DU`a '7cUghž: `cf]XUž'I G5'! 5'fYWYbh'\][\!gdYYX'W\UgY]bj c`j]b['hk c'hYYbU[Yfg'cb'Y`YWhf]WV]_Yg'fY!V]_YgŁ'\Ug'gdUf_YX g][b]Z]WUbh'X]gW gg]cbg'UVci h'gUZYhm'UbX'fY[i `Uh]cb']b'DU`a 7cUgh"'H\]g']bW]XYbhž'k \]W\'i bZc`XYX'Uh'h\Y'VY[]bb]b['cZ'h\Y a cbh\ž'\Ug'dfca dhYX'h\Y': `U[`Yf'7ci bhm'G\Yf]ZZ g'CZZ]WY'hc dfcdcgY'bYk 'cfX]bUbWYg'U]a YX'Uh'Wcbhfc``]b['fYW_`Ygg'Xf]j]b['cb Y!V]_Yg"'H\Y'di g\'Zcf'h\YgY'fY[i `Uh]cbg'Zc``ck g'h\Y'[fck]b[dcdi `Uf]hm'cZ'Y!V]_Yg'bch'f gh']b'DU`a '7cUghž'Vi h'h\fci [\ci h : `cf]XUž'k \YfY'h\Y``Uk 'fYWUgg]Z]YX'h\Ya 'Zfca 'a chcf]nYX'j Y\]WYg hc'V]WhWYg'f gh'hk c'mYUfg'U[c'''H\]g'W\Ub[Y'\Ug'YX'hc']bWfYUgYX `Yb]YbWm'Zcf'f]XYfgž'Vi h']h'gYYa g'hc'\Uj Y'U`gc'cdYbYX'h\Y'Xccf'Zcf]ffYgdcbg]V`Y'VY\Uj]cf'cb'h\Y'fcUXg'UbX'g]XYk U`_gž'fU]g]b[VcbWffbg'Ua cb[``cWU```Uk 'YbZcfWYa Ybh'UbX'fYg]XYbhg'U`]_Y''



5`\][\!gdYYX`Y!V]_Y`W\UgY`]b`DU`a `7cUgh`fU]gYg`gUZYhm WcbWYfbgž`dfca dh]b[`bYk`dfcdcgYX`fY[i`Uh]cbg`Vm`h\Y :`U[`Yf`7cibhm`G\Yf]ZZ/_\$'-/g`CZZ]WY"

HYYb'9!6]_Y'7\UgY'GdUf_g'I f[Ybh'GUZYhm CfX]bUbWY']b'DU`a '7cUgh'

K]h\ h\]g`]bWfYUg]b[ZfYYXca Wca Yg`U`\Y][\hYbYX`fYgdcbg]V]`]hm Zcf'f]XYfg"'GUZYhm'dfchcWc`q'UfY']b'd`UWYž'gi WX'Ug'a UbXUhcfm \Y`a Yh`i gU[Y`Zcf`f]XYfg`i bXYf`h\Y`U[Y`cZ`%* ž`UbX`fY[i`Uh]cbg fYei]fY`h\Uh`Y!V]_Yg`VY`Yei]ddYX`k]h\``][\hq`j]g]V`Y`Zfca`U X]qhUbWY"'H\Y'bYk 'dfcdcqYX'cfX]bUbWY'k]``'U`][b'`cWU` fY[i`Uh]cbg`k]h\`h\YgY`ghUhY`[i]XY`]bYgžYa d\Uq]n]b[`h\Y`bYYX Zcf'qUZYhm'Ug'k Y``Ug'Zib Zcf'h\Y'Ybj]fcba Ybh'UbX'Zcf'f]XYfg"'+b

YI]gh]b['hfUZZ]W`Uk g"

5g'Y!V]_Yg'VYWca Y'Ub']bWfYUg]b[`m'Wca a cb'g][\hž ibXYfqhUbX]b[`h\Y`W ffYbh``Y[U``ZfUa Ykcf_`Ufci bX`h\Ya `]q`j]hU`" $9!V]_Yg']b': cf]XU'UfY'WUgg]Z]YX']bhc'h\fYYX]gh]bWhWUhY[cf]Yg.$ 7`Ugg'%'Y!V] Yg'cZZYf'dYXU``Ugg]ghUbWY'h\Uh'WYUgYg'Uh'&\$'a d\ž $k \ge 1^{Y-7} = 2 g^{-1} + 1 g^{$ h\Y`gUa Y`gdYYX"`H\Y`a cfY`dck YfZ``7`Ugg`' `Y!V]_Yg`[c`U`ghYd Zifh\YfžU``ck]b['dYXU``Uqq]qhUbWY'id'hc'&, 'ad\"'8Yqd]hY'h\Y]f [fck]b[`iqYžY!V]_Yq'Xc'bch'fYei]fY'Xf]jYfg``]WYbgYgž fY[]ghfUh]cbžcf`]bgi fUbWY hccdYfUhYžU``Yj]Uh]b[gca Y VUff]Yfg Zcf'f]XYfg"⁵g'H\Y⁷mW]ghg⁷\c]WY^{*}XYhU][°]gž'f]XYfg^{*}a i gh^{*}UX\YfY hc 'gd Y W[Z]Wgd Y Y X ``]a]hg h]Y X 'hc 'Y UW\ 'WUgg c Z'Y ! V]_Y 'Ub X 'Zc ``c k

I bXYfghUbX]b[9!6]_Y FY[i`Uh]cbg

fYhf]Yi Y'h\Ya "

H\Y'q\cW]b['j]qiU`q'Zfca 'VcXmWUa 'ZcchU[Y'fYWcfXYX'cb'\$'`m'& XYd]Wh'U'dc`]WY'XYdihm'W\Ug]b['UZhYf'cbY'cZ'h\Y'hYYbgž'k \c i `h]a UhY`m'Zci bX`h\Ya gY`j Yg`UffYghYX'Zcf'Y`i X]b['`Uk YbZcfWYa Ybh'UbX'fYW_`Ygg'Xf]j]b["'G\Yf]ZZF]W_'GhU`m'\Ug'dc]bhYX ci h·h/Uh·]bW]XYbhg·]bj c`j]b[·fYW_`Yqq`Xf]j]b[·/Uj Y·gi f[YX·g]bW/ h\Y``Uk`W\Ub[Yžk]h\`a UbmY!V]_Y`i gYfg`fYdcfhYX`m'a]gi g]b[`h\Y V]WmWYg`cb`g]XYk U`_g`UbX`k U`_]b[`dUh\g"`=b`fYgdcbgYž`h\Y dfcdcgYX'fY[i`Uh]cbg'bch'cb`m'a UbXUhY'h\Y'i gY'cZ'\Y`a Yhg'k \]`Y f]X]b['Vi h'U`gc'gh]di `UhY h\Uh'h\cgY Yb[U[]b[']b fYW_`Ygg'VY\Uj]cf Wci `X`\Uj Y`h\Y]f`V]_Yg`]a dci bXYXž'ZUW]b[`UXX]h]cbU``ZYYg`hc

bYYXYX"

A mBYk g%' 'fYdcfhg'h\Uh'h\Y'dfcdcgYX'cfX]bUbW']bWi XYg'Z]bYg ZcffYW_Yggf]X]b['UbX'U``ck]b['XYdi h]Yg'hc'WcbZ]gWUhY'Y!V]_Yg']Z

`]bY`k]h\`h\YqY`fY[i`Uh]cbqžY!V] Y`iqYfq`a i qh`U`qc`m]Y`X`hc $dYXYghf]Ubg'k \setminus Yb'f]X]b['cb'g]XYk U`_gžU'dc]bh' |[\`][\hYX'Vm$ Vch\``Uk 'YI dYfhg'UbX'UXj cWUhYg"'DcfWUfc'@Uk 'fY]hYfUhYg'h\Y]a dcfhUbWY'cZ'h\YqY'`Uk q`]b'_YYd]b['Vch\'WmW]qhq'UbX

7ca a i b]hmFYUWh]cbg'UbX: i hi fY'GhYdg

G_m`Yf`GWchhž'Ub`Y!V]_Y`f]XYf'UbX'j cWU``UXj cWUhY`Zcf`gUZYhm a YUqi fYqžYI dfYqqYX qi ddcfh Zcf G\Yf]Z GhU`m q dfcdcqYX

cfX]bUbWY"` ≢hgʻUʻ[ccX`XYU`Zcf`YjYfmcbYž GWchhibchYXž Ya d\Ug]n]b[`h\Y`]a dcfhUbWY`cZ`gUZYhm`]b`Ub`]bWfYUg]b[`m

Wfck XYX Ybj]fcba Ybh" 5g h\Y Wca a i b]hm [YUfg i d Zcf U

g\UfY`h\Y]f`h\ci [\hq"`H\]g`XYa cWfUh]WUddfcUW\`U]a g`hc

Wcbghfi Wh'U'VU`UbWYX'ZfUa Yk cf 'h\Uh'UWWca a cXUhYg

k cf_g\cd`k \YfY`h\Y`dfcdcgYX`cfX]bUbWY`k]```VY`X]gW ggYX`cb

fYWfYUh]cbU``i gY`cZY!V]_Yg`k \]`Y`g]a i `hUbYci g`m'Ybgi f]b[`di V`]W

H\]g`]bW]XYbh`gYfj Yg`Ug`U`k U_Y!i d`WU```Zcf`DU`a `7cUgh`UbX`h\Y

 $h Y f' f X Y k \) Y h Y f Y gh c Z h Y W ca a i b hm f Y a U b g g U Z Y K h$

h\Y`VUfZcffYgdcbg]V`Y`Y!V]_Y`igU[Y"@Yhg`\cdY`h\cgY`k`\YY`g

[fYUhYf:`cf]XU[·]UfYUž'\][\`][\h]b[[·]h\Y[·]bYWygg]hm[·]cZ[·]fY[i `Uh]b[[·]Y! V]_Yg'Ug'h\Y]f'bi a VYfg'gk Y``"H\Y``cWU``YZZcfhg'hc'fYZ]bY'Y!V]_Y

`Uk g`UfY`h]a Y`m`UbX`fY`Yj UbhžYbgi f]b[`h\Uh`Yj Yfm`f]XYf`WUb`Yb^cm

Wcbh]bi YX`X]U`c[i Y`UbX`Wca a i b]hm`]bj c`j Ya Ybhž': `cf]XU`WUb`qYh

i `m'&&'Uh'- 'U"a "ž'fYg]XYbhg'UfY'YbWci fU[YX'hc'k Y][\']b'UbX

dYXYahf]Ubg'gUZY"

8 Y hUl`a Cfh DU`a 7cUghž:`cf]XUžIG5 EiY``Yb • a mbYk g%' "Wca h\YWmW]ghW\c]WY"Wca dcfWUfc`Uk "Wca

hi fb gUZY`m°

gUZY hm"

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