

91 d`cfY'Cf`UbXc/ [\$'-/g'j]VfUbh'b][\h`]ZY'UbX YbhYfhU]ba Ybh'cdh]cbg'Zcf'U``'U[Ygž']bWi X]b['X]b]b['UbX ci hXccf'UWh]j]h]Ygž'Ug'cZ'; `m'&%z'&\$&)"



) %& '9 'K Ug\]b[hcb'Ghž'Cf`UbXcž': @'' &, \$%'!'K \Yb'h\Y'gi b g]b_g'VY`ck'h\Y'\cf]ncbž'Cf`UbXc'hfUbgZcfa g']bhc'U'j]VfUbh d`Um[fci bX'Zi ```cZ'YbX`Ygg'dcgg]V]`]h]Yg'Zcf'YbhYfhU]ba Ybh``cj Yfg cZ'U```U[Yg'''CZZYf]b['Ub'YI\]`UfUh]b['a]I'cZ'X]b]b[ž'g\cdd]b[ž'UbX fYj Y`fmž'h\YfY g'gca Yh\]b['Zcf'Yj YfmcbY']b'h\]g': `cf]X]Ub'[Ya"

5 WWcfX]b['hc'HfUj Y`&BYI hž'Cf`UbXc g'b][\h`]ZY']g'X]j YfgY'UbX YI W]h]b['ž'ZYUhi f]b['UWh]j]h]Yg'fUb[]b['Zfca'ci hXccf'W]bYa Ug'hc Y`YWhf]Zm]b['`]j Y'a i g]Wj Ybi Yg''<YfY'UfY'gca Y'cZ'h\Y'\chgdchg'Zcf Ub'i bZcf[YhhUV`Y'b][\h'ci h.

I ba]ggUV`Y`5 hhfUWh]cbg

- F]XY'h\Y'Cf`UbXc'9mY.'H\]g'hckYf]b['cVgYfjUh]cb'k\YY`Uh'=7CB'DUf_'cZZYfg'VfYUh\hU_]b['j]Ykg'cZ'h\Y'W]hm'UbX']gU'dYfZYWh'ghUfh'hc'Ubm'b][\h'cih'fl'+)'=bhYfbUh]cbU`'8fžCf`UbXcž':@''&, %-Ł"
- Ghfc```5fci bX'@U_Y'9c`U'DUf_.'K]h\']hg'WbhfU``kUhYf
 ZYUhi fYž'WcbWfhgž'UbX'Yj Ybhgž'h\]g'dUf_']g']XYU`'Zcf'U
 'Y]gi fY`m'Yj Yb]b['f) %&'9'K Ug\]b[hcb'Ghž'Cf`UbXcž': @
 ' &, \$%t"
- J]g]h'8]gbYm'Gdf]b[g.'H\]g'YbhYfhU]ba Ybh'UfYU']g
 Vf]a a]b['k]h\'`]j Y'g\ck gž'gWfi a dh]ci g'X]b]b[ž'UbX
 d'Ybhm'cZ'UWh]j]h]Yg'Zcf'ZUa]']Yg'f%(, *'6i YbU'J]ghU'8fž
 @U_Y'6i YbU'J]ghUž': @' &, '\$Ł"
- < Y`]WcdhYfB][\h'Hcif.': cf'h\cgY'gYY_]b['UXj YbhifYž h\YgY'hcifg'cZZYf'UYf]U`'j]Yk g'cZ'h\Y'W]hmgWUdY'UbX [`]hhYf]b['8]gbYm'Z]fYk cf_g"
- < ci gY c Z 6 `i Y g. 5 'a i ghlj]g]h Zc f 'a i g]W `cj Y fgž h \]g j Y bi Y 'Wca V]b Y g ``]j Y 'd Y f Zc fa Ub W g 'k]h \ 'X Y `]W]ci g 'X]b]b[f%(\$ '9 '6 i Y b U 'J]ghU '8 fž 'C f`Ub X c ž': @' ' &, ' \$ Ł "</p>

 $\label{lem:combined} K \ Yh \ Yf'mci f Y'`cc_]b['hc'WUhW\ 'U'WcbWYfh'cf']bXi`[Y']b'gca Y \\ ZUa]`m!Zf]YbX`m'Zi bž'h \ YgY'\][\`][\ hg'fYdfYgYbh'' f gh'h\ Y'h]d'cZ'h \ Y] \ WYYf['k \ Yb']h'Wca Yg'hc'Cf`UbXc g'b][\ h`]ZY''$

HY9bhYfhU]ba Ybh8]ghf]Whg

: cf'h\cgY'k Ubh]b['hc'YI d`cfY'Cf`UbXc'VYmcbX'h\Y'h\Ya Y'dUf_gž'
Ghcfm, fci d'Cf`UbXc'\][\`][\hg'gYj YfU`'YbhYfhU]ba Ybh'X]ghf]Whg
h\Uh'dfcj]XY'ZfYY'Ybhfm'UbX'j Uf]YX'YI dYf]YbW'g"

- 8]gbYm'Gdf]b[g.'<ca Y'hc'cj Yf'*) 'X]b]b['cdh]cbg'UbX
 \$Ž'g\cdgž'h\]g'k UhYfZfcbh'X]ghf]Wh'U`gc'ZYUhi fYg
 UhhfUWh]cbg'`]_Y'5Yfcd\]`Y'VU``ccb'f]XYg"
- I b]j YfgU``7]hmK U`_.`K]h\`Ufci bX`&) `X]b]b[`gdchg`UbX i b]ei Y`b][\h`]ZY`cdh]cbgž`]h g`U`[fYUh'j Ybi Y`Zcf`Vch\
 ZUa]`]Yg`UbX`UXi `hg`UZhYf`U`XUm`Uh`h\Y`dUf_g"
- Dc]bhY'Cf`UbXc.'H\]g'`]j Y`m'\i V'cZZYfg'&\$Ž'fYghUi fUbhgž VUfgž'UbX'ZUa]`m'UhhfUWh]cbg']bWi X]b['K cbXYfK cf_g'UbX Vck`]b["

- =7 C B 'DUf_. '5bW\cfYX'Vm'H\Y'Cf'UbXc'9mYž']h'ZYUhi fYg
 XY`]W]ci g'X]b]b['UbX'ZUa]`m'UhhfUWh]cbg'gi W\'Ug'A UXUa Y
 Hi ggUi Xg'UbX'G95'@= 9'Cf`UbXc'5ei Uf]i a "
- **Gi bgYh**'K **U**`_.'?bck b'Zcf']hg'cdYb!U]f'j]VYž'h\]g'X]ghf]Wh\Ug'cj Yf'U'XcnYb'fYghUi fUbhg'UbX'`]j Y'YbhYfhU]ba Ybhcdh]cbg"

9UWX 'X]ghf]Wh'cdYfUhYg``]_Y`U`a]b]'k cbXYf`UbXž'WfUZh]b[
a Ya cfUV`Y`a ca Ybhg`k]h\ci h'h\Y`bYYX`Zcf'h\Ya Y`dUf_'h]W_Yhg"
: fca '6`i Y`A Ufh]b] g`Vi nn]b['Uha cgd\YfY'hc'h\Y`U``i fY`cZ'H\Y
9X]gcbž'h\YfY`hfi `m']g`gca Yh\]b['Zcf'Yj YfmcbY"

$B = (h)^2 Y \cdot Zc f \cdot 9j \cdot Yfmc b Y$

 $H\YfY\]g\ bc\ g\ cfhU[\ Y\ cZ\ b][\ h\]ZY\ cdh]cbg\ Zcf\ d\ Uhfcbg\ cc_]b[\ hc\ fYj\ Y\]b\ Cf\ Ub\ Xc\ g\ j\]VfUb\ h\ Yb\ Yf[\ m''\ 5\ WWcfX]b[\ hc\ H]a\ YC\ i\ h\ z\ a\ cgh\ b][\ h\]ZY\ fi\ bg\ U\ cb[\ CfUb[\ Y\ 5j\ Ybi\ Y\ Ub\ X\ 7\ i\ fW\ Ghf\ Yh\ z\ Vi\ h\ ch\ Yf\ Uf\ YUg\ g\ ci\ X\ bc\ h\ VY\ cj\ Yf\ cc_YX"$

- a dfcj '7ca YXm'H\YUhYf. '9b^cm'U'b][\h'cZ``Ui [\hYfk]h\'`cWU``Wca YX]Ubg'k\YfY'X]bbYf']g'gYfj YX'U`cb[g]XYXf]b_gž'Vi h'VY'a]bXZ `ž']h g'ghf]Wh`m'&%Ž "
- K U```GhfYYh`D`UnU.`H\]g`dUfhm`W\bhfU``ZYUhi fYg`gYj Yb X]ZZYfYbh'j Ybi Yg`UbX`\cghg`U`V`cW_'dUfhm`Yj Yfm`Gi bXUm"
- < ck ``Uh'h\Y'A ccb'Cf`UbXc.'?bck b'Zcf']hg'Xi Y`]b[
 d]Ubc'g\ck gž'h\]g'`]j Y`m'b][\hgdch']g'dYfZYWh'Zcf'h\cgY']b
 gYUfW\'cZ'U'XUbWY'Z'ccf"</pre>
- Cf`UbXc'6fYk]b['7cadUbm': cf'U'fY`UlYX'YjYb]b[žh\]g'cf[Ub]WVfYkYfm'cZZYfg'hUgh]b[g']b'U'`U]X!VUW_ Uhacqd\YfY'f%'\$%'5h`UbhU'5jYž'Cf`UbXcž': @'\&,\$*\!"

■DXYYXŽ'C f`UbXc g'b][\h`]ZY']g'U'WUVUfYh'c Z'YI dYf]YbWYgž'WUhYf]b[hc'j Uf]ci g'hUghYg'UbX'Ybgi f]b['h\Uh'bc'hk c'b][\hg'UfY'Yj Yf'h\Y gUa Y"'K\Yh\Yf']h g'Ub'Y`Y[Ubh'X]bbYfž'U'ZUa]`m'b][\h'ci hž'cf'Uk]`X'WY`YVfUh]cb'k]h\'Zf]YbXgž'h\Y'7]hm'6YUi h]Zi`'fYU``m'XcYgXY`]j Yf"

 $\label{thm:condition} UXj\ Ybhi\ fci\ g`\ Y`]WcdhYf`hci\ fg`hc``Y]gi\ fY`m`ghfc``g`h\fci\ [\ \ WX\ Ufa\]b[\ 'd\ Uf_gž'h\Y`b][\ \ h`]g`U`k\ Umg`mci\ b[\ ']b`h\]g`Vi\ gh`]b[\ 'W]hm''$

8YhU]`g	
Cfh) %& '9 'K Ug\]b[hcb 'Ghž'Cf`UbXcž': @'' &, \$%
EiY``Yb	hfUj Y`&bYI h"Wca
	ghcfm[fcidcf`UbXc"Wca
	• k k k "h]a Yci h"Wca

6Ygi WXYb G]Y i bg Ui Z. a Y]b!k]Yb bYh