

GYW f]hm UbX XYZYbgY]bXi ghfm F\]bY`UbX!DU`Uh]bUhY cb h\Y Zi hi fY Wci fgY°

A]b]ghYfcZ'9Wcbca]W5ZZU]fg'GW\a]hhcdYbg': cfi a 'cb'h\Y gYW'f]hm'UbX'XYZYbgY']bXi ghfm']b'F@D'UbX'Ya d\Ug]nYg]bbcj Uh]j Y'ghfYb[h\cZa YX]i a !g]nYX'Wca dUb]Yg"



F\Y]b`UbX!DZU`nž'8Yi hgW\`UbX'!Cb'* bY'%\$ž'&\$&) ž'A]b]ghYf'cZ
9\cbca]\Wg'8Ub]Y`U'GW\a]hh'cdYbYX'U'bUh]cbk]XY'Zcfi a 'h\Uh'di hg
h\Y'gYW' f]hm'UbX'XYZYbgY']bXi ghfmfGJ \(\perp ')\b'Y\UbX!DU`Uh]bUhY
Uh'h\Y'\W'bhYf'cZ'UhhYbh]cb"'\(\perp 'Xc)\b[''\gz'g\Y'Ya d\Ug]nYX'h\Y
YggYbh]U`'fc`Y'cZ'h\]g']bXi ghfm'Zcf'h\Y']bXi ghf]U`'Zi hi fY'cZ'h\Y
ZYXYfU`'ghUhY'UbX'h\Y'bYYX'hc'fYUWh'Uddfcdf]UhY`m'hc'h\Y'gYW'f]hm
dc`]\Wm'\W\U``Yb[Yg'\Wi gYX'\m'h\Y'k Uf'cZ'Fi gg]U'U[U]\bgh'I _fU]\bY''
H\YgY'XYj Y`cda Ybhg'fYei]fYX'bYk 'Y\\cbca]\Wdc`]\Wm'\UbX'h\Y
b\WfYUgYX'\\cdYfUh]cb'\Yhk YYb']\bXi ghfm\(\text{z}'F\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\UbX'h\Y\\cdYf\gY\Uf\W\'\\deft\gY\\f''\

GWA a]hh'\cV'X]Y'VYgcbXYfYb'GhÀf_Yb'XYg'f\Y]b`UbX!dZÀ`n]gW\Yb A]hhY`ghUbXg'\Yfj cfž']bgVYgcbXYfY'XYggYb'\bcj Uh]cbg_fUZh'i bX XUg'j cf\UbXYbY'[YgY``gW\UZh`]W\Y'JYfUbhk cfhi b[gVYk i gghgY]b" H\YgY'ZUWhcfg'UfY'Wfi W]U`'VYWUi gY'h\Y'6i bXYgk Y\f'UbX']hg'B5HC dUfhbYfg'UfY'i f[Ybh`m'XYdYbXYbh'cb'cdYfUh]cbU`'fYUX]bYggž a cXYfb]nUh]cb'UbX']bbcj Uh]j Y'gc`i h]cbg"'\b'\Yf'Wcbhf]Vi h]cbž'h\Y DfYg]XYbh'cZ'h\Y'6UU]bVk ž'5bbYhhY'@Y\b][_!9a XYbž'U`gc dfYgYbhYX'h\Y'i f[YbWm'cZ'Z]bUbW]U`'fYgci fWYg'UbX'U'dck YfZi`]bXi ghf]U`'UddfcUW\'hc'ghfYb[h\Yb'; Yfa Ubmfg'XYZYbgY'UV]`]hm''

Yj Ybh Zcf dfca ch]b[WccdYfUh]cbg

'H\Y'Yj Ybh'k Ug'bch'cb`m'U'Zcfi a 'Zcf'h\Y'dfYgYbhUh]cb'cZ'&)

WcadUb]Yg'UbX'fYgYUfW\']bgh]hi h]cbgž'Vi h'U`gc'U'd`UhZcfa 'Zcf

dfcach]b['WccdYfUh]cbg"'GdYW]U`'d]hW\'fci bXg'dfYgYbhYX

WcbWfYhY'hYW\bc`c[]Yg'UbX'gc`i h]cbg'Zfca'h\Y'GJ="'H\Y

cj YfUfW\]b['[cU`'k Ug'hc'aU_Y'h\Y'WcadYhYbW]Yg'cZ'h\Y

F\]bY`UbX!DU`Uh]bUhY'UWhcfg'j]g]V`Y'UbX'hc']bhY[fUhY']bXi ghfm

a cfY']bhc'dfcWygqYg'cZ'XYZYbqY'UbX'gYW'f]hm'dc`]Wh"'

'A]b]ghYf'GW\a]hh'U`gc'Ubbci bWYX'U'Zc``ck '!i d'Yj Ybh'bYI h'mYUfž k\]W\k [h\ 'dfUWh]WU`'hcd]Wg'gi W\ 'Ug'di V`]WdfcW fYa Ybh `Uk ž'gYW f]b['g_]``YX'k cf_Yfg'UbX'dfca ch]b[']bbcj Uh]cb"'H\YgY X]U`c[i Y'Zcfa Uhg'UfY']bhYbXYX'hc'Ybgi fY'h\Uh'Wca dUb]Yg'UbX fYgYUfW\']bgh]hi h]cbg'WUb'Wcbhf]Vi hY'Yj Yb'a cfY'YZZYWh]j Y`m'hc ghfYb[h\Yb'h\Y'YWcbca]WUbX'XYZYbgY'dc`]Wm'g]hi Uh]cb']b; Yfa Ubm''

$\dc^{h}WU^{ghfUhY}[m]b^hY^WcbhYIh^cZ^hY$ gYW f]hm^g]hi Uh]cb^

"H\Y'bYk gYW f]hm'UbX'XYZYbgY']bXi ghf]U``ghfUhY[mcZ'h\Y'ZYXYfU`
[cj Yfba Ybhžk \]W\"Ua cb['ch\Yf'h\]b[g'U]a g'hc'gi ddcfh'h\Y'GJ ₹
]g'fY[UfXYX'Ug'U'Z bXUa YbhU``UddfcUW\"hc'dfca ch]b['h\Y'Ybh]fY
]bXi ghfm"5 WbhfU``dc]bh'cZ'h\]g'ghfUhY[m']g'hc']bWfYUgY'h\Y
]bbcj Uh]j Y'ghfYb[h\'UbX'YZZ]W]YbWm'cZ'h\Y'; Yfa Ub'XYZYbgY
]bXi ghfm']b'cfXYf'hc'a YYh'h\Y'fYei]fYa Ybhg']b'U'W\Ub[]b['k cf`X"

 $\label{thm:condition} $$ \times \ensuremath{\mathbb{M}} \times \ensuremath{\mathbb{\mathbb{M}}} \times \ensuremath{\mathbb{\$

 $\begin{tabular}{ll} :: cf']b!XYdh\']bg][\hg']bhc'h\Y'gYW'f]hm'ghfUhY[]Yg'UbX'YWcbca]WUgdYWhg'cZ'h\Y'GJ=~~]h']g'k cfh\k\]'Y'hc'`cc_'Uh'h\Y']bZcfaUh]cb'cZh\Y$

8 YhU]`g	
Cfh	F\Y]b`UbX!DZU`nž'8Yi hgWX`UbX
EiY``Yb	• a k j `k "f`d"XY
	• k k k "Va j ["XY
	• k k k "gd X!k]fhg W\ UZhg Zcfi a "X Y

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