

F 76 '_fÒbh'g]W\'ni a 'YfghYb'=D@!7\Ua d]cb '?c\`]'YbX`]W\'Ub'XYf'Gd]hnY'

5`` \forall lnYYfU`VYf]W\hYh`ØVYf`XYb`YfghYb` \Rightarrow @!H]hY``XYf`FcmU` 7\U``Yb[Yfg`6Yb[U`i fi ž`X]Y`Di b'\UV'?]b[g`]a ::]bU`Y VYg]Y[hYb"



F76'VY[Ubb'X]Y'DUfh]Y'a]h'Y]bYa 'gc`]XYbž'k Ybb'Ui W\'b]W\h ØVYfk À`h][YbXYb'GhUfh"'?Ud]hÀb'J]fUh'?c\`]ž'XYf'gY]h'&\$\$, 'a]h XYa 'HYUa 'j YfVi bXYb']ghž'k Uf'a]h'(' 'Fi bg'XYf'VYghY'GW\`À[Yf ZØf'F76"'?fi bU`'DUbXmU'Yfk]Yg'g]W\'U`g'GW\`ØggY`gd]Y`Yf'a]h'XYf 6U``ž']bXYa 'Yf'nk Y]'K]W_Yhg'ZØf'%+'Fi bg']b'j]Yf'Cj Yfg'Yfn]Y`hY"

K À\fYbX`XYf`YfghYb`\db]b[g'j Yf`cf`F 76`ZfØ\`D\]``GU`hž`XYf`bi f`%*
Fi bg`XYb`GWcfY`VY]ghYi YfhY"'?c\`]`gW\`cgg'g]W\`a]h`A UmUb_
5[Ufk U``f&(`Fi bgŁi bX`FU'Uh`DUh]XUf`f&* `Fi bgŁini gUa a Ybž`VYj cf
XUg`HYUa 'a]h`%-\$`Fi bg`ZØf`- `K]_Yhg`]b`&\$`Cj Yfg`YbXYhY"

8Yf JYf `Ui Z XYg `Gd]Y `g

 $8]Y `Di b 'UV `?] b [g``Y[hYb `a]h `C ZZY bg] j gd] Y `Yfb `k] Y `Df] m Ubg \ `5 fm U f \& (`Fi bg \& i b X `Df UV \g] a f Ub `G] b [\ `f \& * `Fi bg \& Y] b Y b j]Y `j Yfg d f Y W \ Y b X Y b `Gh Ufh `\]b "\ 5 ``Yf X] b [g`_Ua `X Y f`? b U W_di b_h ž U `g` G \ f Y m Ug` = m Y f`] b `X Y f` % $ "`C j Y f` ZØ f` bi f` % `Fi b` Ui gg W \]Y X ž `k Ug` X] Y 8 m b Ua]_ `X Y g` G d] Y `g` A b X Y f h Y "` <math>\approx$ g \ `=\begin{align*} \left(`]g `j Y f gi W \ h Y ž X] Y `K Y b X Y a]h '' - `Fi bg` Ui g` & '` 6 A``Y b` \ Y f V Y] ni ZØ \ f Y b ž `k i f X Y `U V Y f` Y V Y b Z U`` g j c b` D U b X m U` [Y g h c d d h "` 5 a `9 b X Y `k i f X Y `G \ Ug \ Ub_ `G] b [\ ž X Y f` * % Fi bg`] b '' \$ `6 A``Y b` Y f n] Y` h Y ž `U` g``Y h n h Y f` < c Z Z b i b [gh f A [Y f` Z Ø f` D i b ' U V Ui g [Y g W X `c g g Y b ž `k Ug` g] Y`] b` X Y f` G W `i g g d \ Ug Y` X Y g` G d] Y` g ni f Ø W_k U f Z"

 $8]Y `\ Yfj \ cffU[\ YbXY'6ck `]b[\ !DYfZcfa \ UbWY'j \ cb`F 76z'VYgcbXYfg']b XYf YbhgWX Y]XYbXYb`D\ UgYz`\]Y`h'Di b'UV`XUj \ cb`UVz'XYb`N]Y`k Yfh ni `YffY]WXYb''' <math>\approx$ g\ '< Un`Yk ccXz'XYf'YVYbZU``g'Y]bY'k]WXh][Y`Fc``Y gd]Y`hYz'_cbbhY'Y]b'K]W_Yh'ZØf'F 76'j YfVi WXYb'i bX`XfØW_hY'gc XYa `Gd]Y``gY]bYb'GhYa dY``Ui Z''8]Y'6ck `Yf'j cb'Di b'UVz [Y_YbbnY]WXbYh'Xi fWX '5fg\XYYd'G]b[\'fl!(\$\L'i bX'?m'Y'\Lambda]Ygcb fl!(,\Lz'_cbbhYb'nk Uf'Y]b][Y`K]W_Yhg'bY\a Ybz'fY]WXhY''YXcWX b]WXh'ZØf'XYb'G]Y["

9a ch]cbYb i bX : Y]Yf`]WX _Y]hYb

BUWW 'XYa 'Gd]Y``Ài » YfhY'?c\`]'gY]bY'9f`Y]WW hYfi b['XUfØVYfž'XUgg F 76 'YbX`]WW 'XYb'H]hY`'[Yk cbbYb'\Uhž'bUWW 'Y]bYf'FY]\Y'j cb nk Y]hYb'D`ÀhnYb']b'XYb' \forall U\fYb'&\$\$- ž'&\$%%'i bX'&\$%*''' 9g']gh'Y]bY [fc» Y'9f`Y]WW hYfi b[ž'X]Y'I bhYfdYfZcfa Yf!A Uf_Y'UVni `Y[Ybž_ca a Ybh]YfhY'?c\`]''5i WX' \approx g\'<Un`Yk ccX'Yf_UbbhY'X]Y 6YXYi hi b['XYg'; Yk]bbg'ZØf'?c\`]ž'XYf'gc'`Ub[Y'HY]`'XYf : fUbWW]gY']gh'i bX'bi b'YbX`]WW'XYb'9fZc`['ZY]Yfb'_Ubb''

cf[Ub]g]Yfh'k]fXž\Uh'g]W\ 'ni 'Y]bYa 'XYf'[fÒ> hYb'i bX a Y]gh[YgY\YbYb'7f]W_Yh!Hi fb]YfY'XYf'K Y`h'Ybhk]W_Y`h''8]Y'@][U Vf]b[h'X]Y'VYghYb'7f]W_Yh!HU`YbhY']b'Y]bYa 'gdUbbYbXYb H&\$!: cfa Uh'ni gUa a Yb'i bX'\Uh'Y]bY'ghUf_Y'5b\Àb[YfgW\UZh'' F 76g'Hf]i a d\ 'a Uf_]Yfh'Y]bYb'k Y]hYfYb'Ui ZfY[YbXYb'A ca Ybh']b XYf'; YgW\]W\hY'XYf' \oplus @'i bX'k]fX'g]W\Yf']W\']b'XYb'_ca a YbXYb \\\J\fYb'Z\Øf'; Ygdf\\W\Y'gcf[Yb''

Đ@AY]ghYf

&\$\$, .`FU^Ugh\Ub`FcmU`g`fFFŁ
&\$\$`8YWWUb`7\Uf[Yfg`fB97Ł
&\$%\$.`7\YbbU]`Gi dYf`?]b[g`fl7G?Ł
&\$%%.`7\YbbU]`Gi dYf`?]b[g`ff7G?Ł
&\$%&.'?c`_UhU'?b][\h'F]XYfg'fp?FŁ
&\$%'.`AiaVU]'+bX]Ubg'fA+Ł
&\$%(.'?c`_UhU'?b][\h'F]XYfg'fp?FŁ
&\$%) Aia VU] +bX]Ubg fA +Ł
&\$%*.~Gi bf]gYfg~< mXYfUVUX~fGF < Ł
&\$%+.`AiaVU]`±bX]Ubg`fA±
&\$%, .'7\YbbU]'Gi dYf'?]b[g'ff7G?Ł
&\$%'Aia VU]'±bX]Ubg'fA ±
&\$&\$. `Aia VU] ±bX]Ubg fA ±
&\$&%.'7\YbbU]'Gi dYf'?]b[g'ff7G?Ł
&\$&&.; i 'UfUh'H]hUbg'f HŁ
&\$&'.'7\YbbU]'Gi dYf'?]b[g'ff7G?Ł
&\$&(.'?c`_UhU'?b][\h'F]XYfg'f??FŁ
&\$&). FcmU`7\U`Yb[Yfg'6Yb[U`ififF76Ł

 $: \emptyset f'k Y]hYfY' + bZcfa Uh]cbYb'VYgi WkYb'G]Y'X]Y'5fh]_Y`'j cb'5` \\ \times UnYYfUž'7f]W_Yh'5i ghfU`]U'i bX': fYU_'7f]W_Yh''$

8 YhU]`g	
J c f ZU``	Gdcfh
Cfh	5∖a YXUVUXž'⊕X]Yb
EiY``Yb	• k k k "U`^UnYYfU"Wca
	• k k k "Wf]W_Yh"Wca "Ui
	 ZfYU_Wf]W_Yh"Wca

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