

I _fU]bY']b'5`Ufa VYfY]hgWX UZh. 'GY`Ybg_m^ ZcfXYfh'Xf]b[YbX'a Y\f'K UZZYb\]`ZY°

8 UgʻHfYZZYbʻ]bʻC XYggUʻUaʻ%&"\$*"&\$&)ʻghÀf_hʻX]Y I bhYfghØhni b[ˈZØfʻX]YʻI _fU]bYʻ]ba]hhYbʻgW\k YfYfʻ? Àa dZY [Y[YbʻFi ggʻUbX"



C XYggUžI _fU]bY'!'8Yf';]dZY`XYf'GhUUhg!'i bX'FY[]Yfi b[gWXYZgUi g'GØXcghYi fcdU']b'C XYggU'VfUW hY'bYi Y'<cZZbi b['ZØf'X]Y
I _fU]bY"'6Y]'X]YgYa 'HfYZZYb'Yf\]Y`h'XUg'@UbX'Ni gU[Yb'ZØf
ni gÀm`]WXY'K UZZYb\]`ZYbž'k]Y'GØXXYi hgWXY"XY'VYf]WXhYh''
5i »Yba]b]ghYf'5bXf]^GmV]\U'VYghÀh][hYž'XUgg' k Y]hYfY
JYfhY]X][i b[gdU_YhY 'j cb'a Y\fYfYb'@AbXYfb']b'5i gg]WXh'[YghY``h
k i fXYbž'c\bY'YXcWX'8YhU]`g'ni 'bYbbYb"'DfÀg]XYbh'K c`cXma mf
GY`Ybg_m^ghY``hY'X]Y'Bchk YbX][_Y]h'Y]bYf'j YfghÀf_hYb
a]`]hÀf]gWXYb'5i ZfØghi b[']b'XYb'A]hhY'di b_h'gY]bYf'5bgdfUWXY"'9f
Ài »YfhY'XYb'Jcfk i fZž'XUgg'Fi gg`UbX'k Y]hfY]WXYbXYfY
9fcVYfi b[gd'ÀbY'\Y[Y'i bX'k UfbhY'j cf'a Ò[`]WXYb'?cbZ]_hYb']b
XYf'FY[]cb'CXYggU'gck]Y'Ub'XYb'; fYbnYb'ni 'A c'XUk]Yb'i bX
Fi a Àb]Yb"

8Yf;]dZY`X]YbhY'b]W\h'bi f'XYf'8]g_i gg]cb'fY[]cbU`Yf'DfcV`Ya Yž gcbXYfb'Ui W\XYf'?ccfX]bUh]cb']bhYfbUh]cbU`Yf'<]`ZY'ZØf'X]Y
I_fU]bY"'GY`Ybg_m^ZcfXYfhY'i bhYf'UbXYfYa 'I bhYfghØhni b['ZØf'X]Y: `i [UVk Y\f'i bX'dc`]h]gW\Y'F ØW_YbXYW_i b['ZØf'XYb'9I!6Y]hf]hh''=bY]bYa 'VYk Y[YbXYb'A ca Ybh'j YfÒZZYbh`]W\hY'Yf'Y]b'J]XYcž']b'XYaYf'6`i a Yb'ZØf'[YZU``YbY'i _fU]b]gW\Y'Gc`XUhYb'b]YXYf`Y[h'' KÀ\fYbXXYggYb'fY]ghY'GYfV]Ybg'DfÀg]XYbh'5`YI UbXUf'Ji W]WYfgha U`g'gY]h'6Y[]bb'XYg'?f]Y[Yg']b'X]Y'I _fU]bY'i bX'j YfgdfUW\žg]W\Ua'K]YXYfUi ZVUi 'XYf'i _fU]b]gW\Yb'GhÀXhY'ni 'VYhY]`][Ybži bhYfnY]W\bYhY'YXcW\X]Y'GW\`i ggYf_`Afi b['XYg';]dZY`g'b]W\hž'XUX]YgY'GUb_h]cbYb'[Y[Yb'Fi gg`UbX'Ybh\]Y`h''

$A = \frac{1}{h} A f gWX Y @U[Y i b X ? Aa d ZY]$

8]Y'G]hi Uh]cb'Ub'XYf': fcbh'XYf'I _fU]bY'V`Y]Vh'Ub[YgdUbbh''' +b'XYb YhnhYb'&('Ghi bXYb'[UV'Yg'fi bX'&\$\$'a]`]hÀf]gWXY
Ni gUa a YbghÒ» Yž']bgVYgcbXYfY']a '; YV]Yh'8cbYn_"'Dc_fck g_']gh
XUVY]'Y]b'GWXk Yfdi b_h'XYf'Fi gg]gWXYb'5b[f]ZZY'a]h'Yhk U'*\$
JcfghÒ» Yb'''Ni XYa 'VYf]WXhYhY'a Ub'j cb'k Y]hYfYb
8fc\bYbUb[f]ZZYb']b'a Y\fYfYb'FY[]cbYb'XYf'I _fU]bY']b'XYf
BUWXh'ni a '8cbbYfghU["'A cg_Ui 'd`Ubh'ni XYa '?f]Y[g[YZUb[YbYb!5i ghUi gWXYž'VY]'XYbYb'Yg'g]W'i a 'GWXk Yfj Yf`YhnhY'\UbXY`b'gc``''

±0.7]Yk 'k i fXY'Ub`Àgg`]W\ 'XYg'Xf]hhYb' ±U\fYghU[Yg'XYg'fi gg]gW\Yb 5b[f]ZZg_f]Y[g'[Y[Yb'X]Y'I_fU]bY'Y]b'k Y]hYfYf';]dZY``a]h'9I!
Gd]hnYbj YfhfYhYfb'UV[Y\U`hYb"'N8: "XY'VYf]W\hYhž'XUgg'9I!
?ca a]gg]cbgdfÀg]XYbh]b'I fgi `U'j cb'XYf'@YmYb'X]Y'Gc`]XUf]hÀh'a]h
XYf'I_fU]bY'VYhcbhY'i bX'Yf_`ÀfhYž'XUgg'XUg'GW\]W_gU``9i fcdUg
Ui Z'XYa 'Gd]Y`ghY\Y"'=a 'A Àfn'&\$&) 'gc``X]Y'I_fU]bY'ni gÀhn`]W\'' ž)
A]``]UfXYb'9i fc'Yf\U`hYbž'Z]bUbn]Yfh'Xi fW\'N]bgYfhfÀ[Y'Ui g
Y]b[YZfcfYbYa 'fi gg]gW\Yb'GhUUhgj Yfa Ò[Yb"'6Y]XY'GY]hYbž'X]Y
a]`]hÀf]gW\Y'I bhYfghØhni b['XYf'I_fU]bY'i bX'X]Y'U``[Ya Y]bY
J YfhY]X][i b[gVYfY]hgW\UZh'XYf'9I ž'gc``Yb'j YfghÀf_h'k YfXYb"

K]fhgWX UZh`]WX Y '< YfUi gZcfXYfi b[Yb

8]Y'k]fhgW\UZh`]W\Yb'5i gk]f_i b[Yb'XYg'?f]Y[Yg'kYfXYb']a a Yf XYi h`]W\Yf'UbU`mq]Yfh"'8]Y'6i bXYgVUb_'i bhYfgi W\h']b']\fYa

Ni gàhn`]W\ k]fX`Y]b`F \emptyset W_[Ub[`XYf`5i g`UbXgbUW\ ZfU[Y`i bX XYi hgW\ Y`9I dcfhY`Yfk UfhYh"\8]Y`I bg]W\ Yf\Y]hYb`]a `A Uf_h _\ObbhYb`gck c\``[Yk YfV`]W\ Y`\bj Ygh]h]cbYb`U`g`Ui W\`XYb`df]j UhYb ?cbgi a `VY`UghYbž'k Ug`X]Y`[YgUa hk]fhgW\ UZh`]W\ Y`@U[Y`k Y]hYf j YfgW\ AfZYb`_\ObbhY"\8 Ug`F]g]_c`Y]bYg`XfUa Uh]gW\ Yb`5i gZU``g fi gg]gW\ Yf`9bYf[]Y`]YZYfi b[Yb`_\ObbhY`X]Y`]b`\AbX]gW\ Y`DfcXi _h]cb Yf\YV`]W\`\Ya a Yb"

8YhU]`g	
JcfZU``	?f]Y[gZØ\fib[
Cfh	CXYggUž'l _fU]bY
EiY``Yb	• kkk"giYXXYihgWXY"XY
	• k k k "nXZ\Yi hY"XY
	k k k "Vi bXYgVUb_"XY

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