7 ? QML? J: CNMQQMQC 7 GLQF; CPPGML MDQC C = LQQB 7 ? QMLP2 MORK ML 2 MOPQP

; JM\$?I : CNR@ICA

, 3 GSd_RUb, *+*

)'',\$'('

/ MQAP

4 C?B MD2 MORQP. ECLAU! CY5%6 GLORQU#0 CN? OQK CLQ

FOLU4 E bE ONK^ G^TbUZnk[

LYLUA 9 Saly W< YUSd_b? U^UQ_VdXUKUSdY^_V>_blcdi Q^TO __THb_SlccYW&

E Y Ychi _V9 WbYSe\cbU&=^f Yb_^] U^dQ^T J UWY_^Q < Uf U_`] U^d

9 TTbUcc4 < Rb f Ym f Q+, &KC'2+, 00 : bQMY\G Q&K\ f Q J U e R\YS

HX_^U4 %, +', '/3, 00/*0 >Qh4 %, +', '/3, 00/1/

='] QX4] $QYQ^{(-1)USQ} 8 Q^{T}(Wf(c)$

=722 L?QML?JIMA?JNMLQ

9 TTbUcc4 < Rb_f Yn_f Q+, &KC'2+, 00 : bQNY\Qf Q&K_f Q J U eR\YS

\Uful&ceSSUccVe\ Yf`\UfundQtY^_votXUF>HY cYWYYSQ^di TUU^TU^d_^Yf`\UfundQtY_^_votXUb `_\YSYLe)`b_WYQ] UcbUQUTd_VbUcdcUSd_b#UfwFQtY^QfebQ<UU_`] U^dHb_WYQ] U%

$HQbd+(, 4A^3db^4Qb^4Qb^4Q TY U^cY^4$

LXU9 SdY^ H,Q^ _VdXUF QiY^Q >_blcdHb_WcQ | UYS\eTlc | UQceblc dXQiQi Qii

 $\begin{tabular}{ll} $U^* cebY^* WQSdY^* U^* QdSY^* QiY_^ -VdXUK_fQ^* U^* eR_YS^* Y^* dLb^*QiY_^Q^* b_SUcUc&Y^* YYQY^* Uc Q^T YcdYedY^c \#F>HVQ_U_b & RZLSdY^* UF (., $& \end{tabular}$

9 SAY YNK _VRYQLUQ S__`UQAY_^4U W Yf_\fU U'd_VK_fQ U&UQSXUC Y G<9 `b_ZLSC Y KURYQQ'T M[bQYU#b_ZLSc] QY\i QTTbUCYWAXUYCeU _V] Q|UAYWV_bUdbU b_TeSAYU] QUBYQ Q'T cecdQYQR\U V_bUd] Q'QWU U'd\$(

A dXU S_^dLhd _V dXU YdLb^QM_^Q S__`UQM_^& dXU QSSUccY^ _V dXU K_fQ JU eR\YS Yd_ dXU E; H>=)>_bLbd=eb_`U? U^UQ; __bTYQMW; _]] YdLU#S__bTYQMWR_Ti _VdXU] YYdLbYQ`b_SUcc\$YF_fU] RUb, **1`b_fYTU: Qe^YieU_``_btb^Yi V_bdXUK_fQ JU eR\YS d_Y\YeU^SUV_bUbdbUQUT`_\YSYUC QYT`b_SUccUt QdQ`Q^'Ubb_`UQ^\UfU(

$HQxd+(-49 TTYYY^Q) TQQQ^T Y^Vb] QYY^$

9 TTYMY^Q TQLQ Q^T Y^V_b] QMY^ SQ^ RU V_e^T Y dXU ^QMY^Q bU _bd _^ `Q^'=eb_`UQ^ aeQYQMY U YTYSQL bc V b cecdQMQR\UV bUcd] Q^QWU U^d

9?(0) - < FC2 MOPOSLPORK (LQ

I eUcdY^4@Qc dXU>_bUcdA'cde] U'dRUV dQ'c\QLTY'd_ i _ebS_e^da qc _WSYQ \Q^WU

 $\underline{P} = \underline{K}$

 $\label{eq:hold_cect_opt} \mbox{HQxd, (+4 KtbU^WXU^YW \YMSQS]] Y U'dd cect_opt_opt_uvbltd] Q'QWU U'dKUU^Qtd+($

HQtd, (, $4 \ge YQ^SYWcecdQYQRUV_bUcd$] $Q^QWU_U^bUcd$

 $\label{eq:continuity} E_bU_fUb\&dXU9\:SdY^{\ }H\Q^{\ }YS\eTUc\]\:\:UQebUc\:dXQIQY\ QH$

ce``_bd _V TUFU_`] U^d Q^T Q\$dfYMY& _V `bYQU V_bUcd _g ^Uc Qcc_SYQfY_^c& f_\e^dQi Qcc_SYQfY_^c _Vc] Q\'cYUT V_bUcd\Q^T _g ^Uc Q^T `eR\YS'

HQtd, (/ $4=^XQ^SUTYdU^QY^QS ^ UQY^$

 $LXU9 \ SdY^{\ }HQ^{\ }YS\\eTUc \] \ UQcebUc \ dXQdQY \ QH$

 $\label{thm:continuous} U`cebY`WQ$dY`U`QdYSY`QiY_^ _VdYUK__fQ`J`U`eR\YS`Y`YdJb^QiY_^Q`b_SU&cU&Y`YQYY`U&Q`T`YcdYedY_^c\#F>H`VQ\Ug_b_[_RZJ$dY`UF_(.\,,\,$\&$

] QY^dQY^YW Q^T& W Q`b_`bYQL&U^XQ^SYW RY_\WSQ TY*UbcYI Y V_bLbdc g YX `bUfQYYW US_\WSQ Q^Tc_SYQ Ve^SdY_^c#F>HVbQ Ug_b|_RZLSdYUF_(1\$&

 $TUFU_{_}^{Y}W Q^{Y}T] QY^{d}QY^{Y}W S_{_}^{T}YY_{_}^{Y}c \underline{d} S_{_}^{c}UFU RY_{_}^{Y}WSQ TY^{U}cYI Y S_{_}^{}] USYQ \\ \# b_{_}^{T}SSY^{U}US_{_}^{Y}US_{_}^{Y}US_{_}^{Y}UF_{_}^{+*}S&$

QTQ dY Wcdes SebU_VV_bl&dcdQ^Tc d_ Uh` USdUT S\YJ QIUSXQ^WUQ^T Ye S_^cUhe U^SU& Ri] UQ^c _V QTQ dQY_^] UQebU&#F>H VQ| Ug_b[_RZLSdYUF_(+, \$&

 $TUFU_{-}^{Y}WQ^{Y}UWUSdFUcicdU_{-}^{Y}b^{U}UQQMY_{-}^{W}A^{Y}WQ^{Y}Y_{-}^{Y}UU^{Y}W^{Y}b_{Z}Sdc_{-}VV_{-}Udd_{-}^{Y}b_{Z}Sdc_{-}VV_{-}Udd_{-}^{Y}b_{Z}Sdr_{-}^{Y}WQ^{Y}Y_{-}^{Y}UU_{-}^{Y}UU^{Y}W_{-}^{Y}D_{-}^{Y}UU_{-}^{Y}UU^{Y}W_{-}^{Y}D_{-}^{Y}UU^{Y}UU^{Y}W_{-}^{Y}D_{-}$

Y `b_f YWbUbUQbSX_VV_bUbddXbUQb Q^T TYUQcUb Q^T dXUbbY `Q\$dc_^ V_bUbdUS_ci cdU] c& YS\e TYWYf UbdWQ\Y_^ V_` dY_^c d_ c_\f UdXUS_^cUbeU^SUb Y V_bUbdQbUQb e^TUbXWXTUWbUU_V ^QbbUS_^cUbf Q\Y_^ #F>H VbQ_Ub_B _BZU\$dYUF_(+0)(

HQtd, (24KSYL^SUQ^TbLbUQSX

LXU9 SdY^ H/Q^ YS\eTUc | UQcebUc dXQdQY QH

Y `b_f YW US_^] Y&\UWQ& YccMedY^Q Q`T YV_b] QNY^ YccMe] U`d: d_cdU`WMX\^ V_bUcd bUcUQSX&dLSX^_\WSQ TUFU_`] U`d&Y^_f QNY^c Q`T dQ`cVUb_V[^_g\UTWU Y`d_`bQxX\U#F>H VQ Ug_b[_RZLSdY UF_(, 2&Qc_\YddTe^TUbr; Q QSYI: e YTYWQ`T LUSX^__W LbQ`cVUbs && ce``_bd bUcUQSX V_SecUT_^ UWUSdY U ecU_VU`f Yb_^] U`dQ&US_^] YS Q`T c_SYQ`_dU`dYQ_V V bUcd: #g YXYY F>H VQ Ug_b[_RZLSdYU F (-/&Qc_\YdUT e^TUb r

 $\label{eq:continuous_bound} $$Y \circ_b f YWS_bTYQIY^QY QYTS_`UDQIY^Q Q_^WdV_bUdQYTr^_^'V_bUdds_bWQYYQIY^c Y^eRYS_bUQIY^c QSYYYUGY^UV_bUdds_#F>HVQ_Ug_b[__RZLSYYUF__(//$&$

Y `b_f YWYcdNedY^Q VG Ug_bj &YS\eTYW&^TYW&Y dXUWUT_V eR\YS bUQNY^c Q&Y YNLE Y V bledii Q^T bUQUT cUSd bc #F>H VG Ug bj RZLSdY UF (/0%)

9 Say Yn $\mathcal{Y} \setminus U$ U dit $\mathcal{Q}(Q \times Q) \setminus U \setminus Y$, **1', *+*4

`b_`_cQ\V_bQ^Q\Y_^Q\cdQUW_V`eR\\S\U\Q\Y_^cQ\TS_]] e^\SQ\Y_^ \Y\V_b\Lcdi\ g\Q:`bU\Q\UT\Y\, **1&

 $\label{eq:local_$

HQxd, (+*4HbY QtUcUsd b Q^T Y Tecchi

LXU9 SdY^ H/Q^ YS\eTUc | UQcebUc dXQ1QY Q44

YSUQYWUS_^_] YS UWUSdY U^Ucc_V b_TeSdY_^ `b_SUcc Y V_bUcdi Ri _`dJ YYW \Q^^YW&TUSYY_^'] Q YW&J QH UdYWQ^T Y^_fQU^ b_SUTebUc#F>H VQ Ug_b|_RZISdY UF_(, 0&Qc_\YdUTe^TUbr; Q QSYI: eYTYWQ^TLUSX^_\W LbQ^cVUb\$(

HQdd, (++4A^TYWU^\ ec Q^T\ SQ S]] e^YMUc

9?00*-<FC3 JM@J8 @HXQ6CPML2MORP

&./)(.')-+*Q1+!4

(

LXLbUQbUdg _ Qc` USdc _ VdXUW_RQ\ _RZLSdY U+4

r`bUfU^dYWV_bUcdTUWQTQYY_^s4cUU`Qrd+(

&./)(.')-+*Q1+''%

$\underline{A} \ \ \underline{U} \ \underline{U} \ \underline{Q} \ \underline{Y} \ \underline{Q} \ \underline{Q} \ \underline{Y} \ \underline{Q} \ \underline{U} \ \underline{U}$

9 T_` dY_^ _VdXUF QNY_^Q >_bUcdHb_WbQ|] UQ^T Yb 9 SdY_^ H_Q^ Ri dXU? _f Ub^] U^d_VdXUK__f QI U e R_YS

&./)(.')-+*Q1+#%

LXUUQUU, Qc`USdc_VdXUW_RQ_RZLSdYU-4

- #, \$ r KecdQMQR\i] Q\QWUT V_bl&ds49 \\ V_bl&d\QYT Y dXUK_fQ J U eR\YS Y] Q\QWUT QSS_bTYWd_ V_bl&d] Q\QWU U\d`\Q\c(E_bU_fUb&] _bUdXQ\ 1*! _VV_bl&d\QYT Y SUbMYUT Ri dXUYdb\QMY\Q SUbMYSQM\^ cSXUJ U&#H=>; &>K; \$(LXU9 SdY\ H\Q\ _VdXUF QMY\Q >_bl&dHb_WQ]] UYS\eTU] UQebl&QJ YWQlce``_bd_V\'WYWV_bl&dSUbMYSQM\^\ b_SU&c#YdUT e^TUbFD: AS\ecdbc

9?OO+- 8 OFOO?BBQQQL?JAMKKCLQP?LB GLIMK?QQL

QT_`dY_^Q^TQ`\YSQNY_^_VdXU^QNY_^Q SbYLbYQQ^TY^TYSQ1_tc__VcecdQ^(QR\UV_bUcd] Q^QWU U^d#S_^cUbfQNY__VRY_WSQ_TY*UbcY1 Y^V_bUcdUS_cicdU_cQc_^U_VdXUSbYUbYQ\&

 $\begin{tabular}{ll} $V_bUdWVUWS bUd_ebSUdS_^cUbfQiY^Y_1\ \UUUUUXWY^QudSeQb&dXb_eWXdXU9 Sd_^>_bUdd $U b TeSQYUE QUbYQ& \end{tabular}$

] _^Yl_bYW_VYfQ:YUV_bl&dd:Uc` USY& g YXY dXU^Q!Y_^Q V_bl&d:YfU^d_bi #bl&e\& Q!Q\Q\UY , **1\$&

^'WYW b SUcc VV bUcd SUbdYYSQY ^&

Q`\iYW&XUUS_cicdU] Q`b_Q\$Xd_d\$U] Q^Q\$V] U`d_VQ\d`U&_VV_bU&d&b_e\XV_bU&d] Q^Q\$V] U`d`\Q^Y\## bY\$Y\U_VT\$WUbU^d\$QUTQ`b_Q\$XY bUQ\Y_^ d_^Q&bQ\S_^TYY_^cY\Q`\YIT\$&

] _^YI_bY`WV_bl&dUS_ci cdL] c dXb_e WX&c_ SQ\UT&LS__WSQ cebf U c g YXY dXU` b_Sl&c_VV_bl&d] Q`QWU U`d`\Q`c U(QR_bQiY_&

Y `\U U'dQNY__VYV_b] QNY_^ ci cdU c Y V_bUcdi #TQQQ\T YV_b] QNY_^ S_^SUb^YW& & V_bUcdRY_TY UcYl QUUVQNUUT& b_SUcUT Q\T cd_bUT\&

 $Y \setminus U \cup QY \wedge VF QEDQ, *** \wedge UD \cup A \wedge V \cup CO \setminus QY$

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