXUa]h'bc\W\aa Y\f'6\Of[Yf]bbYb'i bX'6\Of[Yf'Ui g']\fYbd\Yb'?f]gYb'Z\O\fYb\Zgc'Gcn]U\aa|b]ghYf]b'\Aa UbbY'\@i \W\U''

## &\$&%'i bX'&\$&&'^Yk Y]`g'ØVYf'nk Y]'A ]``]cbYb 9i fc

: Øf'X]Y'5b\YVi b['XYf': U``dUi gW\U`Y'i a 'fi bX'nY\b'DfcnYbh'i bX Y]bYb'dfc[bcgh]n]YfhYb'5bgh]Y['XYf'UbhfU[ghY``YbXYb'GW\i `XbYf Ui Z[fi bX'XYf'7cfcbU!?f]gY'gc``'XYf'GhUUhg\Ui g\U`h']b'X]YgYa 'i bX ]a 'bÀW\ghYb'\J\f'YkY]`g'ØVYf'nkY]'A ]``]cbYb'9i fc'\UVYb"

## I bhYfghØhni b[ 'VY] =bgc j Ybnj YfZU\fYb

8 UgʻJ YfVfUi WXYf! cXYfʻDf]j Uh]bgc`j Ybnj YfZU\fYbʻ]gh'Y]b
a Y\fghi Z][ YgʻJ YfZU\fYbž'VY] XYa `]a `YfghYbʻGWXf]hhʻY]b
Ui »Yf[ Yf]WXh`]WXYgʻJ Yf[ `Y]WXgj YfZU\fYbʻa ]hʻI bhYfghØhni b[
\_ca a i bU`YfʻcXYfʻ[ Ya Y]bbØhn][ YfʻGWXi `XbYfVYfUhi b[ gghY``Yb

c XYf'F YWX hgUbk À'hY'Xi fWX [ YZØ\fh'k YfXYb'a i gg"'8 Yf'GWXi `XbYf a i gg'j Yfgi WXYbž'a ]h'XYb'; `Ài V][ Yfb'Y]bY'9]b][i b[ 'ØVYf'X]Y GWXi `XYbfY[ Y'i b[ 'ni 'Yfn]Y`Yb"'? ca a h'X]YgY'9]b][i b[ 'b]WXh ni ghUbXYž'Zc`[ h'XUg'; Yf]WX hgj YfZU\fYb"'? Ubb'Xcfh'nk ]gWXYb; `Ài V][ Yf'i bX'GWXi `XbYf'\_Y]bY'9]b][i b[ 'Yfn]Y'h'k YfXYbž'Zc`[ h'XUg [ Yf]WXh']WXY'J YfVfUi WXYf]bgc`j Ybnj YfZU\fYb"'8 UbUWX 'VY[ ]bbh'XUg FYghgWXi `XVYZfY]i b[ gj YfZU\fYb'a ]h'Y]bYf K c\`j Yf\U`hYbgdYf]cXY"'BUWX '5V`Ui Z'XYf'; YgWXÀZhgcfXbi b[ Yf`Aggh'XUg'; Yf]WXh'Ui Z'5bhfU[ 'X]Y'FYghgWXi `X'XYg'GWXi `XbYfgž k Ybb'\_Y]b'J YfgU[i b[ g[ fi bX'j cf`]Y[ h"

a '8 YnYa VYf'&\$&\$`\Uh'XYf'6i bXYg[YgYhn[YVYf'X]Y
8i fW ZØ\fi b[gZf]gh'j cb'gYW g'Ui Z'XfY]'>U\fY'j Yf\_Øfnh"'8]Yg
ZØ\fh'ni 'Y]bYf'U\_hi Y```\Ò\YfYb'5i g`Ughi b['XYf
GWXi `XbYfVYfUhi b[gghY``Ybž'XU'j]Y`Y'GWXi `XbYf'Ui Z'X]Y
Ub[Y\_ØbX][hY'; YgYhnYgÀbXYfi b['[Yk UfhYh'\UVYb"

A ]b]ghYf]i a 'ZØf'Gcn]U`Ygž'; Ygi bX\Y]h'i bX'=bhY[fUh]cb. JYfVfUi W\Yf]bgc`j Ybn'fFYghgW\i `XVYZfY]i b[Ł

A ]b]ghYf]i a 'ZØf'Gcn]U`Ygž'; Ygi bX\Y]h'i bX'=bhY[fUh]cb. 6YfUhi b['i bX'l bhYfghØhni b['VY]', VYfgW\i `Xi b[

 $e^{-\epsilon}$ 

bgd]f]Yfh'j cb'@UbXYgfY[]Yfi b['6K

8 YhU]`g

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