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10%2&,3%45)(:);+2+,,(+)+07)10%2&,3%7+7)<, +0=%3=(7&)>%4(, %+)

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&())%\$4(.3(!\$.!4#(!&'%%\$5.!\$.8(%49(.4!9'):(4;!!-&(3\$2\$3'//0<\$4!'.'/0(%=!2\$.(!>\$.(!&)\$3(!
\$.1\$3(%<!?!1\$'95.1!&)\$3(!\$.1\$3(%<!?A!')4!&)\$3(!\$.1\$3(%<!'.1!?!%4'9&!&)\$3(!\$.1(B!'4!4#(!
1'\$/0<95.4#0!' .1!7*'')4(0/02)(7*(.30;!"#(!)(%*/4%13'.!C(!%*99')\$%(1!'%!25//>%D!>\$.(!
&)\$3(%!'')(!25* .1!45!C(!#6#0/!&())%\$4(.4<!>#\$/%4!%4'9&!&)\$3(%!'&&'')!45!C(!5./0!>(':/0!
&())%\$4(.4!4#5*6#!4#(0!3' .!%4\$//C(!3#)'34(\$%!(1!'%'!'/5.6E9(95)0!&)\$3(%%F!'%'!25)!
1\$'95.1!&)\$3(%<!4#(0!3' .!C(!&())%\$4(.4!GH\$'95.1! I!J(9%K<!' .4\$E&())%\$4(.4!GH\$'95.1!
L')'4!\$.1\$3(%K!5)!(8(.!)'.159!GM5/\$%#(1!M)\$3(%!H\$'95.1!N.1(BK;!"#(!10.'9\$3!+,-!
'.'/0%\$%!'/%5!%#5>%!4#'4!&())%\$4(.3(!\$%!4\$9(E8')O\$.6!' .1!4(.1%!45!2/*34*'4(!')5* .1!4#(!
'8(')6(;"#(%(!2\$.1\$.6%13' .!C(!B&/'\$. (1!C0!4#(1!\$22)(.4!1(6)(!52!/\$7*\$1\$40!52!4#(!'%%(4%!
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63=!>?@2!6AB!, (%.5C!D4<5.#5(*EF%&.BG%\$*%&5#H; &4)#5B%-B4IJK''\$/CL*%- .OB*-<LMMMMEEMMNEMOPPEPO>Q!
RR!S3#: !?5%/4)!<&%#+4558!%-I)*T5#0<#/+.)%)-.%5!/4\$*\$&'!&*('K#F.)./'&8!*+!,04-%'.*)!%)0!U-.#)-#!*+!
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\$. %4' .3(<!4#(\$)!&()25)9' .3(!)/'4\$8(145!35.8(.4\$5.'/'! '%%(4%!Ga (/1!' .1! a (/1E] ():5*/58'<!
T@U! 25)! %4' 9&%F! H\$9%5.! I! -&'(.Q()<! T@?[! 25)! %4' 9&%! ' .1! ')! 5CQ(34%KF! 4#(!
1\$8()%)\$2\$3'4\$5.! C(. (2\$4%! 52! &*)3#'%\$.6! 2\$. (! >\$. (%! GL#*<! T@?[F! S5*)\$<! T@? [<! T@?AF!
b*)(8\$sc\$(.d! I! b' : '85.04d<! T@?AF! S5*)\$! (4! '/;<! T@?YK! ' .1! 1\$' 95.1%! GHX \ 33/(%\$'! I!
b54' .58\$3<T@?YF!S ')C\$(4!'/;<!T@T@KF!4#(!G\$.K(22\$3\$(.30!52!4#(!2\$. (!>\$. (!9 '): (4!G(;6;<!S5*)\$!
(4! '/;<! T@?UF! ` (). ' .1(eEM()(e! (4! '/;<! T@?ZF!] '%(4! ' .1! ^ (.1())%5.<! T@?@K;! R%!25)!4#(!
&())%\$%4(.3(!52!&'%%\$5.! '%%(4!&)\$3(%<! 9\$B(1!(8\$1(.3(!#'%!C((. !5C4'\$. (1!C0!4#(!25//5>\$.6!
%4*1\$(%D! J 5(4e9' .! G?ZZAK<! 25)! &'\$.4\$.6! %'/(%! 1'4!' 2)59! ?U?f! 45! ?ZYff! R0(! GT@?UK<
] * .4(' .!*! .1M(3!GT@?AK!' .1!R 9 (*)! ' .1!g(! *)!GT@?ZK<125)4#(!')4!9 '): (4F!L#5 .6!!(4; '/;<!
GT@?TK<R*()!GT@?=K!' .1!R*()!' .1!-3#*#9 '#()!GT@?=K<125)!1\$' 95.1%F!S5*)\$!(4; '/;<!GT@?fK<!
R 9 (*)! ' .1!g(! *)!GT@?ZK!' .1!h * 9 ')!GT@T?K<125)!2\$. (!>\$. (%;!!

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&'%%\$5.! 9 '): (4!C0!(B' 9\$. \$.6! '!>\$1(!)' .6(!52!&)\$3(!\$.1\$3(%!G95)(!&)(3\$(/0<!=125)!2\$. (!
>\$. (!&)\$3(%<! ?@125)!1\$' 95.1!&)\$3(%<! ?A!25)!')4!&)\$3(%<' .1! ?!25)!%4' 9&1&)\$3(%K!'4!4#(!11 '\$/0<
95.4#/0!' .1!7*')4()/0!2)(7*(.30!*%\$.6!4>5!1\$22)(.4!/5.6E9(95)0!9(4#51%<!&(3\$2\$3'//0!
+,-!' .'/0%\$%' .1!2)'34\$5.'/!\$.4(6)'4\$5.;!"#('/'05*4!52!4#(!&'&())\$%!4#(!25//5>\$.6;-(34\$5.!
T!&)58\$1(%!'!C)\$2!)(8\$(>!52!4#(!)/'(8' .4!/\$4() '4*);! -(34\$5.! =! 1(%3)\$C(%!4#(!1'4!' ' .1!
5*4/\$. (%!4#(! (9&\$)\$3' /! 9(4#515/560;-(34\$5.![!&)(% (.4%!4#(! (9&\$)\$3' /!)(%*/4%;!-(34\$5.!A!
&)58\$1(%!%59(135.3/*1\$.6!)(9 '): %;!!

7@! AB:135:431!\$

&)\$3(%<' . 1!CO! - '/((9!GT@[K!25)!65/1!' . 1!%/8(!)(4*) . %;! J\$/ER/' . '!(4;! '/;!GT@?AK!25* . 1!
&())%\$%4(. 3(!\$. !65/1!&)\$3(%;! \ 8\$1(. 3(!52!/5 . 6!9 (95)0!> '%!'/%5!&)58\$1(1!CO!h#* . 4\$'!' . 1!
M'44' . '0' :!GT@?YK!' . 1!L '&5)'/(!4!' /;!GT@?YK!\$. !4#(!3'%(!52!1 '\$/0!S\$435\$. !)(4*) . %<' . 1!CO!
CO! i#5*! ' . 1! h' . 6! GT@??K<! i#5*! GT@?fK<! g\$*! (4; '/;!GT@?ZK! 25)! + \N"%! G+ ('/! (%4'4(!

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\$.!4#(!>\$.(!9 '):(!>'%!25* .1!CO!S5*)\$!(4;'/;!GT@?fK<!R 9 (*)!'.1!g(!`*)!GT@?ZK<!h*9 ')!

^!o!@;A;+ ' . 15 9!1 '4'!) (!3#)' 34()\$(1!\$. %4(' 1!CO! ^!p!@;A;!R. 4\$E&())%\$%4(. 3(!\$%!1(4(34(1!
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8%I'@4'5'6A'B'8%I'@/A'C'? D8%I'@&A!G^*)%4! ?ZA?K;!] 5) (!&)(3\$%(/O<4#(!(%4\$9 '4\$5. !&)53(1*)(!
\$%!4#(!25//5>\$. 6D!

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?;! "#(!5)\$6\$. ' /! 1 '4' ! % (4! \$%! 4)' . %25) 9 (1!\$. 45! ' ! 1 '4' ! % (4! N_i35. %\$%4\$. 6! 52! /56!
) (4*) . %D!

$$N_i = \log \frac{close_t}{close_{t-1}}, t = 1, 2, \dots, M - 1 ;! ! \quad G?K!$$

T;! "#\$%!1 '4' ! % (4! \$%! 1\$8\$1(1!\$. 45!35. 4\$6*5*% !7!% *CE1 '4' ! % (4! >\$4#! / (. 64#! . <!% *3#!
4# '4! 7! 'B'E<4#(. ! ('3#!% *CE1 '4' ! % (4! \$%! \$1 (. 4\$2\$(1! ' % (<!6\$8(. !4#(!2' 34!4# '4' ! "p! ?<T< !=; !; !; !< !7; !
\ '3#! / (9 (. 4! ("! \$%!) (&) (% (. 4(1! ' % !E#! >\$4#! F! p! ?<T< !=; !; !; !< !E; ! ` 5) ('3#! ("! >\$4#! / (. 64#! & !4#(!
'8)' 6(! ! \$%! 1(2\$. (1! ' %D!

$$e_a =$$

NG1K;! s 54(!# '4!* . 1()!#(!\22\$3\$(. 4!] '): (4!^0&54#(%\$%!4#(!8'/*(!52!1!\$. !GUK!%#5*/1!C(!7*'!/!
45!?!' . 1!*%#5*/1!C(!'!>#\$4(!.5\$%(!&)53(%%;!)

O+P\$&RI)B4+4%=)D'',34)&?. (0&04)=+=\$=''+4%(03): (,)4C&)L%+ ' (07)%07%=&3))

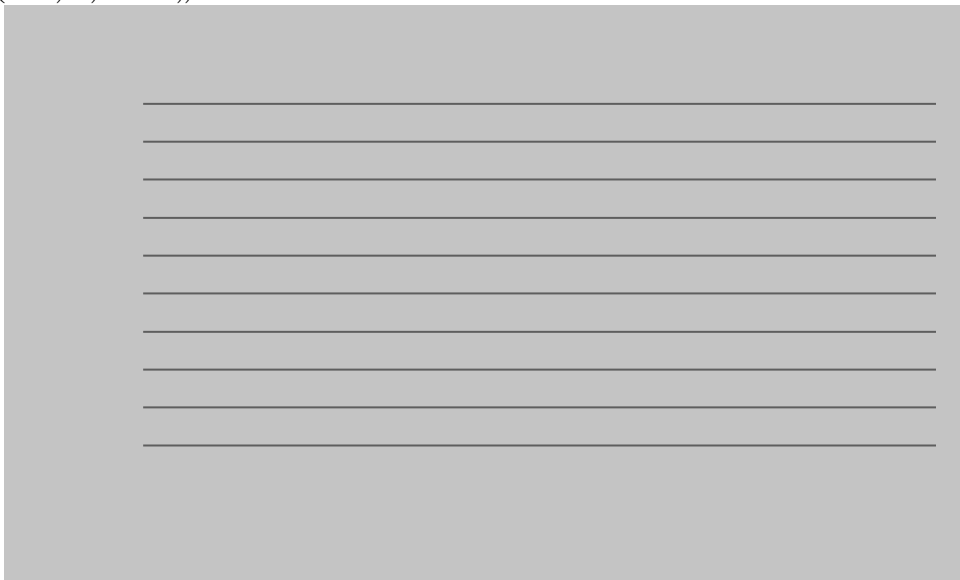
"#\$%!	&'()*+, %')!	-+*(!) %.\$/'%')!
L17, / '6(!	MMBH5 CA4LA!L17, / '6(!N!F%, (!!JH&MD!&CLDO!	9:P>!
	CGHMA4LA!L17, / '6(!N!F%, (!!JH&MD!&CLDO!	9:P9!
	0 GH2L4LA!L17, / '6(!N!F%, (!!JH&MD!&CLDO!	9:P9!
	L17, / '6(4>M7*7)!M/ , , %*Q17@!&'6% . !4!JH&MD!&CLDO!	9:R8!
	L17, / '6(4>M7*7)!S 1.%6!&'6% . !4!JH&MD!&CLDO!	9:T8!
	L17, / '6(49:R!M7*7)!S 1.%6!&'6% . !4!JH&MD!&CLDO!	9:TP!
	L17, / '6(4>M7*7)!='%!&'6% . !4!JH&MD!&CLDO!	9:RP!
	L17, / '6(49:R!M7*7)!M/ , , %*Q17@!&'6% . !4!JH&MD!&CLDO!	9:T9!
	L17, / '6(49:R!M7*7)!='%!&'6% . !4!JH&MD!&CLDO!	9:RU!
	L17, / '6(49:8!M7*7)!M/ , , %*Q17@!&'6% . !4!JH&MD!&CLDO!	9:R<!
	L17, / '6(49:8!M7*7)!='%!&'6% . !4!JH&MD!&CLDO!	9:R>!
	L17, / '6(49:8!M7*7)!S 1.%6!&'6% . !4!JH&MD!&CLDO!	9:TU!
	J / @1(V%6!J*1Q%(!L17, / '6!&'6% . !4!JH&MD!&CLDO!	9:8>!

)

"#(! . (B4! %4(&! \$%! 4#(! 10. ' 9\$3! +, -! ' . /0%\$%<! >#\$3#! &)58\$1(%!\$. 25)9 '4\$5.!'C5*4!
 3#' .6(%!\$.!&())%\$%4(.3(!58(!4\$9 (;!"#(!)(%*/4%!)(!&/544(1!\$.!' \$6*)(!?!; a\$%* '/!\$.%&(34\$5.!
 %*66(%4%4# '4!&())%\$%4(.3(!58!4\$9 (E8')0\$.6!' .1!4(.1!45!2/*34*'4(!')5* .1!\$4%!'8('6(;!!!

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<%#" ,& HI) L50+ ' %=) D'',34) &?. (0&04)=+=\$=''+4%(03): (,) 4C&)=+3&) (:) - - 9N / ; B8LB)
 L%+ ' (073)S)! &' 3))



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"#(!%4'4\$3!^*)%4!(B&5. (.4!25)!4#(!R)4!&)\$3(!\$. 1\$3(%!\$%!)(&5)4(1!\$.!' 'C/(!:=!

>!
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O+P\$&KI)B4+4%=)D'',34)&?. (0&04)=+\$=''+4% (03): (,)4C&9,4) . , %=&)%07%=&3))

"#\$%! &'()*+, %')!

.5\$%(!'.1!'*4535))(/'4(1!())5)%<!\$.!4#(!/'44())!3'%'!*%\$.6!4#(! (B&5. (.4\$'/'!%&(34)'/!951(/!52!
S/5592\$(/!G?ZU=K;! "#\$%!\$%!'.5.E&')'9(4)\$3!9(4#51!45!3'&4*)(!'*4535))(/'4\$5. !\$9&/\$3\$4/0!
%\$.6!4#(! %&(34)'/!1(.%\$40!2.34\$5.

-)\$(%!	s 5!1(4)9\$. \$%4\$3! 4()9%!	R. !\$. 4()3(&4!
2134%. !5 / *6%7+. !899! & ' 6%. !!	?;? ?!!!G?;@T<!!!?;?ZK!	HIMX)))YHIKXU)))HIWKZ)
2134%. !=1' %! 0 1' %!>99! & ' 6%. !!	?;TU!!!G?;?U<!!!?;AZK!	HITR)))YHIMRU)))HIWKZ)
2134%. !=1' %! 0 1' %! & ' 3%()7?@%(!& ' 6%. !!	?;[Y!!!G?;=Z<!!!?;AZK!	HITR)))YHIMKU)))HIWKZ)
\$\$K!-4' 9&%!!		
A " BC2DE!F&5 5GCA! FHG I J!	?;@Y!!!G?;@[<!!!?;??K!	HIH[)))YHIHM(U)))HIRHZ)

Y)!; *50!K#/#5#- '#0!/\$#- .+-%' .*) !+*&!#%-K!/#&. #/!%- *&O.) <!' *!'K#/'%'. /'. -%5!/.<).
'#& (/B!Y)!\$%&#)'K#/. /!'K#!ZQ [!-*).+O#) -#!.) '#&7%5/B!

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O+P\$&)WPG)F34% ' +4&7)=(&::=%&043)%0)O+P\$&)T+

k \$. (%!' . 1!%4' 9&%!		
SK!!!! k \$. (%!		
-)\$(%!	1!GZAV!35 . 2; !\$. 48;K!	N. 4()3(&4!G4E8' /*(K!
2134%. !5 / *6%7+. !899! & ' 6%. !!	?;[Z!!!G?;=Z<!!!?;f=K!	Z=;@Af!!!GTT;U@K!

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O+P\$&)\+G)F34% ' +4&3)(:7G) Q C%4&)0 (%3&&, , (, 3)

H\$' 95.1%!			
-()\$(%!)	s 5!1(4()9\$. \$%4\$3! 4()9%!	R. !\$. 4()3(&4!	R. !\$. 4()3(&4!' . 1!! /\$. (')!4\$9 (!4)(. 1!
MMBH5CA4LA! L17 , / '6(!N!F% , (!! JH&MD!&CLDO!	?;@!!!G@;ZY<!!!?;@TK!	HIVR)))YVIXXU)))HIVTZ)	?;@T!!!G@;ZZ<!!!?;@AK!
CGHMA4LA!L17 , / '6(! N!F% , (!!JH&MD! &CLDO! 0 GH2L4LA!L17 , / '6(! N!F% , (!!JH&MD! &CLDO!	?;@!!!G@;ZY<!!!?;@TK! ?;@!!!G@;	HIVR)))YVIXXU)))HIVTZ)	?;@T!!!G@;ZZ<!!!?;@AK!

O+P\$&)\PG)F34% ' +4&7)=(&::=%&043)%0)O+P\$&)W+)

H\$' 95.1%!

- ()\$(%!

1!GZAV!35.2; !\$.48;K!

N.4()3(&!G4E8'/*(K!

")(.1!G4E8'/*(K!

MMBH5CA4LA!

L17, / '6(!N!F%, (!!

JH&MD!&CLDO!

HIVR)))YVIXXU)))HIVTZ)

Y;AAAU!!!GTU=;YYK!

EEE!

4#(!3'!(152!>#S4(!.5S%(!1\$%4*)C'.3(%;!R%!3'!.!C(!%((.<!4#(!2\$.1\$.6%!25)!2\$.(!>\$.(!G"'C/(!
ZK!')(!35.>%\$4(.4!>\$4#!4#(!&)(8\$5*%!5.(%!25)!4#(!>#S4(!.5S%(!3'!(!G"'C/(!fKD!25)!'/!25*)!
\$.1\$3(!4#(!4\$9(!4)(.1!\$%!25*.1!45!C(!\$.%\$6.\$2\$3'.4!'!.1!1!\$%!(%4\$9'4(1!45!C(!%\$6.\$2\$3'.4/0!
#\$6#(!4#'!.!?!;

O+P\$&X+G)F34%'+4&3)(:7G)/\$((':%&\$7)+'4(=(,,&\$+4&7)&,,(,3)

k\$.(!!'!.1!%4'9&%!

\$K!!!!k\$.(!'

`5)!1\$'95.1%!G" 'C/(!?!K!4#(!4\$9(!4)(.1!\$%!25*.1!45!C(!%4'4\$%4\$3'//0!%\$6.\$2\$3'.4!G'.1!
. (6'4\$8(K!\$.!f!5*4!52!4#(!?!=!3'(%!(B'9\$. (1<' .1!9 ('.!) (8%)\$5.!.5>!533*)%!.!//!3'(%!
\$.!359&')\$%5. !45!?!@!5*4!52!?!=* .1(!4#(!'%%*9&4\$5. !52!>#\$4(!.5\$(!())5)!G" 'C/(!UK;!

O+P\$&)HHPG)F34% ' +4&7)=(&::=%&043)%0)O+P\$&)HH+)

R)4!&)\$3(%!\$. 1\$3(%!			
- ()\$(%!	s 5!1(4() 9\$. \$%4\$3! 4() 9%!	R. !\$. 4()3(&4!	R. !\$. 4()3(&4!' . 1!! /\$. (')!4\$9 (!4)(. 1!
F@/?7@!&' 6%. !W I ALX!	@;Z=!!!G@;UA<!!!?;TTK!	[;f?@!!!G=Y;YAK!	EEE!
F@/?7@!&' 6%. !WD I HX!	@;YZ!!!G@;fA<!!!?;TAK!	[;fT@!!!G[=;fZK!	EEE!
J71')! 'Y!	@;Yf!!!G@;UA<!!!?;@TK!	[;fTf!!!G?=f;Tfk!	EEE!

' . '/O% (! &())%\$%4(. 3(! 52! 4#(! 25//5>\$. 6! '%%(4! &)\$3(%! '4! 4#(! 1 '\$/0<! 9 5 . 4#/0! ' . 1! 7*')4()/0!
2)(7*(. 30D!=!2\$. (!>\$. (!&)\$3(!\$. 1\$3(%<! ?@!1\$' 9 5 . 1!&)\$3(!\$. 1\$3(%<! ?A!')4!&)\$3(!\$. 1\$3(%<' . 1!
?!%4' 9 &!&)\$3(!\$. 1(B;! "#(!)(%*/4%!3' . !C(!%*9 9 ')\$(1!' %!25//5>%;! k \$. (!&)\$3(%!')(!25* . 1!45!
C(!#\$6#/0!&())%\$%4(. 4<!>#\$/%4!%4' 9 &!&)\$3(%!' &&(')!45!C(!5 . /0!>(' :/0!&())%\$%4(. 4<!4#5*6#!4#(0!
3' . !%4\$//!C(!3#')' 34()\$(1!' %!' !/5 . 6E9 (9 5)0!&)\$3(%%F!' %!25)!1\$' 9 5 . 1!&)\$3(%<!4#(0!3' . !C(!
&())%\$%4(. 4!GH\$' 9 5 . 1%! I !J (9 %K<' . 4SE&())%\$%4(. 4!GH\$' 9 5 . 1%L')' 4!\$. 1\$3(%K!5)!(8(.!)' . 15 9!
GM5/\$%#(1!M)\$3(%!H\$' 9 5 . 1!N . 1(BK;! "#(!10 . ' 9 \$3!+, -!' . '/O%\$%' /%5!%#5>%14#' 4!&())%\$%4(. 3(!
\$%14\$9 (E8')0\$. 6!' . 1!4(. 1%!45!2/*34* ' 4(!')5* . 1!4#(!' 8)' 6(;!"#(12\$. 1\$. 6%13' . !C(!B&/'\$. (1!
CO!4#(!1\$22)(. 4!1(6)((!52!/\$7*\$1\$40!52!4#('%%(4%!(B' 9 \$. (1;!!

N . !4#(! 9 'Q5)\$40!52!3' %!(%4#(! (8\$1(. 3(! '&&(')!45!35 . 4)' 1\$34!4#(! \ 22\$3\$(. 4!] '): (4!
^0&54#(%\$%D!&())%\$%4(. 3(! \$ 9 &/\$(%!&)(1\$34' C\$/ \$40<' . 1!' . 4SE&())%\$%4(. 3(! 9 5)(!2)(7*(. 4! 9 (' . !

\$1D131E;19!

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R 9 (*)<! S; ^;<! I! `*)<! \;g;! GT@?ZK;! a5/'4\$/\$40! 4)' .% 9\$%\$5. ! 45! 4#(! 2\$. (! >\$. (! 9 '): (4;! \35.59\$3!] 51(/\$.6;!YA<!=@UE=?f;!15\$D?@;?@?f,Q;(35.951;T@?Z;?@;@?U!

S5*)\$<!\;N;<! I !+5*C'*1<!H;!GT@?fk;!`\$. (! k \$. (%!' .1! -453:%!2)59!4#(!M())&(34\$8(!52! 1 h!
N.8(%45)%D! ^(16(! 5)! -'2(! ^'8(.v! b5*). '!/! 52! k \$. (! \35.59\$3%<! ??GTK<! T==_
T[Y;!15\$D?@;?@?U,q>(;T@?A;?@!

L '&5)'/(!J;!] ;!g*\$%!J\$/ER/' . '<!R/(B!M/'%4* .<!GT@?YK<!M())%\$%4(.3(!\$.!4#(!

a (1<L;<a (1E