

JQ/2HHBM; i?2 aT`2 / Q7
* QKTH BMib KQM; SQHB+2 P.

C2`2Kv >m/bQM *? M

>QQQ`b i?2bBb T`2b2Mi2/ 7Q` i?2 /2;`22 Q7
" +?2HQ` Q7 `ib U>QQQ`bV BM *QKTmi2` a+B

JQ``Bbb2v *QHH2;2 Q7 `ib a+B2M+2b
.2T `iK2Mi Q7 *QKTmi2` a+B2M+2
"QbiQM *QHH2;2
*?2biMmi >BHH- J
IMBi2/ ai i2b
J v e- kykj

/pBbQ`, S`Q7X :2Q`;2 JQ?H2` S?X.)

b i ` + i

_2+2Mi`2b2`+? ? b T`QTQb2/ i? i TQHB+2 #2? pBQ`- BM+Hm/
M/ KBb+QM/m+i- + M bT`2 /i?`Qm;? +QMi ;BQM T`Q+2bb QM`
M2irQ`FbX >Qr2p2`- i?2 HBi2` im`2 Bb Kbt2/ QM i?Bb iQTB+- r
7QHHR2/ TQbBiBp2 }M/BM;b Q7 +QMi ;BQM BM bQK2 +BiB2b B
BKTH2K2Mi bi iBbiB+ H i2bib `2 M22/2/ iQ ?2HT TQHB+2 ;2M
Q7 mMr Mi2/ TQHB+2 #2? pBQ` BM TQHB+BM; M2irQ`FbX AM i
i?Bb HBi2` im`2 QM r?2i?2` 2t+2bbBp2 TQHB+2 mb2 Q7 7Q`+2 E
+2` M2irQ`Fb M/ T`2b2Mi b2p2` H KQ/2Hb Q7 2t+2bbBp2 mb2 C
T`QTQb2/ H;Q`Bi?Kb /Q MQi`2[mB`2 b K Mv T ` K2i`B+ KQ/2
2tBbiBM; KQ/2HbX q2 T`QTQb2 b2i@# b2/ _2b KTHBM; h2bi p
KQ/2H iQ i2bi i?2 ?vTQi?2bBb i? i i?2 mb2 Q7 7Q`+2 `Bb2b i?

+FMQrH2/;2K2Mib

qQ`/b + MMQi 2tT`2bb Kv ;` iBim/2 iQ Kv /pBbQ` S`Q7X :2Q`;
K2 i?`Qm;? r`BiBM; i?Bb >QMQ`b h?2bBbX qBi?Qmi vQm- ArC
bi2T QM2- i`vBM; iQ }M/ iQTB+X Air b TH2 bm`2 iQ rQ`F 7C
i?2 b+B2M+2 #2?BM/ bQ+B H +QMi ;BQM- +`BKBMQHq;v- M/
aT2+B H i? MFb iQ Kv . / M/ JQK 7Q` KQiBp iBM; K2 r?2M iBK
;BpBM; K2 TQBmi2`b QM r? i iQ BKT`Qp2X >QT27mHHv- A ? p
Aö/ HBF2 iQ +FMQrH2/;2 umiBM; CB 7Q` bm;;2biBM;` M/QK E
iQ i?Bb i?2bBb M/ K FBM; H2 `MBM; r v KQ`2 Bmi2`2biBM; M
7`B2M/b M/ 7 KBHv- i? MF vQm 7Q` KQiBp iBM; K2 iQ }MBb?c
rBi?Qmi vQm UvQm FMQr r?Q vQm `2VX

GBbi Q7 6B;m`2b

9XR P`B;BM H.Bbi`B#miBQM 7XPX+2`X* QKT H MB bX X X X
8XR _2b KTHBM; h2bi aBKmH iBQM XBXiBX#niBQM QX o Hkr
8Xk SiHv I`M JQ/2H aBKmH iBQM .BbX B# niBQM QX X m2b
8Xj aTBHHQp2` SiHv I`M JQ/2H aBKmH iBQM XBXiBX#niBQM
XR aTBHHQp2` SiHv I`M JQ/2H aBKmH iBQM XBXiBX#niBQM

GBbi Q7 h #H2b

9XR AMBiB H.Bbi`B#mXBQM Q7Xo XiX2b X X X X X X X X X X
8XR _2b KTHBM; h2bi aBKmH iBQM XBXiBX#niBQM QX o Hkr
8Xk SiHv I`M JQ/2H aBKmH iBQM .BbX B# niBQM QX X m2b
8Xj aTBHHQp2` SiHv I`M JQ/2H aBKmH iBQM XBXiBX#niBQM
XR J2 M a[m `2/ 1``Q` Q7 1 +? H;Q`Bi? *QKT X`X iQ .BBB

* Q Mi 2 Mi b

R AMi`Q/m+iBQM

e

k GBi2` im`2 _2pB2r

3

kXR _2 bQMBM;b #2?BM/ SQHB+2 bBQH2MX+2 X X X X X X X X
kXk S`2/B+iBM; SQHB+2 bBQH2MX+2 X X X X X X X X X X X X
kXj aQ+B H *QMi ;BQM b 6 +iQ`XBMI bBQH2MX+2 X X X X X
kX9 h?2 .2# i2 QM q?2i?2` aQ+B H *QMi ;BQM B Ry6 +iQ` B

j J2i?Q/QHQ;v

Rk

jXR _2b KTHBM;h2b X
jXRXR q? i Bb i?2 _2b KTHBM; h2bi X X X X X X X X X X X X
jXRXk h?2 _2b KTHBM; h2bi X X X X X X X X X X X X X X X X
jXRXj Sb2m/QXQ/2 X
jXk SiHv I`M JQX2H X
jXkXR q? i Bb i?2 SiHv I`M JQ/2H X X X X X X X X X X X X X X
jXkXk h?2 SiHv I`M JQ/2H bXMX H;Q`BiXK X X X X X X X X
jXkXj Sb2m/QXQ/2 X
jXj aTBHHQp2` SiHv I`M JQ/2H X X X X X X X X X X X X X X X
jXjXR q? i Bb i?2 aTBHHQp2` XSXHX X`M XQ/2H X X X X X X
jXjXk h?2 aTBHHQp2` SiHv I`M JQX2H XbXMX H;Q`BiRk
jXjXj Sb2m/QXQ/2 X

9 . i

Rd

9XR " +F;`QmM/X.Xi X
9XRXR AMPbB#H2 AMbiBimi2, *BiBx2Mb SQHB+2 . i
9XRXk .2b+`BTiBQM Q7X?2 Xi X X X X X X X X X X X X X X X
9Xk . i S`2T`QX2bBM; X
9XkXR bbmKTiBQMX
9XkXk ai2Tb X

8 1tT2`BK2Mi _2bmHib

ky

8XR 1tT2`BK2Mi X
8Xk _2bmHib X
8XkXR _2b KTHBM; h2bi XbXmHib X X X X X X X X X X X X X X
8XkXk SiHv I`M JQ/2H X 2bXmHib X X X X X X X X X X X X X X
8XkXj aTBHHQp2` SiHv I`M JQX2H X 2bXmHib X X X X X X X X

e *QM+HmbBQM 6mim`2 qQ`F

k9

eXR *QM+HmbBQM X
eXk 6mim`2 qQ`F X

* ? Ti2` R

AMi` Q / m + i B Q M

AM`2+2Miv2`b-i?2`2? p2 #22M KQ`2 M/ KQ`2 Tm#HB+Bx2/
Q7 7Q`+2 #vi?2 TQHB+2c M 2t KTH2 Q7 i?BbrQmH/ #2 i?2 FBH
k8- kykxQ`2 BM+B/2Mib Q7 2t+2bbBp2 mb2 Q7 7Q`+2 M/ TQH
BM h?2 L2r uQ`F hBK2b M/ `2`2TQ`i2/ HH Qp2` M2rb bi iBQ
(k) 6QHHQrBM; bm+? ?B;?Hv Tm#HB+Bx2/ BM+B/2Mib- Bi Bb mI
#2ir22M i?2 TQHB+2 M/ i?2 Tm#HB+ b22Kb iQ ? p?)#2+QK2 E
G bi v2`-`Qm;?Hv eyy-yyy iQ dyy-yyy IXaX`2bB/2Mib ;2/ F
iQ ? p2 2tT2`B2M+2/ TQHB+2 +QMi +i BMpQHpbM; H2bb@i?
TT`QtBK i2Hv d8W iQ 3jW Q7 IXaX`2bB/2Mib`2TQ`i2/ i? i
7Q`+)2X(

h?2`2 ? b #22M`2b2`+? i? i bm;;2bib i? ii?2 bT`2 / Q7 pBQH
T` HH2H iQ 2 +? Qi?2`X aQK2 T T2`b ? p2 BMP2biB; i2/ ?Q
BM72+iBQmb /Bb2 b2b M/ T`2b2Mi #2ii2` ;mB/ M+2 7Q` 7mi
pBQH2)X+2 b2/ QM i?Bb i?2Q`v- Km+?`2b2`+? Bb /QM2 QM iQ
bQ+B H +QMi ;BQMirbi ;3g Òb24BB; ii ;3ñ;3Rli]/2L; BQv2 c@4fb

; P- ezCq |

X S Cq- z~ qC p Cf S C...

| ic p C- sb^ S^ Ls 4CPS^ @ d b Y S C , S b Y C ^ < C

30HbqC ..C <- ^ @CfObc \ -zPC\ -zS- Y \ b@C6 zb sS \ -Y zC - YCL -zSb^ ^-\ 4Cps> ..C
sPb-Y@ <b^sS@Cq zPC eCpsC-zSfC bHebYSC b' <Cps - ^@ zPC qC- sb^S^L 4CPS^@ zPCsq
- <zSb^s>..PCZPCq zPC%o qC ~s^L C t <CssSfC HbqC

y PC] -zSb^-YR^szS~zC bHT~szSC e~4YSPC@ - sz~@%S^ [-%d CEEEsPb..S^L zP-z S^
c_v>S\ edpeCq ~sCbHbqC...s ~sC@S^ {DeCqC^z bHC^ <b~^zCps S^fbYfS^L HbqC | 9|:
3- <MS^ c_vu>{I eCqC^z bH\ C2S^Ls S^fbYfS^L HbqC...CqC C t <CssSfC ~s LD y PC@ z-
PCqC ..CqC @q...^ Htp\ \ C@s-\ GS C@s-\ eYc sS Cs bHI vDD - ^@ cl vl <-sCs> qCseC-Q
zSfC%o[- ^%4CSCfC@zP-z zPb-LP zPCsC S^ <S@C^zs..CqC ^bz <b\ \ b^>zPC%oPb~Y@ 4C
eCq\ SzC@zb ~sC\ bqC HbqC zP- ^ zPCY... 4- <WzPC^>-s zPC%zPb-LPz zP-z>S^ sb\ C
<-sCs>S ...s - <<Cez- 4Y Hbq\ bqC HbqC zb 4C- eeYSC@ | 9|: a zPCq YS Cq- z-qC \ C^zSb^
Pb...PSLPCq C@-<zSb^ S^ b' <Cps YC @s zb YCss - 4~sCbH- ~zPbqf%btp\ ebYSC b' <Cpsi
9|: , sS@C Htp\ zPCsC e-eCps> YszYC qCsC-qP P-s 4CC^ <b^@-zC@ b^ ebYSC b' <Cps
sz- ^<Cs 4CHbqC <b\ \ SzS^L C t <CssSfC HbqC

y PCqC P-s 4CC^ - Ybz bHqCsC-qP b^ ebYSC 4q-z- YS%o ^@ SzS S^zCpsC-zSb^ ..SZP q t <S Y
4S si r P-q q - ^@ <bYc L-Cse-4YSPC@- e-eCq S^ a <zb4Cq | C|c>..SZP zPCsq" ^@S^Ls
sPb..S^L zP-z b-z bH{ CEE@C-zPs Htp\ ebYSC fSbYc^<C 4Cz..CC^ c_DCE- ^@ | CED>zPC
-LCCz- ^@ q@s C@ \ bqz- YS%q zC @-C zb ebYSC fSbYc^<C ...s PSLPCsz S^ ^b^C Sse- ^S
3Y <WeCbeYc fCEv_ eCq cCEEE> ..SZP bzPCq q <Cs P-fS^L - sS^S <- ^zY%ab..Cq \ bqQ

-qC edpebsC@S^ zPC e-eCq>-s ..OY-s sbY-zS^s zb qC@-<C zPC q-zC bHf^S^Y^z eb^S^C
\ S^b^@-zi, s zPS^ e-eCq...s e-4YS^PC@S^ | CEE>..C...SY^bbWS^zb \ bC^YS^Cq z-qC
qC^zC@zb eb^S^C f^S^Y^<D

|i| d qC@S-zS^L db^S^C, S^b^Y^<C

[PS^%sz-@S^P-fC S^fCszS^L-zC@zPCH <zbq>-^@ <b^@S^S^s zP-z S^•~C^<CzPCsC^~\ Q
4Cqj y PCsC H <zbq> S^<Y-@C zPC eqCsC^<C bH- H^YQS^ C S^zCq^~Y-' - S^s @Ce-q^ \ C^z>
S^Cqf^S^C zq S^S^L>f^S^Y^z <C^ C q-zCs S^ zPC -qC>-<-@ \ %eCqHbq^ -^<C> b' @-z%
S^<S^C^z> Cz^i 9_> |CE y PC ep4Y^ \ ..SZP zPCsC qCsC-qP e-eCq S^ zP-z zPC @z-
f-qS 4YCs zP-z zPC%S-LLCs z b ..PCzPCq-^ b' <Cq..b-^@ <b\ \ S^ -qC CSzPCq^bz H^C^%
-f-S^ 4YCb zPce~4YS>bq-qCzPC%GfC^ zq <V@-z -Y^ y PCqHbq>..PSCzPCf-qS 4YCs
S^@S- zC@S^ zPCsq e-eCq>-qC CssC^zS YS^ zPCbq%..C <-^bz fCq^%..PCzPCq zPC%o qC
<b^sSzC^z bfCq @S Cq^z Yb<-zS^s>zS^ Cs>-^@@z-sCzi

y PCqP-s 4C^ sb\ C qCsC-qP b^ eq@S-zS^L zPC ^~\ 4Cq bH<b\ eY^S^zs ~S^L zPC
bq^S^ bH<b\ eY^S^zi K qC^C-^@ <b^Y^L-Cs ~sC@zPC sz-zSzS^-Y\ CzPb@a @as p-zS^
fa p g- \ G-s-qC bH-ssb<S zS^ 4Cz..C^ -^ Ctebs-qC -^@ -^ b-z<b\ C>zb S^C^zS^%
<bqC^zC@f-qS 4YCs 9 CE y PS^ \ CzPb@PCes S^C^zS^%f-qS 4YCs>4-z ..PC^ S^ zPC <-sC
..PCq zPCsC f-qS 4YCs -qC ^bz H^C^%f-S^ 4Y^S^ ..b-^@ ^bz 4C-4YCb CszS^ -zC zPC
zbz-Y^~\ 4Cq bH<-sCsi G-qzPCq\ bCq> eq@S-zS^L<-^ @A 4e 4e b-^@ ^b-@<

; P-ezCq {

[CzPb@bYbL%o

{ic p Cs- \ eY^L yCsz

{icic ,, P-z \$ zPC p Cs- \ eY^L yCsz

GSzY%o\Z ~s <q-zC- ^~WP%bzPCsS b^ C CzSfC%a b@OS^L zPC @SzqS4-zb^i y PC
^~WP%bzPCsS \$ zP-z sb\ Cb' <Cq>4%qf ^@b\ S^@CeC^@C^z e-Ss^Ls>..SYP-fC@S0
HCs^L -\ b~^zs bH-sC bHHq<C S^<S^C^zsi yb CteY S^>Yz ~s \$L^bqC -Y bzPCq H <zbaq
-^@-eep- <P zPs eq4Y\ Hb\ - \ -zPC\ -zS-Y-^LYQ RH-^ S^<S^C^z \$s -z - e-q
zS~Y q Yb<-zS^ f^G-q- 4G-zg>zPC%qf ^@b\ Y%oC^@b-z sCfCq Yb' <Cq zb qseeb^@
a ~z bHzPCsC ebYS-C Hbq<C qseeb^sC>zPC b^Cs q<CfS^L <b\ eY S^zs ..SY 4C ^bzC@- ^@
-@@@zb zPC @-z-i Ob....b-Y@ ..CsS -Y-zCzPSm

K S^C^ zP-z -^ S^<S^C^z P-eeC^s ^G-q- ebYS-C 4G-z>Yz ~s sCz zPC ^~\ 4Cq bHb' <Cq
eCq S^<S^C^z zb zPC bqL S^-Y^~\ 4Cq bHb' <Cq S^ G <P S^<S^C^z>-s zPCqC \$ ^b\ CzPb@
Hbq ~s zb qCzqCfC -^@ sS -Y-zC zPC ^~\ 4Cq bHb' <Cq eCq S^<S^C^zi] b..>..C <^
sS -Y-zC..PS-P b' <Cq q<CfC <b\ eY S^zs Hb\ G <P S^<S^C^z 4%o^S Hbq\ Y%oC<zS^L
zPC\ Hb\ G <P 3G-z S^fbYfC@ ,, C <^ sS -Y-zC zPS 4%o\ -Vb^L -Y zPC b' <Cq
..CSLPzs epebzS^~Yzb zPC ^~\ 4Cq bHb' <Cq S^ zPC 4G-zsi

y PC S^C PCqC \$ zP-z>Hbq G <P S^<S^C^z>..CLCz zPC bqL S^-Y3G-z ..PCqC zPC S^<S^C^z
b<<-qi ,, C..b~Y@zPC^ @b s- \ eY^L ..S^Pb-z qCeY <S^L zPC ^~\ 4Cq bHb' <Cq S^fbYfC@
S^ zPC S^<S^C^z fVij ,, PC^ -^ b' <Cq \$ s- \ eY@ S^ -^ S^<S^C^z>..C ..SY S^<q\ C^z
zPCsq <b~^z 4%e zb VQCe zq <WbHPb... \ -^%zS Cs zPC%o qC sCzCzC@zPqb-LPb-z zPC
eq<Csi yb s- \ \ -qS C>zPC\ -S^ S^C- bHzPCp Cs- \ eY^L zCsz \$ zb sCC S^b' <Cq ..S^P
- PSLP ^~\ 4Cq bHS^<S^C^zs <b~Y@ b<<-q 4%qf ^@b\ <PbS-D ,, C ..SY qCz zPC ^~Y
P%bzPCsS \$ HzPC eq@-<C@ @SzqS4-zb^ @S Cq Hb\ b-q bqL S^-Y@z- @SzqS4-zb^i

y PC HbYb..S^L s-4sC

{i| d Y%o } q^ [b@CY

{i|ic ,, P-z S zPC d Y%o } q^ [b@CY

„ C\ -sz qC YSCzP-z S^ qC YSC^bz GfCq%b^C S\$ d -- Y%oS/M%zb qC<CfC b\ eY'S'zs ..PSC b^ @-z%o, Ysb>-s \ C^zS^C@ 4C Hbq>qCSC-qP sPb..s zP-z \ -^%eb\SC b' <Cp 4CSCfC@Ct<CssfC HbqC b~Y@sb\ CzS Cs 4C-<<Cez- 4Yd 9|: y PCeqfSb-s \ b@CY-sQ s-\ Cs zP-z zPCeq4- 4SS%bH ^ b' <CqC<CfS'L - b\ eY'S'z S\$ b^sz- ^z zPcp-LPb-z> 4-z zPS sPb~Y@ ^bz 4C zPC <-sD r b>Pb... sPb~Y@ ..C S' bqbq zC zPC @S Cq^z eq4Q -4SSS bHG <P b' <Cqma' <Cp ..Pb 4CSCfC Ct<CssfC HbqC S\$ -<<Cez- 4YC ..SY zC^@ zb qeYs- zC zPC 4CP-fsq -z - PSLPq eq4- 4SS%o..PSC b' <Cp ..Pb @b ^bz 4CSCfC S' S ..SYP-fC- Yb..Cq eq4- 4SS%oOqC>..CeqpebsC zPC d Y%o } q^ [b@Cw PS^CsC pCsz-~q ^z d cp<Css -YlbqSP\ zb sS -YzC db\SC } sCDBHbqC b\ eY'S'zi

OqC> ..C S'zcp@<C - ^C..e-q \ CzCp- Yp- f g>zPC b^sz- ^z ..C ..SY-@@ zb G <P b' <Cq -Hq qC<CfS'L - } sCDBHbqC b\ eY'S'zi , s \ C^zS^C@ S' ; P-ezCq | XSQ Cq-z-q p CfS. >sb\ C b' <Cp 4CSCfC zP-z Ct<CssfC ~sC bHHbqC S\$ ^C<Css- q%o.PC^ zPC%@C\ sb>GfC^ zPb-LP S \ SLPz 4C-L-S'sz zPCY..i ,, CS eY\ C^z zPS SGC 4%o -@S'L - b^sz- ^z f g zb zPC ..CSLPz eqpebqS^ bH- ^ b' <Cq RH..C S'<q\ C^z G <P b' <Cq 4%o G <P zS CzPC%qC<CfC- b\ eY'S'z>zPC%o.SY S/M%4C sCzC@S' Hz-qC b\ eY'S'z S'<S^zs S' b-q sS -YzS^i

{i|i| y PC d Y%o } q^ [b@CY-s - ^ , YlbqSP\

rzCe c=R^SS YSCG <P b' <Cqs <P- ^<C-z 4CS'L sCzC@Hbq - ^ S'<S^z 4%eqpebq zS^S'L zPC\ bfCq zPC ybz-Y] -\ 4Cq bHa' <Cp Hb\ G <P 3G-z fsS S'q zb {icg

rzCe |=rCz - ^ ~^sCzC@S'<S^z>Lz zPC ^-\ 4Cq bHb' <Cp ffg S' zPC bqS'-Y S'<S^z>- ^@Lz zPC 4G-z bH..PCz zPC%o qC Hb\ i

rzCe {=rCz b' <Cp Hb\ zPCs-\ C4G-z bHzPC bqS'-YS'<S^z>..SP G <P b' <Cqs eq4- 4SS%bH4CS'L sCzC@- @J-szC@-<bqS'L zb zPCsq <-qp^z ..CSLPzi

rzCe J=, @@ zb G <P b' <Cqs zbz-Y b~^z bH b\ eY'S'zs>..SP G <P b' <Cq 4CS'L e-q bHzPC sCzC@†i

rzCe l=, @@ zb G <P b' <Cqs ..CSLPz zP-z ...s e-q bHzPC sCzC@† fs-\ C b' <Cp S' rzCe Jg

rzCe v=pCeG-z rzCes| zb l ~^zS'-YS'<S^z>-qC-<b~^zC@Hbq>..SP G <P S'q zS^ -S'L zPC ^C..%o-e@ zC@b' <Cq ..CSLPzi

[b@CYS'L zPCreq@bH; b\ eY'S'zs, \ b^L db'SCa' <Cq

{i{i| yPC reSMofCq d Y%oo } q^ [b@CY-s - ^ , YLbqSP\

rzCe c=R'SS Y&CC <P b' <Cqs <P- ^<C -z 4CS'L sCC-zC@Hbq - ^ S^<C^z 4%eCpebcQ

; P-ezCq J

? -z-

Jic 3 - <Wqpb~^@ . ? -z-

Jicic R^fSSAYCR^szS~zC=; SSSC^sdbYS<C? -z- dqbUC<z f; d? dg

yPCR^fSSAYCR^szS~zCS- ^b^eq" zUb~q^-YS\ eqb@~<zS^ <b\ e-^%4-s0@S'; PS<Lb>
RYS^bS>zP-z S^fCszS~zCs -^@PbY@s e~4YS S^szS~zS^s -<<b~^z-4YD yPC%0 eYb%0
^- \ Cpb-s z-<zSs s~<P -s S^fCszS~zS^C qeEqS^L>\ -YS C@S szbq%0CYS^L>P~\ -^
qL Pzs @b<~\ C^z-zS^> Cz i yPCsq ..bqW<C^zCq -qb~^@ - <C^zq Y eqS^<SeYC= „ C
-s <SSC^s P-fC <bqCeb^sSIS%0..SP zPC LbfCq^ C^z Hbq \ -S^z-S^S^L qSeCz Hbq
P~\ -^ qL Pzs -^@>..PC^ -4-sCs b<<-q>Hbq @\ -^@S^L qC@qssi 91:

[bqC S^Hbq -zS^ -4b-z zPC R^fSSAYC R^szS~zC -^@ SzS PSzbf%0 beCq zS^s> -^@
-<PSC^ C^zs S b^ Ss ..CAsS^C Pzes=vwS^fSSAYCS^szS~zCw

yPC R^fSSAYC R^szS~zC P-s \ ~YSeYC beC^Cb~qC @-z-sCzs ..S@C%0f-S^ 4YC zb zPC
e~4YSi yPC @-z-sCz ..C -s0@ zb S^fCszS~zC PCqC S zPC; SSSC^s dbYS<C? -z- dqbUC<z
f; d? dg , eqCs qCG-sC qL-q@S^L zPC @-z-sC CteY-S^S^L S^SS Yb4sCqf-zS^s -^@
- 4qSCH@Cs-qe zS^ bHzPC @-z-sCz <-^ 4C Hb~^@ -z zPC HbYb..S^L YS^W# Pzes=vwS^fSQ

JQ/2HHBM; i?2 aT`2 / Q7 *QKTH BMib KQM; SQHB+2 P{+2`b

TT`Q +?c ?2M+2 i?2 / i r2 +QHH2+i2/ BMBiB HHv iQ b2i mT C
r b /2T2M/2Mi QM iBK2X b `2bmHi- i?2 / i r2 +QHH2+i2/ r
#2ir22M kyyy iQ kyRe- r?B+? Bb i?2 iBK2 7` K2 Q7 r? i Qi?2` H
(k e)

h?2 / i 7Q`K i r2 +QHH2+i2/ 7`QK i?2 r2#bBi2 r b 1t+2Hc r2
v2 `X 1 +? 1t+2H }H2 +QMbBbib Q7 9 bT`2 /b?22ibc HH2; iBQM
TH BMBM; qBiM2bb2b- M/ P{+2` S`Q}H2X h?2 HH2; iBQMb
BM7Q`K iBQM Q7 2 +? HH2; iBQM i? i M Q{+2` `2+2Bp2/ i?
TH BMBM; qBiM2bb2b +QMi BM BM7Q`K iBQM #QmirBiM2bb:
UMQi HH + b2b ? p2 rBiM2bb2bVX 6BM HHv- i?2 P{+2` S`Q}H
BM7Q`K iBQM Q7 2 +? Q{+2` #v i?2B` P{+2` A.X AM //BiBQM
_ +2- TTQBMiK2Mi . i2b U1t+2H LmK2`B+ . i2V- _ MFb- M/

6Q` Qm` Bmp2biB; iBQM- r2 K BMHv 7Q+mb2/ QM i?2 }`bi M/ H
2 +? 1t+2H 6BH2 U HH2; iBQMb M/ P{+2` S`Q}H2V- BKBM; iQ
Q7 HH2; iBQMb `2+2Bp2/ #v Q{+2`bX h?2 / i T`2T`Q+2bbB
/2i BH BM i?2 7QHHQrBM; +? Ti2`- *? Ti2` 9Xk . i S`2T`Q+2b

9Xk . i S`2T`Q+2bbBM;

9XkXR b b mKTiBQMb

b K2MiBQM2/ QM i?2 *S.S r2#bBi2öb /Bb+H BK2`- i?2 ++m`
T`QpB/2/ #v *S.S + MMQi #2 ;m ` Mi22/X *S.S BMbi2 / +QKK
BM; ?QM2bi #Qmi ~ rb M/ i` MbT `2Mi BM Bib Tm#HBb?BM;
+Q/2 i?2v mb2/ BM i?2B` T`2T`Q+2bbBM; Bb Tm#HB+Hv p BH
_2TQbBiQ`v, ?iiTb,ff;Bi?m#X+QKfBmpBMbif+?B+ ;Q@TQHB+
iBQMb #Qmi i?2 / i HB;M rBi? *S.Söb /Bb+H BK2`X

9XkXk ai2Tb

b K2MiBQM2/ #Qp2- i?2 K BM bT`2 /b?22ib M22/2/ 7Q` Qm`
H2; iBQMb M/ P{+2` S`Q}H2 bT`2 /b?22ibX q2 }`bi T`Q+22/2/
HH2; iBQMb 7`QK kyyy iQ kyRe BMiQ QM2 }H2 b Bi rQmH/ 2
i?2 MmK#2` Q7 HH2; iBQMb T2` Q{+2`X L2ti- r2 }Hi2`2/ Qmi
TQHB+2 pBQH2M+2 Q` 2t+2bbBp2 mb2 Q7 7Q`+2 M//BbTQb2/
i HHv Q7 i?2 MmK#2` Q7 HH2; iBQMb T2` Q{+2` #v +QmMiBM;
Q7 2 +? P{+2` A.X

7i2`r `/- r2 +QK#BM2/ i?2 P{+2` S`Q}H2 bT`2 /b?22ib BMiQ QM
i?2 /mTHB+ i2 Q{+2`bX .QBM; i?Bb rQmH/ ;Bp2 mb M ++m` i2
i H2 bi QM2 HH2; iBQM BM i?2 :`2 i2` *?B+ ;Q `2 /m`BM; k
K TT2/2 +? Q{+2` BM i?2 2ti2MbBp2 HH2; iBQMb }H2 iQ i?2B`
+`BiB+ HBM +QM/m+iBM; Qm` T`QTQb2/ H;Q`Bi?Kb #Qp2X 6
T`2T`Q+2bbBM; rBi? }H2 i? i +QMi BMb P{+2` A.b- i?2B` BM
M/ i?2B` MmK#2` Q7 HH2; iBQMbX

hQ #2ii2` `2T`2b2Mi i?2 / i 7i2` Qm` T`2T`Q+2bbBM; bi2Tb-
BMiQ 72ri #H2b M/ } ;m`2 #2HQRX b bB/2 MQi2- i?2`2 r2`2

JQ/2HHBM; i?2 aT`2 / Q7 *QKTH BMib KQM; SQ

R Q` k Q{+2`b ? / R8Y HH2; iBQMb ; BMbi i?2Kc b i?2b2 BMbi
/2+B/2/iQ; `QmTi?2K BMiQ + i2; Q`v Q7 RyYiQ 2 b2 i?2 pBbm H
T`Q+2bbX

LmK HH2; iBQMb P{+2`b
R j8Nj

* ? Ti2` 8

1tT2`BK2Mi _2bmHib

8XR 1tT2`BK2Mi

6Q` 2 +? Q7 Qm` T`QTQb2/ H;Q`Bi?Kb- r2 Ryyy bBKmH iBQMb
M/ p2` ;2/ i?2`2bmHibX q2 mb2/ i?2 Svi?QM T`Q;` KKBM; H
LmKSv- M/ SHQiHv HB#` `B2b iQ BKTH2K2Mi Qm` T`QTQb2/

6Q` i?2 H;Q`Bi?Kb SiHv I`M JQ/2H M/ aTBHHQp2` SiHv I`M
T` K2i2`bM/ - r?B+? r2 ? / iQ }M/ M QTIBK H p Hm2 7Q`X 6B
J2 M a[m `2 1``Q` HQbb 7mM+iBQM- r2 iQQF p Hm2/b #2ir22M

8Xk _2bmHib

8XkXR _2b KTHBM; h2bi _2bmHib

JQ/2HHBM; i?2 aT`2 / Q7 *QKTH BMib KQM; SQHB+2 P{+2`b

8XkXj aTBHHQp2` S!Hv l`M JQ/2H _2bmHib

LmK	HH2; iBQMb	P{+2`b
R	jjjy	
k	RR8R	
j	deR	
9	ey3	
8	8y8	
e	9Rd	
d	j9k	
3	kdd	
N	kkk	
RyY	jN	

h #H2 8Xj, aTBHHQp2` S!Hv l`M JQ/2H aBKmH iBQM .Bbi`B

6B;m`2 8Xj, aTBHHQp2` S!Hv l`M JQ/2H _2bmHib

6`QK Qm` `2bmHib Uh #H2 8Xj 6B;m`2 8XjV- r2 + M b22 i? i 7
TQb2/ 7Q`KmH iQ Qm` +Q/2- T?BK2ib2iiQM2iy?X9y- Qm` bBKmH
/Bbi`B#miBQM KQ/2Hb i?2 +im H /Bbi`B#miBQM Q7 p Hm2b `2
irQ bQHmiBQMbX h?2 i`2M/ Q7 Q{+2`b 7`QK i?2 bBKmH iBQM 7
r?B+? 7QHHQrb Qm` ?vTQi?2bBb Q7 BM+Hm/BM; i?2 bQ+B H +C
i KQ/2HBM; i?2 /Bbi`B#miBQMX

b 2tTH BM2/ BM *G BTi22` ikm`2 _2p2B2r? b MQi #22M Km+? `2b2`
/QM2 QM T`2/B+iBM; Q{+2`bö 2t+2bbBp2 mb2 Q7 7Q`+2 BM+B/2
`2b2 `+? ? b QMHv #22M /QM2 # b2/ QM /Bz2`2Mip `B #H2b r?B
K2Mib F22T i` +F Q7X " b2/ QM Qm` HBKBi2// i M/ p `B #H2b
KQ/2Hb bBKmH i2 i?2 MmK#2` Q7 +QKTH BMib TQHB+2 /2T `iK2
*?B+ ;Q `2 Qp2` Re v2 `b Ukyyy@kyReVX

q2 T`QTQb2 i?Bb bQHmiBQM b MBMBiB H ;mB/2 QM ?Qr K Mv 2
M `2 b?QmH/ `2+2Bp2 Qp2` +2`i BM T2`BQ/X h?Bb 7Q`2+ b
Q7 7mim`2 +QKTH BMib- M/ TQHB+2 /2T `iK2Mib + M b22 r?2i?
T2`7Q`K #2ii2` Q` rQ`b2 i? M i?Bb bBKmH iBQM- HHQrBM; i?2
iBp2M2bb Q7 i?2B` 2tBbiBM; bvbi2KX hQ b22 +QK#BM2/ };m`2
b r2HH b i?2 J2 M a[m `2/ 1``Q` 7Q` 2 +?- TH2bK2#B2M2/ iQ TT
_2bmHib

* ? Ti2` e

* Q M + H m b B Q M 6 m i m ` 2 q Q ` F

e X R * Q M + H m b B Q M

P m ` 2 t T 2 ` B K 2 M i ö b ` 2 b m H i b b ? Q r i ? i i ? 2 a T B H H Q p 2 ` S i H v l ` K i B + H H v B M + Q ` T Q ` i 2 b i ? 2 b Q + B H + Q M i ; B Q M b T 2 + i Q 7 i # 2 i r 2 2 M T Q H B + 2 Q { + 2 ` b - ? b i ? 2 # 2 b i ` 2 b m H i b X q 2 # 2 H B 2 p 2 i i ? i p B Q H 2 M i + i b + M H b Q # 2 b T ` 2 / # 2 i r 2 2 M Q { + 2 ` b X h ? B b B i v T 2 b Q 7 p B Q H 2 M + 2 - b m + ? b ; M ; M / ; m M b ? Q i p B Q H 2 M + 2 X ` 2 b m H i b H B ; M 2 / r B i ? Q m ` ? v T Q i ? 2 b B b - Q m ` B M p 2 b i B ; i B Q M 6 B ` b i H v - r 2 Q M H v m b 2 / Q M 2 / i b 2 i Q 7 + Q K T H B M i b B M Q m ` 2 / Q M Q i T ` Q p B / 2 i ` M b T ` 2 M i / i H B F 2 i ? 2 A M p B b B # H 2 A M b i B S ` Q D 2 + i X a 2 + Q M / H v - Q m ` B M p 2 b i B ; i B Q M r b Q M H v + Q M / m + i k y y y i Q k y R e X q 2 b ? Q m H / ? p 2 K Q ` 2 / i U b v - m M i B H k y k k V i K Q / 2 H } i b r 2 H H X G b i H v - Q m ` K Q / 2 H Q M H v b B K m H i 2 b i ? 2 M m # v Q { + 2 ` b ; B p 2 M i ? 2 b B x 2 Q 7 i ? 2 + Q K T H B M i b U B X 2 X - i ? ` 2 2 Q Q M 2 B M + B / 2 M i V X q 2 r B H H M 2 2 / i Q + Q K 2 m T r B i ? K Q / 2 H i Q # 2 M / + Q K T H B M i b B x 2 b b r 2 H H X a m ; ; 2 b i B Q M b i Q i ? 2 b 2 H B K B i B M / 2 i B H B M * 6 m i m ` 2 e q Q ` F

e X k 6 m i m ` 2 q Q ` F

q 2 # 2 H B 2 p 2 i ? i K Q ` 2 i i 2 M i B Q M i Q # 2 # ` Q m ; ? i i Q T Q H B + 2 / 2 H 2 + i B M ; K Q ` 2 B M @ / 2 T i ? / i / B ; B i H H v i Q 2 M ? M + 2 # 2 i i 2 ` T ` p ` B # H 2 b b m + ? b Q M @ / m i v Q p ` Q { • Q ` Q ... A Q ... ` p 2 i i + 2 /

i?2 SQBbbQM T`Q+2bb- +QmH/ #2 mb2/ BM TH +2 Q7 Qm` H;Q`E
2p2MibX q2 +QmH/ mb2 i?2b2 KQ/2Hb iQ 2biBK i2 T` K2i2`b b
MmK#2`b UBX2X- i?2 p2` ;2 MmK#2` Q7 2t+2bbBp2 7Q`+2 + b2
Q{+2`VX A7 KQ`2 p`B #H2b`2 p BH #H2- bQK2;` T?@# b2/i2
M2m` H M2irQ`Fb- +QmH/ #2 mb2/ iQ 2biBK i2 i?2 i` MbKBbbB
TQHB+2 Q{+2`b- TQi2MiB HHv ;BpBM; mb KQ`2`2bmHibX
hQ +QM+Hm/2- r2 #2HB2p2 i? i #2ii2` / i +QHH2+iBQM K2i?Q/b
i?2 iQTB+ rQmH/ #2 #2M2}+B H BM T`2p2MiBM; 2t+2bbBp2 mb2

" B # H B Q ; ` T ? v

(R) X > BHH- X hB272Mi? H2`- *X h`B2#2`i- .X CQ`/ M- >X qB
;2Q`;2 ~Qv/ r b FBHH2/ BMht?2HL2+2u Qmfb hCB/W2pX

(k) X LX uX hBK2b- óSQHB+2 #`mi HBiv- KB22 Q M/ m Qi FM/ b?
hBK2kykjX

(j) CX aX JQiH2v _P C`- óSQHB+2 mb2 Q7 7Q`+2 #v 2i?MB+Bi
+H bCX-Qm`M H Q7 i?2 aQ+B2iv 7Q` aQ+Bp Q H p Q 3R- MWQ X 182
TTX Rkkk Rkk3- kyR3X

(9) X aHmiFBM- *X _ Mb7Q`/- Mm`2Xo'XQ.H22M22-, h`2 iBM; oBQ
b *QMi ;BQmb .TBbX2 9h 28eX *? K, aT`BM;2` AMi2`M iBQM
kyR8X

(8) X oX S T +?`BbiQb- .X JX >m`2 m- M/ X X "` ; - óh?2 +Q`
h?2 BM~m2M+2 Q7 ;2Q;` T?v M/ bQ+B H M 2K2QB F bMQ M ; M
aQ+BQHQ;B+pH Q H X p B2-r MQX j- TTX 9Rd 99d- kyRjX

(e) X S T +?`BbiQb- X "` ; - M/ .X >m`2 m- óaQ+B H M2irQ`
;mMb?Qi B Ma_d_r`1H2+i`QMB+y R Q y R R X H

(d) X "QM/ M/ "X "mb?K M- óh?2 +QMi ;BQmb bT`2 / Q7 pBQ
H2b+2Mib i?`Qm;? bQ +B2`HBM2MrQQFrb`M H Q7 p Q # M B y d 2 Hi
TTX k33 kN9- yk kyRdX

(3) X Pm2HH2i- aX > b?BKB- CX :` p2H- M/ X oX S T +?`Bb
bm`2 M/ 2t+2bbBp2 m`b2KB2M Q Q`Q;2- ó Sm #HCB+X SQH BM+Q X j-
TTX ed8 dy9- kyRNX

(N) X qQQ/- .X _QBi?K v`- M/ X oX S T +?`BbiQb- óh?2 M2ir
TQHB+2 KBb a Q M B m Q H X 8- TX kjd3ykjRRN3dNdN3- kyRNX

(Ry) X *? H}M M/ CX E TH M- ó>Qr K Mv +QKTH BMib ; BMbi T
i2/ #v BM+ T +Bi iBM; 72r ó#KB2M Q H 2 Q ; ó-óSm#HB+ SQ
pQHx ky- MQX k- TTX j8R jdy- kykRX

(RR) X "Qbb M/ CX EH2BM2`i- óJQiBp iBQM H +QMi ;BQM /m`
Q7 BMi2`T2`bQM H`2H iBQM b?BT b, b M ? CT Q m B Q H M i R y - bim/
yN kykyX

(Rk) X q2Bb#m`/- _X :`22MbT M- 1X > KBHiQM- >X qBH HB Kb-
iiBim/2b iQr `/ #mb2 Q7 mi?Q`Biv, 6BM/BM; bBQ Q KH M i B
AMbiBimi2 Q B Q mybi B +2

9{ : ; i , i yCce> y PCS\ e-<z bHPS.LPCqC@-<zsb^ b^ eb'YCb' <Cq-zzS-@Cz b...-q@
-4-sC bH--zPbcf% Tb-q^ -Y bH; q\ S^ -YT-szSC B@-<zsb^> fbY ||> ^bi {>
eei { _ | Jc_>|CEci

9J: Gi rP-q q>Bi , bbY>Ki 3CqzbY<<S] i , GfCq>ri 3-Yss% ^b>, i , -zsb^>
R ? SeeC^--q [i ; -^^S'LP-\ >Ti G-YCq>Xi [-q<-V\ ; i TbP^sb^>Ki p bZP>
, i , 4C@S Ti , <-^->ri , @f-^S di , L-szPS>Gi , YP@ 4>Si , YQ Y% ; i , ^zb^%
-^@[i] -LP-fS G-z-YebYSCfSbY^<C4%q<-C-^@sz-zCS^ zPC-s->c_DCE|CE_=
- ^Cz.bqM Cz-@QLqCsb^> yPCX-^<C>fbY { _D>eei c| _ c|| >cCE|CEci

9I: ri , Y^L>?i [< Y'S^C>Bi [< qC@% ^@pi O-q@ \ -^> db'YSC 4q-z-Y% ^@
4Y <MPC-Y P=r CzS'L zPC-LC^@ Hbqe-4Y< PC-Y P s-PbY q> , \ Cq<- ^ Tb-q^ -Y
bHd~4S< OG YP>fbY cCE>^bi |>eei w| w|>|CEui d[R? =|D|{JuCE

9v: Oi Xi ; bbeCq> , -q b^ @q-Ls eb'YSS'L -^@eb'YSC 4q-z-Y% r~4sz-^<C} sC.
[S-sC>fbY |CE^bi DQ>eei ccDD cc_J>|CEI i d[R? =|l uul {cci

9u: di X%C-^@, i [i Bs\ -S> r..bq^ zb edzCz=db'YSC 4q-z-Y% - @SC \ - Hbq
-\ Cq<- s eb'YSC p-<G K C^@q. ; Yss>fbY |>^bi {Q>eei cl | cD|>|CEvi

9D Vi [i XCqP -^@yi [S<Vb..sV\ , SbY^z eb'YSC 4CP-fSbq=d-sz>eqCS^z>-^@
Hz-qC qSC-qP @Sb-zsb^> , LLqCsb^ -^@, SbY^z 3CP-fSbq fbY cCE ^bi |>
eei || | l vD>|CEI

9_ : ?i BS^C>ri Ti ? , YCsb>-^@Xi rzbY C^4Cq> yPCC Cz bHbd-^S-zsb^ -Y-^@
C^fSb^ C^z-YH<z bqs b^ eb'YSC \ S-b^@<z> db'YSC k --qCq% fbY cu>^bi |>
eei cCE c|v>|CEI

9CE Ti KqCC^>, i dS ~Cq> [i OSVW -^>-^@Xi 3qS ^> db'YSC S^zLqS% ^@-<Q
<b-^z-4SS% S^ ePSY @CPS =dq@S^S'L -^@-ssC^S'L eb'YSC \ S-b^@<z> } iri
? Ce-q\ C^z bHT-szSC a' <CbHT-szSC dqlq \ s>c| |CEI

9c: ?i KqS.bY@ ; b\ eY'S'zs -L-S^sz zPCeb'YSC=dq@S^S'L @SbSSb^> Tb-q^ -Y
bH; q\ S^ -YT-szSC>eei |cl ||c>c_Ji

9|: Xi SP-b-^@, i , i d-e- Pqszbs>] Cz.bqWebsSb^ -^@eb'YSC..Pb sPbbz> yPC
,]], Xr bHzPC, \ Cq<- ^, <@ \ %bHdb'YSS-Y-^@rbS Yr <S^<G fbY vDu>
^bi c>eei D_ cc|>|CEI

9{ : [i rCq>Q q f-Yb-^@, i d-e- Pqszbs> 3-@-eeYs -^@S^<C@S^C <CqS-@>
; q\ S^bY% d~4S< db'YSC% fbY |CE^bi |>eei {uc {Dc>|CEci

9J: ; i rS esb^ -^@?i V S V R eb'YSC \ S-b^@<z> <b^z-Lsb-sm ^b^CqS Y^-Y
" ^@S^Ls Hb\ @Y-s>zCt ! d~4Q b CECE

, eeC^@S† ,

; b@C - ^@ G S L ~ q C s

, ic ; b@C

, icic , YeP- a ezS\ S - zSb^ ; b@C

<https://colab.research.google.com/drive/18tC2oznPrCKSD1PXFUzUQIjzYO6JFKck?usp=sharing>

, ici| 3 Cz- a ezS\ S - zSb^ ; b@C

https://colab.research.google.com/drive/1Vf6cH31hYpu_D7VXVTFy8Y2tJjr4cl8?usp=sharing

, ici{ , S~- YS - zSb^ ; b@C

https://colab.research.google.com/drive/1f7q5DCEqUuA4VHl_n4l fTVM u3xARCh#scrollTo=Z-fdvnfLyKAS

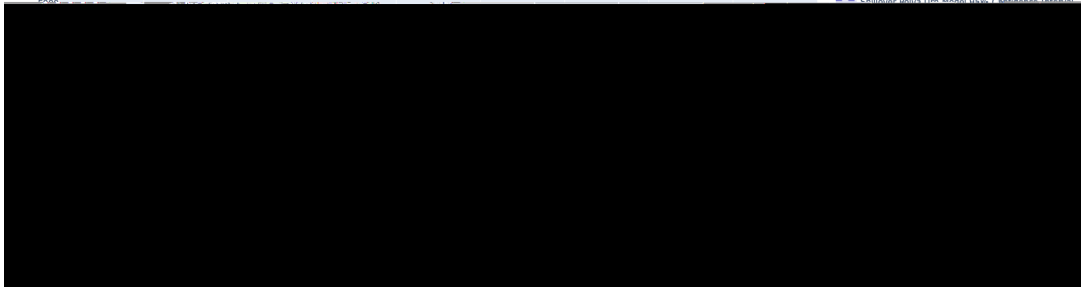
, iciJ K S O ~ 4 p Ce bs S b q % o

Gbq eqCeqp<C s S ^ L @ z- <b@C>eY C s C f S S =

<https://github.com/Jeremyhudsonchan/Undergraduate-Thesis>

, icil ; b\ 4S^C@ p Cs~Yzs

Combined Results



GS~qC, ic=reS\bfCqd %oo} q^ [b@CypCs~Yzs

, \LbqSP\	[G ^ rl ~- qC@ Bqppq
pCs- \ eYS^L	c Jc{_ i_
d %oo} q^	_Cv_viuD
reS\bfCqd %oo} q^	vCicCuc

y-4C, ic=[G ^ rl ~- qC@ Bqppq bHB- <P, \LbqSP\ ; b\ e- qCzb ? -z-