VITA

Norman E. Spear

!"#$% &' ( )

*$+,%! - $.! "/ 012 3"4"52
;<.53, - !". =.<>$%1<!29?=@A
;<.53, - !".E @A (:F'&97'''

03".$6 7'8988 9&77:
BCD6 7'898889&788
G9 - ,<46 .1+$,%H#<.53, - !".I$JK

Present Position: ;<.53, - !". =.<>$%1<!2E ?!,!$ =.<>$%1<!2 "/ @$L A"%M
?=@A *<1!<.5K<13$J 0%"/$11"% "/ 012 3"4"52E (F8)9+%1.!
*<%$!"%E N$.!$% /"% *$>$4"+ - $.! , .J ;$3,><"%,4 @$K%"1 <$. $
N4<.< ,4 0%"/$11"%E *$+,%! - $.! "/ 012 3<,!%2
N4<.< ,4 N, - +K1 "/ =+1!,!$ O$J< ,4 N$.!$%

Personal: O,%%<$JP !L" 3<4J%$.E /<>$ 5%, .J 3<4J%$.

Education: @"%!3L$1!$%. =.<>$%1<!2E G>, .1!".E Q44<."<1E (FRF9(F7:
03I*I<. GS+$%< - $.!,4 012 3"4"52E (F7:
OI?I<. GS+$%< - $.!,4 012 3"4"52E (F7(
;"L4<.5 T%$$. ?!,!$ =.<>$%1<!2E ;"L4<.5 T%$$.E 3<"E (FRR9(FRF
;I?I<. 012 3"4"52E (FRF

Review of General Psychology, (FF8 _ +%1.!

CJ93" ".1K4!,.!/"%6
Developmental Psychology, Psychology and Aging, Behavioral Neuroscience, Journal of Social Behavior & Personality, Journal of Comparative and Physiological Psychology, Physiology and Behavior, Psychological Review, Psychological Bulletin, British Journal of Psychology, Behavioral Brain Research, Pharmacology, Biochemistry and Behavior, Journal of Abnormal Psychology, American Psychologist, National Science Foundation, National Research Council of Canada, National Institutes of Health.

Other:

G4$!<". !" ?" <$!2 "/ GS+$%< - $.!,4 012 3"4"5<1!1
=.<>$%1<!2 CL,%J /"% GS 44. $<. [$1$,% 3E (FF)9FR
CL,%J$J \"L,%J N%"1#2 ` ,%%$. O$J,4 /%" - !3$
?" <$!2 "/ GS+$%< - $.!,4 012 3"4"5<1!1E &''(
?!,!$ =.<>$%1<!2 "/ @$L A"%M CL,%J /"% [1,% 3 ,.J ? 3"4,%13<+E &''R9&''7
^3$ N,#a, J Y, , ;,1<. VO$S< "W 1K#1+$ <$1 "/ !3$ 4<a,%J
? $4"+"%K1 K.JK4,!K1 L,1 ., -$J b? $4"+"%K1 K.JK4,!K1 1+$,%<c
#2 <!1 J<1 ">$%$%E *%I *,><J N3<1a,%
?$.<"% [$1$,% 3 CL,%J /"% - Q.!$%.,!<".,4 ?" <$!2 /"% *$>$4"+ - $.!,4
012 3"#<"4"52E V&'(&W
d"<1 ;I *$B4$K% CL,%J /"% C ,J$ - < C 3<$>$ - $.! ,! ;<.53, - !". =.<>$%1<!2E &'(:

Major Research Grants:

*Simultaneous and successive contrasts in reinforcement*I
@QO\6 O\ 'U88'E (F7:9(F7)

Contiguity and mediation in verbal learning
@QO\6 O\ ('(F)E (F7)9(F7R

Performance after a change in reinforcement
@QO\6 O\ (&'7)E (F7)9(F78

Disruption of effects of conditions of reinforcement
@QO\6 O\ (&'7)E (F779(F8(

*Research Scientist Development Award*E ^2+$ QQ V1,4,%2 ".42W
@QO\6 O\ )8:RFE (F7F9(F8)

Memory and retrieval failure in the rat
@QO\6 O\ (U7(FE (F8'9(F8:

Memory and retrieval failure @,!<".,4 ? <$. $B"K.J,!<".6 ;@? 8)9&)(F)E (F8:9(F8UE
e:&7E'''

Ontogeny, forgetting and retention
@?B6 ;@? 8U9'&:7'E (F8U9(FU(E e(R'E'''

Alcohol *ŕ ŭ ŭ* *g*

Acute fetal ethanol and behavioral development VL<!3 *%I ZK, . O"4<. ,W
C*CO\C ? - ,44 T%, .! 0%"5%, - 6 4 [4 CC'77'RE n *(< !&9

Bibliography
Books:

(I B4,3$%!2 NBE \, -<4!". d `E T,.J$4-,. Ă[E ?+$,% @G V(F88) *Learning and Memory*I @$L A"%M6 [,.J O @,42E R&R +,5$1I

&I ?+$,% @G V(F8UW *Processing Memories: Forgetting and Retention*I \<441J,4$E @Z6 G%4#,K-E R7' +,5$1I

V(FU'W *L'evolution des souvenirs: Oubli et Memoire.* ^%,.14,!$J #2 ;I *$L$$%I 0,%<16 OG*?QI

:I ?+$,% @GE N,-+#$44 ;CE GJ1I V(F8FW *Ontogeny of Learning and Memory*I \<441J,4$E @Z6 G%4#,K-E :&(+,5$1I

)I ?+$,% @GE O<44$% [[E GJ1I V(FU() *Information Processing in Animals: Memory Mechanisms*I \<441J,4$E @Z6 G%4#,K-E :F' +,5$1I

RI Q1,, 1". [dE ?+$,% @GE GJ1I V(FU&W *The Expression of Knowledge*I @A6 O4$.K- 0%$11E)&: +,5$1I

7I i,<4 [E ?+$,% @GE GJ1I V(FU)) *Comparative Perspectives on the Development of Memory.* \<441J,4$E @Z6 G%4#,K-E :8) +,5$1I

8I O<44$% [[E ?+$,% @GE GJ1I V(FURW *Information Processing in Animals: Conditioned Inhibition*I \<441J,4$E @Z6 G%4#,K-I

UI ?+$,% @GE [< <" *N V(FF)W *Memory: Phenomena and Principles*I @$$J3,- \$<53!1E OC6 C42.];, ".I

FI ?+$,% @GE ?≠$,% dOE ` ""J%K// O VGJ1IW V(F%FR) *Neurobehavioral Plasticity: Learning,*

(FI ?+$,% @GE O"4<. ,

:&I ?+$,% @GE O"4<. , ZN V&' ' (WI N". 1mK. $1 "/ $,%42 $S+"1K%$!" ,4 "3"46 \ "L , .< - ,4
1!KJ<$1 %$>$,4 4,!$% +,!!$%.1 "/ K1$, . J ,#K1$ <. 3K - , . 1I Q. OI N,%%"44] ; I
>$% - <$% VGJ1IWE *Linking An в d ,*

All Publications :

[redacted] . $% ; "SE
%K . L , 2E , . J ^9 - , a$ +$%/"% - , . $I Z N" - + 0321<"4 012 3"4 RR6 78F9U)I 0OQ*6
(: FUFFR ' n0K#O$J 9 <. J$S$J /"% OG * dQ@Go

&I ?+$, % @GE \<44 ` B V(F7&W O$!3"J"4"5< , 4 . "!$6 GS $11<>$ L$<53! 4"11 <. %, !1 4<><. 5 <. , !><!2
L3$$41I 012 3"4 [$+ ((6) : 89) : UI

: I \<44 ` BE ?+$, % @GE N4, 2!" . i @ V(F7&W ^9 - , a$ %$>$%1 , 4 4$, %. <. 5 , /!$% 1$>$%, 4 J</$%$. !
">$%!%, <. <. 5 +%" $JK%$1. Z GS+ 012 3"4 7)6 R : : 9) 'I 0OQ*6 (: FR) RR : n0K#O$J 9
<. JSJ /"% OG * dQ@Go

)I \<44 ` BE ?+$, % @G V(F7&W [$1<1!, . $!" $S!<. !<". , 1 , f"<. ! /K. !<". "/ %$L , %J - , 5. <!KJ$
, . J !3$ 1+, <. 5 "/ $S!<. !<". !%<, 41. Z GS+ 012 3"4 7)6 7 : 79FI 0OQ*6 (: FR) RR)
n0K#O$J 9 <. J$S$J /"% OG * dQ@Go

RI ?+$, % @GE \<44 ` BE g?K44<>, . * Z V(F7 : W ?+" . !, . $"K1 , 4!$%. , !<". L<!3 , . J L<!3"K! %$L , %J <.
3""J$J , 4#<. " %, !1I 012 3"4"5< , 4 [$+"%!1 (&6)) (9)) &I

7I \<44 ` BE ?+$, % @G V(F7 : W C %$+4< , !<". "/ ">$%4$, %. <. 5 , . J %$>$%1 , 4 <. , ^9 - , a$I Z GS+
012 3"4 O , % 7R6 : (8I 0OQ*6 (: FR) RR(n0K#O$J 9 , . J %$>$%1 , 4O

(7I \<44 ` BE ?+$,% @GE G%4$#, 3$% C V(F7RW [$-<.<1 $. $, . J /"%5$!!<.5 <. , %K. L ,2I Z GS+ 012 3"4 8'6 &'(9FI 0OQ*6 ( ) :) (8R: n0K#O$J 9 <. J$S$J /"% OG*dQ@Go

(8I ?+$,% @GE 0 ,>4<M ` ; V(F77W 0$% $.!,5$ %$<./"% $-$.! , . J %$L ,%J $//$!1 <. , ^9 - ,a$ #$!L$$. , . J L<!3<. ?1I Z GS+ 012 3"4I 8(V)W6 R&(9U 0OQ*6 RF'F'88 n0K#O$J 9 <. J$S$J /"% OG*dQ@Go

(UI ?+$,% @GE O<MK4M, 0E 0"JJ O V(F77W ^%, .1/$% ,1 , /K. !<". "/ RF RF RF

)FI jB$<54$2 *CE ?+$,% @G

7RI ?+$,% @G V(F87W [$!%<$>,4 "/ -$ - "%<$1I Q. `I iI G1!$1E GJIE \, .J#" "M "/ d$,%.<.5 , .J
N"5.<!<>$ 0%" $11$1E Y"4I QYE C!!$.!<". , .J O$ - "%2I \<441J,4$E @Z6 G%4#,K - E (89F'I

77I ?+$,% @GE j0,%1".1 0 V(F87W C.,421<1 "/ , %$, !<>,!<". !%$,! - $.!6 .!"5$.$!<
J$!$% - <. , .!1 "/ ,44$><,!$J /"%5$!!<.5I Q. *I O$J<.E `I ["#$%!1] [I *,><1E GJ1IE
0%" $11$1 <. C.<- ,4 O$ - "%2I \<441J,4$E @Z6 G%4#,K - E (:R9(77I

78I ?+$,% @G V(F87W .!"5$.$!< /, !"%1 <. !3$ %$!%<$>,4 "/ -$ - "%<$1I C ! @$%> ?K+$% VO%,3,W
I (UV)W6 :'&9((I 0OQ*6 ('(R&'U n0K#O$J 9 <.J$S$J /"% OG*dQ@Go

7UI j;%2,. [TE ?+$,% @G V(F87W B"%5$!!<.5 "/ , J<1 %< - <.,!<". ,/!$% <.!$%>,41 "/ <.!$% - $J<,!$
4$.5!36 ^3$ i, - <. G//$! L<!3 3"< $#$3,><"%I Z"K%.,4 "/ GS+$%< - $.!,4 012 3"4"526
C.<- ,4 ;$3,><"% 0%" $11$1 &6 &&(9&:)I

7FI B4,3$%!2 NBE \, - <4!". d `E T,.J$4 - , . [E ?+$,% @GI V(F88W d$,%.<.5 , .J O$ - "%2I @$L
A"%M6 [, .J O @,442E Q. IE R&R +,5$1I

8'I jO, 3! OdE ?+$,% @G V(F88W 0%< - <.5 $//$!1 <. $+<1"J< - $ - "%2I Z"K%.,4 "/ GS+$%< - $.!,4
012 3"4"526 \K - , . d$,%.<.5 , .J O$ - "%2 :6 8::98)(I

8(I jO, 3! OdE ?+$,% @GE d$><1 *Z V(F88W ?!,!$9J$+$.J$.! %$!$.!<". <. 3K - , .1 <.JK $J #2
,4!$%,!<".1 <. ,//$!<>$ 1!,!$I ;K44$!<. "/ !3$ 012 3"." - < ?" <$!2 ('6)(R9)(UI

8&I ?+$,% @G V(F8UW 0%" $11<.5 O$ - "%<$16 B"%5$!!<.5 , .J [$!$.!<".I \<441J,4$E @Z6 G%4#,K - E
R7' +,5$1I

V(FU'W dg$>"4K!<". J$1 1"K>$.<%16 K#4<$ $! O$ - "<%$I ^%, .14,!$J #2 ;I *$L$$%I 0,%<16
OG*?QI

8:I ?+$,% @GE j? - <!3 TZ V(F8UW C44$><,!<". "/ /"%5$!!<.5 <. +%L, .4<.5 %,!1I *$> 012 3"#<"4
((V7W6 R(:9&FI 0OQ*6 8&'8RF n0K#O$J 9 <.J$S$J /"% OG*dQ@Go

8)I j\, - #$%5 ZOE j ?+$,% @G V(F8UW C44$><,!<". "/ /"%5$!!<.5 "/ J<1 %< - <.,!<". 4$,%.<.5I
d$,%.<.5 , .J O"!<>,!<". F6)779)87I

8RI j? - <!3 TZE ?+$,% @G V(F8UW G//$!1 "/ !3$ 3" - $ $.><%". - $.! ". L<!33"4J<.5 #$3,><"%1 , .J
". J<!<".<.5 <. <./, .! , .J .$". ,!,4 %,!1I ? <$. $ &'&V):7RW6 :&89FI 0OQ*6 7F)R:U
n0K#O$J 9 <.J$S$J /"% OG*dQ@Go

87I j ` "4a ZOE j \K%1! *E j?3$%% COE ?+$,% @G V(F8FW ?!< - K4K1 , .J +%" $JK%,4 J$!$% - <. , .!1 "/
!3$ /"%5$!!<.5 "/ ". J<!<".$J /$,%I C - Z 012 3"4 I&V&W6 :'89&(I 0OQ*6)8)U:R n0K#O$J
9 <.JSJ /"% OG*dQ@Go

88I jQ./K%., [@E j?!$<.$%! 0CE jB%$J, Z?E ?+$,% @G V(F8FW ?K %"1$ +%$/$%$. $, .J d<N4 9
<.JK $J ,>$%1<". ,1 , /K. !<". "/ J%K5 J"1$ * 5 I' ⌘ !3$

F)I j?"43$< - T?E j\$.14$% ZTE ?+$,% @G V(FU'W C5$9J$+$.J$.! ".!$S!K,4 $//$!1 ". 13"%!9
!$% - , !<>$,>"<J,. $ %$!$.!<". <. %,!1I \"% - ;$3,> ()V:W6 &')9('I OQ*6 8)&F):F
n0K#O$J 9<.J$S$J /"% OG*dQ@Go

('UI jN"%#2 ZE jN,a, 0CE ?+$,% @G V(FU&W .!"5$.$!< 3,.5$1<. !3$ $//$!<>$.$11 "/ 3" - $
.$1! "J"% ,1 , ".J<!<".$J 1!<-K4K1I ;$3,> @$K%,4 ;<"4I :RV)W6 :R)978I 0OQ*6 8(7R7(F
n0K#O$J 9<.J$S$J /"% OG*dQ@Go

('FI OK44% N ` E d<1 - , . ?CE ?+$,% @G V(FU&W C 3K - , . - $ - "%2 +%" $JK%$!" <.>$1!<5,!$ J%K5
J<1 %<-<.,!<".1 , .J 1!,!$ J<11" <,!<".1 1<-K4!,.$"K142I Q. BINI N"4+,$%!] ZICI
["1$. %,.1E GJ1IE B<%1! Q.!$%.,!<".,4 ?2-+"1<K- ". *%K51 ,1 *<1 %<-<.,!<>$?!<-K4<I
C-1!$%J, -6 G41$><$%X@"%!3 \ "44,.J 0%$11I

(('I j? -<!3 TZE jT""J4$!! N [E ;K%%<53! [TE *".">< M 0ZE ?+$,% @G V(FU:W ^3$ +%1. $ "/
3" - $,5$ 1!<-K4< ,!!$.K,!$1 1+".!,.$"K1 ,4!$%.,!<". J$/< <!1<. %,!1 L<!3 1$+!,4
4$1<".1I 0321<"4"5< ,4 012 3"4"52 ((6 ((F9(&)I

(((I OK44% N ` E d<1 - , . ?CE ?+$,% @G V(FU:W C4 "3"4 $.3,. $ - $.! "/ 3K - , . - $ - "%26 ^$1!1
"/ ".1"4<J,!<". , .J <.!$%/$%$. $ 32+"!3$1$1I 012 3"+3,% - , "4"52 V;$%4WI U'V:W6 &&79
:'I 0OQ*6 7)(&&77 n0K#O$J 9<.J$S$J /"% OG*dQ@Go

((&I j? 3 - ,fKM @CE ?+$,% @GE Q1, , 1". [d V(FU:W C#1$. $ "/ ">$%13,J"L<.5<. %,!1 L<!3
3<++" , - +,4 4$1<".1I 0321<"4"5< ,4 012 3"4"52E ((E RF97&I

((:I ?+$,% @GE OK$44$% N ` V(FU)W N".1"4<J,!<". ,1 , /K. !<". "/ %$!%<$>,4I Q. \I ` $<.5,%!.$%
] GI?I 0,%M$%E GJ1IE O$ - "%2 N".1"4<J,!<".6 012 3"#<"4"52 "/ N"5.<!<".I \<441J,4$E @Z6
G%4#,K - E (((9()8I

(()I ?+$,% @G V(FU)W ^3$ /K!K%$ 1!KJ2 "/ 4$,%.<.5 , .J - $ - "%2 /%" - , +12 3"#<"4"5< ,4
+$%1+$!<>$I Q. YI ?,%%<1] CI 0,%JK <E GJ1IE 0$%1+$!<>$1<. 012 3"4"5< ,4
GS+$%< - $.!,!<".I \<441J,4$E @Z6 G%4#,K - E U89(' :I

((RI ?+$,% @GE

(R'I j \"// - , . . \E ?+$,% @G V(FUUW .!"5$.$!< J</$%$. $1 <. ".J<!<".<.5 "/ , . ,>$%1<".!" ,
5K1!,!"%2 N? L<!3 , +$%<+3$%,4 =?I ;$3,> @$K%,4 ;<"4 R'V(W6 (79&: 0OQ*6 :)'((F)
n0K#O$J 9 <.J$S$J /"% OG*dQ@Go

(R(I ?+$,% @GE i%,$-$% 0ZE O"4<., ZNE j?-"44$% *G V(FUUW *$>$4"+-$.!,4 3,.5$ <. 4$,%.<.5
,.J -$-"%26 Q./,.!<4$ J<1+"1<!<". /"% kK.<!<a,!<".kI Q. ZI*$4, "K%] ZINI?I d$>2E GJ1IE
?21!$-1 L<!3 d$,%.<.5 ,.J O$-"%2 C#<4<!<$16 0%" $$J<.51 "/!3$ ` "%M13"+ \$4J <.
0,%<1E ZK.$ (R9(FE (FU8I C-1!$%J,-6 G41$><$%X@"%!3 \"44,.J 0%$11I

(R&I ?+$,% @GE j i K 3,%1M< *E O<44$% Z? V(FUFW ^3$ N?9 $//$!<. 1<-+4$ ".J<!<".<.5 ,.J
1!<-K4K1 1$4$!<". JK%<.5 J$>$4"+-$.!I C.<-,4 d$,%.<.5] ;$3,><"% (86 8'9U&I

(R:I j \"// - , . . \E ?+$,% @G V(FUFW B, <4<!,!<". ,.J <-+,<%-$.!"/ ".J<!<".<.5 <. !3$

(7:I ?+$,% @GE

&'&I ?+$,% @GE jO i<.a<$ *dE jC%."4J \O V(FF)W ?K55$1!<".1 /%" - !3$<./,.!%,! ,#"K! #%,<.
J21/K. !<". ,.J -$-"%2I Q. ZI *$4, "K% VGJIWE ^3$ O$-"%2 ?21!$- "/ !3$;%,<.I
` "%4J ? <$.!</< 0K#4<13<.5E &8U9:(R

&':I j\$21$% NZE jO i<.a<$ *dE jC!3,4<$ BE ?+$,% @GE] ?+$,% d0 V(FF)W G//$!1 "/ +%$.,!,4
$S+"1K%$!" " ,<.$ ". 3$,%! %,!$,.J ."., 11" <,!<>$ 4$,%.<.5 ,.J %$!$.!<".<.<./,.!
%,!1I ^$%,!"4"52)FV7W6)8'9UI 0OQ*6 88)8&7U n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&')I j\$21$% NZE

&(RI d,%<>$%$ @E ?+$,% @G

&&UI j0$+<." OAE jd"+$a OBE ?+$,% @GE O"4<., ZN V(FFFW Q./,.!%,!1%$1+".J J<//$%$.!42!"
,4 "3"4,/!$% .K%1<.5/%" - ,. ,4 "3"4<.!"S< ,!$J J,-I C4 "3"4 (UV&9:W6(UF9&'(I
0OQ*6 (')R7R8(n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&&FI j\$ 3! T?E ?+$,% @GE ?+$,% d0 V(FFFW N3,.5$1<. +%"5%$11<>$%,!<" %$1+".J<.5/"%
<.!%,>$."K1 " ,<.$<. /$-,4$%,!1!3%"K53"K! !3$%$+%"JK !<>$+%" $11I *$>
012 3"#<"4 :RV&W6(:79)RI 0OQ*6 (')7((&8 n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&:'I Y,%4<.1M,2, GQE 0$!%"> G?E jN3$14" M ?ZE ?+$,% @G V(FFFW C .$L -"J$4 "/ $!3,."4 1$4/9
,J-<.<1!%,!<".<. .$L#"%. %,!16 T$.J$% $//$!1 ". $!3,."4<.5$1!<". !3%"K53 ,
1K%%"5,!$.<++4$I C4 "3"4 N4<. GS+ [$1 &:VUW I'

&R(I jN3$14" M ?ZE Y,%4<.1M,2, GQE \<53 ZOE ?+$,% @G V&' ' :W \<53$%9"%J$% ".J<!<".<.5<. !3$
.$L#"%. %,!6 G//$!1 "/ !$ - +"%,4 J<1+,%<!2<- +42<./,.!<4$ $. "J<.5 "/ 1<- K4!,.$"K1
$>$.!1I Q./,. 2)6 (R89(87I

&R&I Z,5<$4" ZE O<44$% ZE ?+$,% ? - <!3 ZE ?+$,% @G V&' ' :W .!"5$.$!< J<//$%$. $1<. !3$
$S+%$11<". "/ ".J<!<".$J ><1K,4 ,>$%1<".1I *$> 012 3"#<"4)&V&W6(&:9: 'I 0OQ*6
(&RRR&88 n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&R:I 0$!%"> G?E Y,%4<.1M,2, GQE ?+$,% @G V&' ' :W ^3$ 1K%%"5,!$.<++4$!$ 3.<mK$<. !3$ %,!
+%"><J$1 , K1$/K4 ,.<- ,4 - "J$4 "/ 1K M4<.5<. #"!!4$9/$$J<.5 <% K - 1!,. $16 [$+42 !"
;4,11 V&' '&WI 0321<"4 ;$3,>6 8UV)9RW6U(:98I 0OQ*6 (&8U&&:F n0K#O$J 9<.J$S$J /"%
OG*dQ@Go

&R)I jB$%.,.J$a9Y<J,4 ZOE ?+$,% @GE O"4<., ZN V&' ' :W CJ"4$1 $.!%,!1 J<1 %<-<.,!$, -<4J

C4 "3"4 :'V(W6)R97'I 0OQ*6 (&U8U&8) n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&RRI i "a4"> C0E 0$!%"> G?E i,13<.1M2 `E j@<a3.<M"> OGE ?+$,% @G V&' ' :W %,4 " - +%$11<".
, !<><!2 ".,1K%%"5,!$.<++4$<. !3$.$L#"%. %,!6 @K!%<!<>$,.J ".9.K!%<!<>$ 1K M<.5I
*$> 012 3"#<"4):V)W6 &F'9: ' :I 0OQ*6 (R'&8) (& n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&R7I 0$!%"> G?E Y,%4<.1M,2, GQE ?+$,% @G V&' ' :W [$<./"% $-$.!/%" - +3,%-, "4"5< ,4 $//$!1

n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&R8I ;%,11$% ?OE ?+$,% @G V&' ')W N".!$S!K,4 ".J<!<".<.5<. <./,.!1E #K! ."! "4J$% ,.<- ,41E <1
@ /, <4<!,!$J #2 N? ".J<!<".<.5I @$K%"#<"4 d$,%. O$ - U(V(W6)79RFI 0OQ*6 ()78':RU
n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&RUI d,.J dNE ?+$,% @G V&' ')W G!3,."4<-+,<%1 -$-"%2 "/ ,1<-+4$ J<1 %<-<.,!<".<.
,J"4$1 $.!%,! ,! J"1$1 !3,!4$,>$,JK4! -$-"%2 K.,//$!$JI $1 $.!%J"1$1 !3 ṅ'

S K Ń = =

&7:I N3$14" M ?ZE j?, .J$%1 ?E ?+$,% @G V&''))W d$,%.<.5 JK%<.5 !3$.$L#"%.h1 /<%1! -$,46
?+$ <,4 %$1<1!, . $!" %$!%", !<>$<.!$%/$%$. $I *$> ? <I 8VRW6 RU(9FU 0OQ*6(R7':&F(
n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&7)I 0$!%"> G?E j@<a3.<M"> OE Y,%4<.1M,2, GQE ?+$,% @G V&''))W [$+$!<!<>$ $S+"1K%$!" ,
1K%%"5,!$.<++4$ +%"><J<.5 .K!%<!<>$,.J ".9.K!%<!<>$ /4K<J16 G//$!1 ". 1K M4<.5
#$3,><"% "/!3$.$L#"%. %,!I C++$!<!$):V&WE (UR9(F)I 0OQ*6 (R)RUU'R n0K#O$J 9
<.JSJ /"% OG*dQ@Go

&7RI d,.J NdE ?+$,% @G V&''))W B$,% ".J<!<".<.5<1<-+,<%$J<. ,JK4! %,!1 #2 $!3,."4 J"1$1
!3,! J" ."! ,//$! +$%<,J"4$1 $.!1I Q.! Z *$> @$K%"1 <&&VR97W6 :RR97&I 0OQ*6
(R:U'U:R n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&77I ?+$,% @GE O"4<., ZN V&''RWI B$!,4 "%<./,.!<4$ $S+"1K%$!" $!3,."4 +%" -"!$1 $!3,."4
<.5$1!<".<. ,J"4$1 $. $,.J ,JK4!3""J6 C !3$"%$!< ,4 %$><$LI C4 "3"4 N4<. GS+ [$1E
&FV7W6 F'F9&FI 0OQ*6 (RF87R(8 n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&78 j0K$!, OE jC#,!$ 0E ?+$,% @GE O"4<., ZN V&''RW Q.!$%, !<".1 #$!L$$. $!3,."4
$S+$%<$. $1 JK%<.5 4,!$ 5$1!,!<". ,.J .K%1<.56 G//$!1 K+".<./,.!<4$,.J -,!$%.,4
%$1+".1<>$.$11 !" $!3,."4I Q.!$%.,!<".,4 Z"K%.,4 "/N" -+,%,!<>$ 012 3"4"52E (UE &'89
&&)I

&7UI @<a3.<M"> OGE O"4<., ZNE Y,%4<.1M,2, GQE ?+$,% @G V&''7W 0%$.,!,4 $!3,."4 $S+"1K%$
<. %$,1$1 $!3,."4 %$<./"% $-$.!<. .$".,!,4 %,!1I C4 "3"4 N4<. GS+ [$1 :'V(W6:)9)RI
0OQ*6(7)::85

C4 "3"4 N4<. GS+ [$1 :'VFW6 (R'79(R(FI 0OQ*6(7F:'&(:n0K#O$J 9<.J$S$J /"%
OG*dQ@G

&87I @<a3.<M"> OGE Y,%4<.1M,2, GQE ?+$,% @G V&''7W [$<./"% <.5 $//$!1 "/ $.!%,4 $!3,."4
<.f$!<".1<. .$L#"%. %,! +K+1 "J"%I C4 "3"4 N4<. GS+ [$1 :'V(&W6 &'UF9&'F7I 0OQ*6
(8((8F8) n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&88I O"4<., ZNE 0,K!,11< [OE j^%KS$44 GE ?+$,% @G V&''8W *</$%$.!<,4 1 I'

&UUI i "a4"> COE Y,%4<.1M,2, GQE ?+$,% @G V&' 'UW G!3,."4E 1, 3,%<. ,.J mK<.<.$6 G,%42
".!"5$.2 "/!,1!$ %$1+".1<>$.$11 ,.J <.!,M$I C4 "3"4 N4<. GS+ [$1 :&V&W6 &F)9:'RI
0OQ*6 (U(7&'7U n0K#O$J 9<.J$S$J /"% OG*dQ@Go

&UFI 0K$!,E OIE C#,!$E 0IE \,2 - ,4E I;I

: ' (I 0 , K! , 11‹

: (: I O<44$% ?E ?+$,% @G V&' ('W O$%$ "J"% $S+"1K%$ 4$,%.<.5 <. !3$ %,! .$". ,!$ <- - $J<,!$42
,/!$% #<%!3 , . J ". $ J,2 4,!$%I *$> 012 3"#<"4 R&V)W6 :) : 9 : R(I 0ONQ*6
0ON: ')8)) '

: ( ) I C $>$J" OE O"4<. , ZNE @<a3.<M"> OE ?+$,% @GE 0,K!,11< [V&' ('W \<53 $!3, ."4 J"1$
JK%<.5 $,%42 ,J"4$1 $. $ <.JK $1 4" " - "!"% , !<>,!<". , .J <. %$,1$1 1K#1mK.!
$!3, ."4 <.!,M$ JK%<.5 4,!$,J"4$1 $. $I *$> 012 3"#<"4 R&

:&RI 0,K!,11<E [IOIE @<a3.<M">E OIGI] ?+$,%E @IGI V&'(&W G!3,."49-$J<,!$J ,++$!<!<>$
".J<!<".<.5<. <./,.!%,!1E #K! ."! "%!< "1!$%".$%4,1$E <1 J$+$.J$.!". %"K!$ "/
$!3,."4 ,J-<.<1!%,!<".I *$> 012 3"#<"4E R)V(W6 FU9('))I 0OQ*6 &(RF)U8(n0K#O$J 9<.
+%" $11o

:&7I O<%,.J,9O"%,4$1 [?E O"4<., ZNE ?+$,% @GE C#,!$ 0 V&'(&W @,4"S".$,!!$.K,!<". "/
$!3,."49%$<./"% $J "+$%,.! %$1+".J<.5<. <./,.! %,!1<. , %9S+"1K%$ +,%,J<5-I
012 3"+3,%-, "4"52P &(FV(W6 &:R9&)7I 0OQ*6&(8R'UF7 n0K#O$J 9<. +%" $11o

:&8I 0,K!,11< [OE @<a3.<M"> OGE B,#<" OGE ?+$,% @G V&'(&W G,%42 -,!$%.,4 1$+,%,!<".
,//$!1 $!3,."49<.JK $J ".J<!<".<.5<. , ."%9;@Q<.1$.1<!<>$ -,..$%E #K! J"$1 ."!
,4!$% $!3,."49<.JK $J 4" "-"!"% , !><!2I 03,%-, "4 ;<" 3$- ;$3,> (''V:W6 7:'97:UI
0ONQ*6 0ON:&R78)U nC>,<4,#4$ ".&'(:X(X(oI

:&UI i "a4"> C0E @<a3.<M"> OE Y,%4<.1M,2, GQE ?+$,% @G V&'(&W ^3$%"4$ "/1" <,4<1"4,!<".<.
$!3,."4 $//$!1 ".!3$ +%L,.4<.5%,!I ;$3,> ;%,<. [$1 &&8V(W6):9R8I 0ONQ*6
0ON:&)&UR(nC>,<4,#4$ ".&'(:X&X(oI

:&FI 0,K!,11< [OE @<a3.<M"> OGE C $>$J" O;E ?+$,% @G V&'(&W G,%42%"4$ "/!3$ M,++,
"+<"<J %$ $+!"%<. $!3,."49<.JK $J %$<./"% $-$.!I 0321<"4 ;$3,> ('RVRW6 (&:(9

: : 8I O<%, . J , 9O"%, 4$1 [?E @<a3 . <M"> OGE ` , !$%1 * \E ?+$, % @G V& ' (: W 0 , %!< <+, !<" . "/ !3$
. " < $+!<. X"%+3, . <. Bq %$ $+!"% <. $!3, . "49 - $J<, !$J 4" " - "!"% , !<>, !<" . , . J $!3, . "4
<. !, M$ <. +%L, . 4<. 5 %, !1I ; $3, > ; %, <. [$1 &) R VO, 2 (RWP (: 89 ( )) I 0OQ * 6 & :) : F&(7

: : UI C $>$J" O ; E @<a3 . <M"> OGE ?+$, % @GE O"4<. , ZNE 0, K!, 11< [OI V& ' (: WI G!3, . "49<. JK $J
4" " - "!"% , !<><!2 <. , J"4$1 $. ! %, !1 , . J !3$ %$4, !<" . 13<+ L<!3 $!3, . "49<. JK $J
" . J<!<" . $J +4, $ +%$/$%$. $, . J " . J<!<" . $J !, 1!$, >$%1<" . I * $> 012 3"#<"4I
RRV) W6) &F9) &I 0OQ * 6&&RF&RF8

: : FI C $>$J" OE 0, K!, 11< [OE ?+$, % @GE ?+$, % d0 V& ' (: W C5$9J$+$. J$. ! $//$!1 "/ 1!%$11 " .
$!3, . "49<. JK $J - "!"% , !<><!2 <. %, !1I 012 3"+3, % - , "4"52 & : ' V : W6 : UF9 : FUI

:) ' I O, % 3 ?OE 0, K!, 11< [OE O< 3, $4 @<a3 . <M">E ZK, . B$%. r . J$a9Y<J, 4E @"% - , . GI ?+$, %]
ZK, . NI O"4<. , I V& ' (: W 4/, !"%2 +%$/$%$. $ / "% $!3, . "4 / "44" L<. 5 1" <, 4 <. !$%, !<" .
L<!3 , . <. !"S< , !$J +$$% <. , J"4$1 $. ! %, !1 $S+"1$J !" $!3, . "4 <. 9K!$%"I 01< "!3$ - ,
&RV : W6 : RR9 : 7&I

:) (I B, #<" ONE @<a3 . <M"> OGE ?+$, % @GE 0, K!, 11< [OI V& ' ( ) WI ; <. 5$ $!3, . "4 <. !"S< , !<" .
3$<53!$. 1 1K#1mK. ! $!3, . "4 <. !, M$ <. , J"4$1 $. !E #K! . "! , JK4!E %, !1I * $> 012 3"#<"4
R7V : W6R8) 9RU : I 0OQ * 6& : :) (:) '

:) &I NK44$%$E OIE ?+$, %E @IGI] O"4<. , E ZINI V& ' ( ) W 0%$. , !, 4 $!3, . "4 <. %$, 1$1 1K %"1$
%$<. / "% $ - $. !6 C. $//$! 1!%$. 5!3$. $J #2 +"1!. , !, 4 , 11" <, !<" . "/ $!3, . "4 , . J
1K %"1$I C4 "3"4) UV (W6 &R9 : : I 0OQ * 6 & : 8UR : (F

:) : I O<%, . J , 9O"%, 4$1 [?E @<a3 . <M"> OGE , . J ?+$, % @GI V& ' ( ) WW 0%$. , !, 4 $S+"1K%$!" $!3, . "4
JK%<. 5 4, !$ 5$1!, !<" . /, <4<!, !$1 "+$%, . ! 1$4/9, J - <. <1!%, !<" . "/ !3$ J%K5 <. R9J, 29"4J
%, !1I C4 "3"4) U6 (F9& : I 0OQ * 6 &) : RR ' 8&

:)) I @<a3 . <M"> OGE 0, K!, 11< [OE N, %!$% ZOE d, . J<. Z 6

(7I jB"%%$1!$% `E ?+$,% @G V1+".1"%W V(F77W ^3$ $//$! "/ /%mK. 2 ,.J +%"."K. $,#<4<!2 ".
"J<.5 +%" $11$1 <. /%$$ 4$,%.<.5I 0%$1$.!$J ,! -$$!<.51 "/ G,1!$%. 012 3"4"5< ,4
C11" <,!<".I

(8I j\$ M$4-,. ?TE ?+$,% @G V1+".1"%W V(F77W C11" <,!<>$,.J "%!3"5%,+3< <.!%,4<1! 1<-<4,%<!2
<. /%$$ %$,44 "/ 4-$.!,%2 1 3""4 5%,J$1 !L" !" 1<SI 0%1.!$J ,! -$$!<.51 "/ G,1!$%.
012 3"4"5< ,4 C11" <,!<".I

(UI jY"5$4 ZE ?+$,% @G V1+".1"%W V(F77W ^3$ $//$! "/ +"1!9 ".1K- -,!"%2 J$4,2 ". , mK<1<!<".
,.J $S!<. !<". "/ !3$ %K..<.5 %$1+".1$I 0%1.!$J ,! -$$!<.51 "/ G,1!$%.
012 3"4"5< ,4 C11" <,!<".I

(FI j?+<!a.$% Z\E ?+$,% @G V(F78W ?!KJ<$1 "/ +%", !<>$<.!$%/$%$. $<. %$!$.!<". "/ !3$ %,!I
0%1.!$J ,! -$$!<.51 "/ !3$ 012 3"."-< 1 ?" <$!2I

&'I jN,M-,M O;E

)RI j;%2,. [E ?+$,% @G V1+".1"%W V(F8)W ^‹-$ J$+$.J$.! -$-"%2 J$/‹ ‹!1‹. , #%‹53!.$11
J‹1 %‹-‹.,!‹". !,1MI 0%1.!$J ,! -$$!‹.51 "/!3$ G,1!$%. 012 3"4"5‹ ,4 C11" ‹,!‹".I

)7I ?+$,% @G V(F8RW 0,%!‹ ‹+,.!‹. ?2-+"1‹K-E ` "%M‹.5 O$-"%2‹. C.‹-,41E ,! N,.,J‹,.
012 3"4"5‹ ,4 C11" ‹,!‹".I

)8I ?+$,% @G V(F8RW d$!K%$?$%‹$1 ". B%".!‹$%1 "/ سخي ℵ ".I

7(I jQ./K%., [@E j?!$<.$%!E 0ICIE j>".? 3L$%<.E *IE j*,42E *I] ?+$,%E @I GI V1+".1"%W V(F8UW
N".!$S!K,4 J$!$%-<.,.!1 "/!3$ -,5.<!KJ$ "/, 4$,%.$J!,1!$,>$%1<".<. +%L,.<.5
%,!1I 0%1.!$J ,! -$$!<.51 "/!3$ G,1!$%. 012 3"4"5< ,4 C11" <,!<".I

UFI OK44% N ` E j? 3,%$ OdE d<1 - , . ?CE ?+$,% @G V4FU(W * "$1 ,4 "3"4 <.3<#<! !3$ <.!%K1<". "/
<. <J$.!,4 - $ - "%<$1p 0%$1$.!$J ,! - $$!<.51 "/ !3$ C11" <,!<". /"% CJ>, . $ - $.! "/
;$3,><"% ^3$%,+2I

F'I j? 3,%$ OdE OK44% N ` E d<1 - , . ?CE ?+$,% @G V4FU(W C J$ - ".1!%,!<". "/ - ""J 1!,!$9
J$+$.J$.! %$!$.!<".I 0%$1$.!$J ,! - $$!<.51 "/ C11" <,!<". /"% CJ>, . $ - $.! "/

(') I ?+$, % @G V4FU&W .!"5$. $!< <. %$, 1$ <. 4$, % . <. 5 , . J - $ - "%26 #1$%> , !<" . 1 , . J
"%<$. ! , !<" . " - - " . !" 1!KJ2<. 5 3<4J%$. , . J , . < - , 41 I 0%1 . !$J , ! 0K%JK$ = . <>$%1<!2
?2 - +"1<K - " . G , %42 * $>$4"+ - $. ! "/ O$ - "%2 I

(' RI ?+$, % @G V4FU&W ^3$ " . !"5$. 2 "/ 1!< - K4K1 1$4$!<" . 6 * $>$4"+ - $. ! , 4 J</ /$%$. $1 <. L3 , ! <1
4$, % . $JI 0%$1$. !$J , ! \ , %%2 B% , . M TK55$. 3$< - N" . /$%$. $ " . C . < - , 4 N"5 . <!<" . E
N"4K - #< , = . <>$%1<!2 I

(' 7I OK44% N ` E d<1 - , . ?CE ?+$, % @G V4FU&W C4 "3"4 $. 3 , . $ - $. ! "/ %$, 44 >$%1K1
%$ "5 . <!<" . I 0%1 . !$J , ! - $$!< . 51 "/ !3$ C - $%< , . 012 3"4"5< , 4 C11" <, !<" . I

(' 8I OK44% N ` E d<1 - , . ?CE ?+$, % @G V4FU&W C 3K - , . - $ - "%2 +%" $JK%$!" <. >$1!<5 , !$ J%K5
J<1 %< - <. , !<" . 1 , . J 1! , !$ J<11" <, !<" . 1 1< - K4! , . $"K142I 0%$1$. !$J , ! ?$ " . J
Q . !$%. , !<" . , 4 ?2 - +"1<K - " . * %K51 , 1 * <1 %< - <. , !<>$?!< - K4<E ; $45<K - I

(' UI j i K 3 , %1M< * E j ; % , . J! ZE jO$$3 , . ?E ?+$, % @G V4FU&W * $!$% - <. , . !1 , . J 3 , %, !$%<1!< 1 "/
"J"%9/""!13" M " . J<!<" . <. 5 <. !3$ J$>$4"+<. 5 % , !I 0%1 . !$J , ! - $$!< . 51 "/ !3$
Q . !$%. , !<" . , 4 ?" <$!2 /"% * $>$4"+ - $. ! , 4 012 3"#<"4"52 I

(' FI jAK34 * GE * " . ">< M 0ZE ; K%%<53! [TE

((UI j@$L - , . ?E ?+$,% @G V4FU:W .!"5$.$!< J</$%$. $1 <. %"119

(:&I jiK 3,%1M< *E O"4<. , ZNE j\"// - , . . \E ?+$,% @G V4FU)W ?K %"1$, . J 1, 3,%<. ,>$%1<". 1
<. !3$ +%L, .4<.5 %,!I 0%1.!$J ,! - $$!<.51 "/ !3$ Q.!$%. ,!<". ,4 ?" <$!2 /"%
*$>$4"+ - $.!,4 012 3"#<"4"52I

(::I jO$$3, . ?E ?+$,% @GI V4FURW ^3$ $//$!1 "/ N?9 JK%,!<". , . J N?9 !" N?s <.!$%>,41 ".
". J<!<".<.5 !" !3$ N?s <. (R9J,2 "4J %,!1I 0%1.!$J ,! - $$!<.51 "/ !3$ G,1!$%.
012 3"4"5< ,4 C11" <,!<". I

(:)I jiK 3,%1M< *E ?+$,% @G V4FURW .!"5$.2 "/ , - $ - "%2 121!$ - /"% "J"%9 /""!13" M
,11" <,!<". 1 <. !3$ %,!I 0%1.!$J ,! - $$!<.51 "/ !3$ G,1!$%. 012 3"4"5< ,4
C11" <,!<". I

(:RI ?+$,% @GE O"4<. , ZN V4FURW .!"5$.$!< J</$%$. $1 <. !3$ ". !$.! "/ - $ - "%2I 0%1.!$J
,! @QN\ * N"./$%$. $E 012 3"#<"4"5< ,4 C1+$!1 "/ ;$3,><"%,4 *$>$4"+ - $.!I

(:7I ?+$,% @G V4FURW [$+%1.!,!<". "/ 1!< - K4< #2 <./, .! , .< - ,41I 0%1.!$J ,! N"4K - #<,
=.<>$%1<!2 ?$ - <. ,% ". !3$ 012 3"#<"4"52 "/ C.< - ,4 N"5.<!<". I

(:8I O,%M<$L< a ;E j0,K4 ?E ?+$,% @G V4FURW ^3$ $//$! "/ 3" - $,5$ 1!< - K4< ". !3$, mK<1<!<".
"/ ,>$%1<>$!,1M1 K1<.5 , ><#%"!, !<4$ N?I 0%1.!$J ,! - $$!<.51 "/ !3$ Q.!$%. ,!<". ,4
?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

(:UI O"4<. , ZNE j\"// - , . . \E j?$%L,!M, ZNE jd,%><$%$ @E jO$$3, . ?E ?+$,% @G V4FURW
^%, .1/$% , %"11 1$.1"%2 - "J,4!<$1 <. +%$L$, .4<.5 %,!1I 0%$1$.!$J ,! - $$!<.51 "/ !3$
Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

(:FI j\"// - , . . \E O"4<. , ZNE ?+$,% d0E ?+$,% @G V4FURW 0%$. ,!,4 ,4 "3"4 $S+"1K%$ JK%<.5
5$1!,!<". ,4 J,2 U ,//$!1 1$.1"%< - "!"% - ,!K%,!<". , . J ,4 "3"4 %$1+". 1<>$.$11 <. %,!1I
0%1.!$J ,! - $$!<.51 "/ !3$ Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

() 'I jd,%><$%$ @E ?+$,% @G V4FURW .!"5$.$!< J</$%$. $1 <. !%, .1/$% "/ ". J<!<".<.5 #$!L$$.
!L" J</$%$.! "J"%1 "/ $mK,4 /, - <4<,%<!2I 0,+$% +%1.!$J ,! - $$!<.51 "/ !3$
Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

() (I ?+$,% @G V4FU7W O"J$%,!"% , . J J<1 K11, .! /"% 1$11<". E k .!"5$.2 "/ d$, .<.5 , . J
O$ - "%2kI NK%%$.! Q11K$1 <. *$>$4"+ - $.!,4 012 3"#<"4"52 ?2 - +"1<K - E O,%,!3". E
B4"%<J,I

()&I j\"// - , . . \E ?+$,% @G V4FU7W G//$!1 "/ +%<"% $S+$%<$. $ ". !3$ 1K#1mK.! ,11" <,#<4<!2
"/ !3$ +%9S+"1$J K$ <. +%L, .4<.5 %,!1 I0,+$% +%$1$.!$J ,! - $$!<.51 "/ !3$
G,1!$%. 012 3"#<"4"5< ,4 C11" <,!<". I

() :I jd,%><$%$ @E ?+$,% @G V4FU7W ^%, .1/$% "/ 4$,%.<.5 #$!L$$. !L" J<1 %< - <. ,#4$ "J"%, .!1
L<!3 $mK<>,4$.! %$4,!<>$,//$!I 0%1.!$J ,! - $$!<.51 "/ !3$ G,1!$%. 012 3"4"5< ,4
C11" <,!<". I

())I i%,$ - $% 0ZE ?+$,% @GV4FU7W ?+". !, .$"K1 %$ ">$%2 "/ , ". J<!<". $J /4,>"% ,>$%1<".
/"44" L<.5 5$.$%,4<a$J $S!<. !<". I 0%$1$.!$J ,! - $$!<.51 "/ !3$ G,1!$%. 012 3"4"5< ,4
C11" <,!<". I

()RI jO$$3, . ?OE ?+$,% @G V4FU7W d$,%.<.5 , . J %$!$.!<". "/ !3$% - ,4 K$1 <. (R9 , . J &R9J,2
"4J %,!16 G><J$. $ /"% $. "J<.5 "/ ,//$!<>$,!!%<#K!$1I 0%1.!$J ,! - $$!<.51 "/ !3$
G,1!$%. 012 3"4"5< ,4 C11" <,!<". I

(7'I i%,$-$% 0ZE j0KJ<,M NE ?+$,% @G V4FUUW .!"5$ $!ή J<//$%$ ή $1 ! .< 1!<M K4K1$1$$ LK!'3.!3 I' *$>$4 I' V4F
,11" <,!$J L<!3 !3$ $S+%$11<". "/ , J<1 %<-<.,!<".I 0%1.!$J ,! -$$!<.51 "/!3$
G,1!$%. 012 3"4"5< ,4 C11" <,!<".I

(7(I j?-"44$% *GE jN3$. ` ZE ?+$,% @G V4FUUW =.<!<a,!<". "/!$S!K%$,.J "J"%<. !3$ (79J,2 "4J
%,!I 0%1.!$J ,! -$$!<.51 "/!3$ G,1!$%. 012 3"4"5< ,4 C11" <,!<".I

(7&I j\K.! 0?E ?+$,% @G V4FUUW C /K%!3$%<.>$1!<5,!<". "/<.!$%-"J,4!%,.1/$%<. !3$<./,.!%,!I
0%1.!$J ,! -$$!<.51 "/!3$ G,1!$%. 012 3"4"5< ,4 C11" <,!<".I

(7:I jd,%<><$%$ @CE jN3$. ` ZE ?+$,% @G V4FUUW Q-+4< ,!<".1 /"% !3$ /"%-,!<". "/ ".!$S!9=?
,11" <,!<".1<. !3$ +%L,.4<.5%,!I 0%1.!$J ,! -$$!<.51 "/!3$ G,1!$%.
012 3"4"5< ,4 C11" <,!<".I

(7)I O<44$% Z?E j?-"44$% *GE ?+$,% @G V4FUUW ?3"%!9!$%- %$!$.!<". <. (79J,2 "4J %,!1I 0%1.!$J
,! -$$!<.51 "/!3$ G,1!$%. 012 3"4"5< ,4 C11" <,!<".I

(7RI O$44". [NE i%,$-$% 0ZE ?+$,% @G V4FUUW C5$9%$4,!$J J<//$%$. $1<. ".J<!<".<.5!"!".$1E
4<53! ,.J!".$94<53! "-+"K.J1<. !3$%,!I 0%1.!$J ,! -$$!<.51 "/!3$ Q.!$%.,!<".,4
?" <$!2 /"% *$>$4"+-$.!,4 012 3"#<"4"52I

(77I O<K$% Z?E jZ,5<$4" ZCE ?+$,% @G V4FUUW C5$9%$4,!$J J<//$%$. $1<. 13"%!9!$%- %$!$.!<". "/
1$+,%,#4$ 4-$.!1 "/ ,. "J"% ,>$%1<".I 0%1.!$J ,! -$$!<.51 "/!3$ Q.!$%.,!<".,4
?" <$!2 /"% *$>$4"+-$.!,4 012 3"#<"4"52I

(78I j\"//-,.. \E j\K.! 0?E ?+$,% @G V4FUUW GS,-<.,!<". "/ K$9 ".1$mK$. $1+$ <!/< <!2 ,.J
"-+,%<1".1 ,-".5 5K1!,!"%2 ,>$%1<".1 $1!,#4<13$J #2 J<//$%$.!%$<./"% $%1<.
+%L,.<.5%,!1I 0%1.!$J ,! -$$!<.51 "/!3$ Q.!$%.,!<".,4 ?" <$!2 /"% *$>$4"+-$.!,4
012 3"#<"4"52I

(UUI Z,5<$4" ZCE O<44$% Z?E j\K.! 0?E ?+$,% d0E ?+$,% @G V4FF'W ^3$ $//$!1 "/ ".J<!<".$J
#%<53!.$11 ,>$%1<".1<. +%L,.4<.5 %,!1I 0%1.!$J ,! -$$!<.51 "/!3$ [1,% 3
?" <$!2 ". C4 "3"4<1 - I

(UFI j\$21$% NZE jN3$. ` ZE O<44$% Z?E ?+$,%

&'&I j[,f, 3, .J%, . dE jN3$. ` ZE jT""JL<. TCE jO""J2 NCE ?+$,% @GE ?+$,% d0 V(FF(W
0%$. ,!,4 " ,<.$ $S+"1K%$,4!$%1 %$, !><!2 !" !, !<4$ 1!< - K4,!<". E #K! ."! "!3$% 1" <,4
K$1I 0%$1$.!$J ,! - $$!<.51 "/ @$K%"#$3,><"%,4 ^$%,!"4"52 ?" <$!2I

&':I ?+$,% @GE i%,$ - $% 0Z V(FF(W [$!%<$>,4 +%" $11$1 , .J ". J<!<".<.5I ?2 - +"1<K -
+,%!< <+, .! ,! C.< - ,4 N"5.<!<".6 C N"./$%$. $ \ "."%<.5 * ". ,4J CI [<4$2I

&')I ?+$,% @GE O<44$% Z?E jC%."4J \ O V(FF(W C44$><,!<". "/ /"%5$!!<.5 <. !3$ <./, .! %,!I
0%1.!$J ,! - $$!<.51 "/ !3$ 012 3"." - < ?" <$!2I

&'RI j\$21$% NZE ?+$,% @GE ?+$,% d0 V(FF&W G//$!1 "/ +%$. ,!,4 $S+"1K%$!" " ,<.$ ".
J<1 %< - <. ,!<". 4$,%.<.5 <. ,JK4! %,!1I N" - - <!!$$ ". 0%"#4$ - 1 "/ * %K5 * $+$.J$. $I
i $21!".$E N I

&'7I jC%."4J \ OE jO i<.a<$ * d<$ α

&(7I j [,f, 3, . J%, . E dIE ?+$, %E @IGI] ?+$, %E dI0I V(FF&W C K!$ $!3, . "4 J<1%K+!1 +, !!$%.
" . J<!<" . <. 5 #K! . "! " . !$S! " . J<!<" . <. 5 <. , J"4$1 $. ! , . J , JK4! , . < - , 41I O%1. !$J
, ! - $$!<. 51 "/ ?" <$!2 /"% @$K%"1 <$. $I

&(8I j \ 21% NZE j [,f, 3, . J%, . dE ?+$, % @GE ?+$, % d0 V(FF&W ^3$ $//$!1 "/ +%$. , !, 4
$S+"1K%$!" " , <. $ " . !3$ J<1 %< - <. , !<>$ +%"+$%!<$1 "/ " , <. $ <. , JK4! %, !1I ?" <$!2
/"% @$K%"1 <$. $I

&(UI j ; %, 11$% ?OE jO i <. a<$ * dE O"4<. , ZNE ?+$, % d0E ?+$, % @G V(FF:W G!3, . "4 <. !"S< , !<" .

&: 'I jd$$ ZE jO i<.a<$ *dE ?+$,% @G V(FF:W G.3,. $J ".!$S! ,.J 1< - K4!,.$"K1 " - +"K.J1
,44$><,!$!3$ J4!$%<"K1 $//$!1 "/ ,4 "3"4 ". 4$,%.<.5 <. !3$ +%L,.4<.5 %,!I
0%1.!$J ,! - $$!<.51 "/ Q.!$%.,!<".,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&: (I jd".1!$<. Z?E jN3$. ` ZE ?+$,% d0E ?+$,% @G V(FF:W G!3,."4 ,.!,5".<1!E [(R9)R(:E
/,<4$J !" J<1%K+!4,!$.!<.3<#<!<".<. +%L,.4<.5 ,.J +$%<,J"4$1 $.!%,!1I 0%$1$.!$J ,!
- $$!<.51 "/ Q.!$%.,!<".,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&:&I jO i<.a<$ *dE j["$+$?E ?+$,% @G V(FF:W 0%$>,4$. $ "/ b4<!!$% $//$!1c ,1 ,11$11$J
!3%"K53 - K4!<+4$ - $,1K%$16 Q - +4< ,!<".1 /"% ".!"5$.$!< 1!KJ<$1I 0%$1$.!$J ,!
- $$!<.51 "/ Q.!$%.,!<".,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&::I ji%,$#$4 i ?E jO i<.a<$ *dE N3"!%" OTE j ` K%!a$4 @dE O"4<., ZNE ?+$,% @G V(FF:W
N3%".< +%$.,!,4 $S+"1K%$!" $!3,."4<./4K$. $1 4,!$% %$+".1<><!2 !" !3$ 3$ - "1$.1"%2
K$1 "/ $!3,."4<.<./,.!%,! +K+1I 0%1.!$J ,! - $$!<.51 "/ Q.!$%.,!<".,4 ?" <$!2 /"%
*$>$4"+ - $.!,4 012 3"#<"4"52I

&)&I j ;%,11$% ?OE ?+$,% @G V(FF)W *$>$4"+ - $.!,4 3, .5$1 <. !3$ %$4,!<". 13<+ #$!L$$.
". !$S! , . J N? 4$,%.<.5 /%" - 0(R !" ,JK4!3""J <. !3$ %,!I 0%1.!$J ,! - $$!<.51 "/
!3$ Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&):I N3"!%" OTE j i%,$#$4 i ?E jO i<.a<$ *dE ?+$,% @G V(FF)W 0"1!. ,!,4 $S+"1K%$!" $!3, ."4
><, !3$ 1<#4<.51 +%"JK $J , !, 32 ,%J< %$1+". 1$!" ,4 "3"4<. <./, .!%,!1I 0%1.!$J ,!
- $$!<.51 "/ !3$ Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&))I jG1 - "%<19C%%, .a BZE j ;%,11$% ?OE ?+$,% @G V(FF)W G//$! "/ +"1!9!%,<.<.5 ". !$S!
$S!<. !<". ". !3$ $S+%$11<". "/ N? /$,% ". J<!<".<.5<. (89J,2 "4J %,! +K+1I 0%1.!$J
,! - $$!<.51 "/ !3$ Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&)RI j i%,$#$4 i ?E jY<a>,%2 dOE ?+$,% @G V(FF)W N". !$S! 1,4<$. $<./4K$. $1 !3$, - "J,4
+%" $11<.5 "/ <.!$.1<!2 <. , 3$,%!9%,!$ 3,#<!K,!<". +,%,J<5 - I 0%1.!$J ,! - $$!<.51 "/
!3$ Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&)7I j ` K%!a$4 @dE j i%,$#$4 i ?E ?+$,% @G V(FF)W d$,%.<.5 , . J %$!$.!<". "/ , . ,>$%1<". !"
3" - $.$1! "J"%<. !3$ (79J,2 "4J %,!I 0%1.!$J ,! - $$!<.51 "/ !3$ Q.!$%. ,!<". ,4
?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&)8I j \$ 3! T?E jC!3,4<$ BE ?+$,% @GE ?+$,% d0 V(FF)W ^3$ $//$!1 "/ +%$. ,!,4 $S+"1K%$!"
" ,<.$, .J - ,!$%. ,4 1$+,%,!<". ". 3$,%! %,!$, .J ". ,11" <,!<>$ 4$,%.<.5<. <./, .!
%,!1I 0%1.!$J ,! - $$!<.51 "/ ?" <$!2 /"% @$K%"1 <$. $I

&)UI j ;%,11$% ?OE ?+$,% @G V(FFRW ^3$ %"4$ "/ ,%"K1,4 1!,!$<. !3$ /, <4<!,!<>$<./4K$. $ "/ ,
1,4<$.! ". !$S! ". <./, .!<4$ 4$,%.<.5I 0%$1$.!$J ,! - $$!<.51 "/ !3$ O<JL$1!$%.
012 3"4"5< ,4 C11" <,!<". I

&)FI N3"!%" OTE ?+$,% @G V(FFRW B$!,4 #$3,><"% ,1 , /K. !<". "/ - ,!$%. ,4 ,4 "3"4<.5$1!<".

&R)I j ;%,11$% ?OE ?+$,% @G V(FFRW ^3$<./4K$. $ "/ ".!$S! 1,4<$. $ ". 4$,%.<.5E , !><!2E K4!%,1"K.JE ,.J 1!,%!4$<. !3$ +%L,.4<.5 %,!I 0%1.!$J ,! -$$!<.51 "/Q.!$%.,!<".,4 ?" <$!2 /"% *$>$4"+-$.!,4 012 3"#<"4"52I

&RRI j\$ 3! T?E j[< <" dZE ?+$,% @GE ?+$,% d0 V(FFRW Q.!%,>$."K1 1$4/9,J -<.<1!%,!<". "/ " ,<.$<. +%$5.,.! ,.J 4, !,!<.5 %,!1I 0%1.!$J ,! -$$!<.51 "/Q.!$%.,!<".,4 ?" <$!2 /"% *$>$4"+-$.!,4 012 3"#<"4"52I

&R7I j i%,$#$4 i ?E jY<a>,%2 dE ?+$,% @G V(FFRW C-"J,4 $. "J<.5 "/<.!$.1<!2<. +%L,.4<.5 %,!1I 0%1.!$J ,! -$$!<.51 "/Q.!$%.,!<".,4 ?" <$!2 /"% *$>$4"+-$.!,4 012 3"#<"4"52I

&R8I j\$ 3! T?E [< <" dE ?+$,% d0E ?+$,% @G V(FFRW G//$!1 "/ +%$.,!,4 " ,<.$ ". 1!%$119 <.JK $J 5%"" -<.5I 0%$1$.!$J ,! -$$!<.51 "/ ?" <$!2 /"% @$K%"1 <$. $I

&RUI ?+$,% @G V(FF7W N".!$S! ,.J 4$,%.<.5<. <./,.! %,!1I 0%$1$.!$J ,! -$$!<.51 "/ ?" <$!2 "/ GS+$%< -$.!,4 012 3"4"5<1!1E ;%"L. =.<>$%1<!2I

&RFI ?+$,% @G

&7UI j ; , . . "K%, O*E ?+$,% d0E ?+$,% @G V(FF7W .!"5$.$!< J</$%$. $1 <. !3$ J$>$4"+ - $.! "/ $!3, . "4 !"4$%, . $ <. !3$ %,!I 0%1.!$J ,! - $$!<.51 "/ !3$ Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&7FI j \ $%". ZE N3"!%" OTE jN3K CE ?+$,% @G V(FF7W @$". ,!,4 %$1+".1<>$.$11 !" ,4 "3"4 "J"% ,/!$% +%$. ,!,4 ,4 "3"4 $S+"1K%$ <. !3$ %,!6 N". J<!<".$J %$1+".1$1p 0%$1$.!$J ,! - $$!<.51 "/ !3$ Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&8 'I N3"!%" OTE j \ $%". ZE jN3K CE ?+$,% @G V(FF7W G//$! "/ +%$. ,!,4 $S+"1K%$!" ,4 "3"4 ". +"1!. ,!,4 4$,%.<.5 ,#"K! ,4 "3"4I 0%$1$.!$J ,! - $$!<.51 "/ !3$ Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&8(I j ` K%!a$4 @dE j ["1$.#4K - ?GE ?+$,% @G V(FF7W *</$%$.!<,4 ,5$9%$4,!$J $//$!1 "/ <1"4,!<". ". !3$ - ,<.!$. , . $ "/ , ". J<!<".$J "J"% ,>$%1<". <. !3$ +%L, .4<.5 %,!I 0%1.!$J ,! - $$!<.51 "/ !3$ Q.!$%. ,!<". ,4 1" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52I

&U(I Y,%4<.1M,2, GQE ?+$,% @G V(FF8W O"J</< ,!<". "/ 1" <,4 #$3,><"% , .J +4,2 /<53!<.56 ["4$ "/
$.><%". -$.!,4 , .J 1" <,4 /, !"%1I 0%1.!$J ,! -$$!<.51 "/ !3$ Q.!$%. ,!<". ,4 ?" <$!2
/"% *$>$4"+ -$.!,4 012 3"#<"4"52I

&U&I [, .J,44 N i E ?+$,% @G V(FFUW ^3$ $//$!1 "/ ,4 "3"4 ". !< -$ +$% $+!<". <. %,!1I 0%$1$.!$J
,! -$$!<.51 "/ !3$ O<JL$1!$%. 012 3"4"5< ,4 C11" <,!<".I

&U:I ?,%#,K - ZE 0"4, 3$M ?E ?+$,% @G V(FFUW ^3$ $//$!1 "/ +%< $ 3, .5$1 ". !3$
".1K -+!<". "/ ,4 "3"4<. ,4 "3"4 $S+$%<$. $J %,!1I 0%$1$.!$J ,! -$$!<.51 "/ ^3$
G "." -< C.,421<1 "/ ?K#1!, . $ =1$, .J C#K1$6 C. Q.!$5%,!<". "/ G "." -$!%< , .J
;$3,><"%,4 G "." -< [$1$,% 3 V1+".1"%$J #2 @,!<". ,4 ;K%$,K "/ G "." -<
[1,% 3WI

&U)I ?+$,% @G V(FFUW 0$%<. ,!,4 $S+"1K%$!" $!3, ."4 ,//$!1 !3$ %,!n1 %$1+".1<>$.$11 !" $!3, ."4
4,!$%<. 4</$I 0%1.!$J ,1 +,%!< <+, .!<. 12 -+"1<K -E ^$%,!"5$.< , .J T$.$!<
Q./4K$. $1 ". CJ"4$1 $.! , .J CJK4! C4 "3"4 =1$, .J C#K1$E ,! -$$!<.51 "/ !3$
[1,% 3 ?" <$!2 ". C4 "3"4<1 -I

&URI j0$+<." OAE jZ"3.1". ZOE ?+$,% @GE O"4<., ZN V(FFUW ;$3,><"%,4 3, .5$1<. !3$
J$>$4"+<.5 %,! ,1 , /K. !<". "/ $!3, ."4 +%" $11<.5 L<!3<. !3$ .K%1<.5 ".!$S!I
0%1.!$J ,! -$$!<.51 "/ !3$ [1,% 3 ?" <$!2 ". C4 "3"4<1 -I

&U7I j i %,$#$4 i ?E jN3$14" M ?ZE O"4<., ZNE ?+$,% @G V(FFUW G!3, ."4 ,%J<, %$ "5.<!<". , .J
<.!,M$,1 , /K. !<". "/ +%$.,!,4 , .JX"% .K%1<.5 $S+$%<$. $1 L<!3 $!3, ."4I 0%$1$.!$J ,!
-$$!<.51 "/ !3$ [1,% 3 ?" <$!2 ". C4 "3"4<1 -I

&U8I Y,%4<.1M,2, GQE 0$!%"> G?E ?+$,% @G V(FFUW .!"5$.2 "/ !3$ %$<./"% <.5 +%"+$%!<$1 "/
$!3, ."46 @$L#"%. %,!1<.5$1! $!3, ."4 !3%"K53 , 1K%%"5,!$.<++4$I 0%1.!$J ,!
-$$!<.51 "/ !3$ [1,% 3 ?" <$!2 ". C4 "3"4<1 -I

&UUI \$ 3! T?E ?+$,% @GE ?+$,% d0 V(FFUW G//$!1 "/ %$+%"JK !<>$ 2 4$ ". "+$%,.!
%$1+".J<.5 /"% " ,<.$, .J 1K %"1$I 0%$1$.!$J ,! -$$!<.51 "/ Q.!$%. ,!<". ,4 ?!KJ2
T%"K+ Q.>$1!<5,!<.5 *%K51 ,1 [$<./"% $%1I

&UFI Y,%4<.1M,2, GQE j i %,$#$4 i ?E jN3$14" M ?ZE ?+$,% @G V(FFUW G!3, ."4 , .J 1" <,4 #$3,><"%
"/ ,J"4$1 $.! %,!16 ["4$ "/ +%$.,!,4 , .J $,%42 +"1!.,!,4 $S+$%<$. $ L<!3 ,4 "3"4I
0%1.!$J ,! -$$!<.51 "/ ?" <$!2 /"% @$K%"1 <$. $I

&F'I j i %,$#$4 i ?E ?+$,% @G V(FFFW C5$9%$4,!$J %$1+".1$ J<11" <,!<". !" 1!< -K4K1<.!$.1<!26
;$3,><"%,4 >1I ,K!"." -< <.J< $1I 0%$1$.!$J ,! -$$!<.51 "/ Q.!$%. ,!<". ,4 ;$3,><"%,4
@$K%"1 <$. $?" <$!2E @, . 2E B%, . $I

&F(I j ;%,11$% ?OE ?+$,% @G V(FFFW Q. %$,1$J , "K1!< 1!,%!4$9<.JK $J K4!%,1".< >" ,4<a<.5<.
,J"4$1 $.! %,!1 JK%<.5 $!3, ."4 L<!3J%, L,4I 0%$1$.!$J ,! -$$!<.51 "/ [1,% 3
?" <$!2 ". C4 "3"4<1 -E ?, .!, ; ,%#,%,I

&F&I jN3$14" M ?ZE Y,%4<.1M,2, GQE ?<4>$%< OOE 0$!%"> G?E ?+$,% d0E ?+$,% @G V(FFFW C4 "3"4
$S+"1K%$, .J !3$ /<%1! 1K M4<.5 $+<1"J$<. !3$.$". ,!,4 %,!I 0%1.!$J ,! -$$!<.51 "/
[1,% 3 ?" <$!2 ". C4 "3"4<1 -E ?, .!, ; ,%#,%,I

&F:I Y,%4<.1M,2, GQE 0$!%"> G?E ?+$,% @G V(FFFW G.J"5$."K1 "+<"<J 121!$ -1 , .J !3$
%$<./"% <.5 +%"+$%!<$1 "/ $!3, ."4<. !3$.$L#"%. %,!I 0%$1$.!$J ,! -$$!<.51 "/
[1,% 3 ?" <$!2 ". C4 "3"4<1 -E ?, .!, ; ,%#,%,I

&F)I d, . J NdE ?+$, % @G V(FFFW G!3, . "4 $. 3, . $1 - $ - "%2 /"% , >$%1<>$429 - "!<>, !$J 4, 11< , 4
" . J<!<" . <. 5 <. <./, . ! %, !1I 0%1. !$J , ! - $$!<. 51 "/ [1, % 3 ?" <$!2 " . C4 "3"4<1 - E
?, . !, ; , %#, %, I

&FRI d, . J NdE ?+$, % @G V(FFFW G!3, . "4 < - +, <%1 - $ - "%2 "/ , . , ++$!<!<>$ J<1 %< - <. , !<" . <.
+$%<, J"4$1 $. ! %, !1 , ! J"1$1 !3, ! 4$, >$, JK4! - $ - "%2 K. , //$!$JI 0%1. !$J , !
- $$!<. 51 "/ !3$ Q. !$%. , !<" . , 4 ?" <$!2 /"% * $>$4"+ - $. !, 4 012 3"#<"4"52E N"%, 4 T, #4$1E
BdI

&F7I jN3$14" M ?ZE Y, %4<. 1M, 2, GQE 0$!%"> G?E ?+$, % @G V(FFFW 4/, !"%2 " . J<!<" . <. 5 L<!3
- <4M < . . $L#"%. 1 +%" - "!$1 . " . . K!%<!<>$ 1K M4<. 5I 0%1. !$J , ! - $$!<. 51 "/ !3$
Q. !$%. , !<" . , 4 ?" <$!2 /"% * $>$4"+ - $. !, 4 012 3"#<"4"52E N"%, 4 T, #4$1IE BdI

&F8I j@<a3. <M"> OGE 0$!%"> G?E ?+$, % @G V(FFFW [$1+" . 1<>$. $11 !" !3$ 1K%%"5, !$. <++4$
+%"><J<. 5 +%< - , %2 !, 1!, . !1 < . . $L#"%. %, !1I 0%$1$. !$J , ! - $$!<. 51 "/ !3$ Q. !$%. , !<" . , 4
?" <$!2 /"% * $>$4"+ - $. !, 4 012 3"#<"4"52E N"%, 4 T, #4$1E BdI

&FUI j * "K54, 1 dCE Y, %4<. 1M, 2, GQE ?+$, % @GE ?+$, % d0 V(FFFW Y, %<, !<" . 1 <. +$%<, J"4$1 $. !
1" <, 4 +4, 2 #$3, ><"% JK$!" 3"K1<. 5 " . J<!<" . 1 , . J +, %!. $% , !><!2I 0%$1$. !$J , !
- $$!<. 51 "/ !3$ Q. !$%. , !<" . , 4 ?" <$!2 /"% * $>$4"+ - $. !, 4 012 3"#<"4"52E N"%, 4 T, #4$1E
BdI

&FFI j^%KS$44 GOE d, . J NdE j0$+<. " OAE O"4<. , ZNE ?+$, % @G V(FFFW G!3, . "4 , 1 , . <. !$%. , 4
kK$ /"% +%$J< !<. 5 %$L, %J , . J AEAEAEA آبسخي . , 4

0%1.!$J ,! - $$!<.51 "/ Q.!$%. ,!<". ,4 ?" <$!2 /"% *$>$4"+ - $.!,4 012 3"#<"4"52E ?, . *<$5"I

:&'I ?+$,% @G V&' ' (W N".1$mK$. $1 "/ >$%2 $,%42 $S+"1K%$!" ,4 "3"4I Q.><!$J +%$1$.!,!<". /"% *$, .h1 *<1!<.5K<13$J d$!K%$?$%<$1E ;<.53, - !". =.<>$%1<!2E @">$ - #$%I

:&(I ?+$,% @G V&' '&W N".1$mK$. $1 "/ $,%42 $S+"1K%$!" ,4 "3"4I Q.><!$J +%$1$.!,!<". /"% 012 3"#<"4"52 d$!K%$?$%<$1E ;<.53, - !". =.<>$%1<!2E C+%<4I

:&&I j0". $ dBE j0,K!,11< [OE ?+$,% @GE O"4<., ZN V&' '&W Q./, .!<4$ <.!$%, !<".1 L<!3 , . ,4 "3"49<.!"S< ,!$J J, - 6 Q - +,<% - $.! <. - "!"% ""%J<.,!<". ,+,#<4<!<$1I 0%$1$.!$J ,! - $$!<.51 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ?, . B%, . <1 "I

:&:I j0,K!,11< [OE j0". $ dBE ?+$,% @GE O"4<., ZN V&' '&W ^3$ +3,% - , "4"5< ,4 ".1mK. $1 "/ ,4 "3"4 1K++"%! <.3<#<!"%2 , .J $S <!,!"%2 ,>$%1<>$ ".J<!<".<.5 <. <./, .! %,!1I 0%1.!$J ,! - $$!<.51 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ?, . B%, . <1 "I

:&)I jB$%. , .J$a9Y<J,4 ZOE ?+$,% @GE O"4<., ZN V&' '&W ?" <,4 4$,%.<.5 , .J ,4 "3"46 Q.!$%, !<".1 L<!3 , . <.!"S< ,!$J 1<#4<.5 5$.$%,!$, . $!3, ."4 "J"% +%$/$%$. $ <. +$%<,J"4$1 $.! %,!1I 0%$1$.!$J ,! - $$!<.51 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ?, . B%, . <1 "I

:&RI jC#,!$ 0E j \ ,2 - ,4 ; E ?+$,% @GE O"4<., ZNI V&' '&W C4 "3"49 - $J<,!$J ,11" <,!<>$ 4$,%.<.5 <. K!$%"6 @$". ,!,4 %$, !<>,!<". !3%"K53 %9S+"1K%$!" !3$ +3,% - , "4"5< ,4 $//$!1 "/ !3$ J%K5I 0%1.!$J ,! - $$!<.51 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ?, . B%, . <1 "I

:&7I 0$!%"> G?E @<a3.<M"> OGE Y,%4<.1M,2, GQE ?+$,% @G V&' '&W @$". ,!,4 ,4 "3"49+%$/$%%<.5 V0W , .J ". +%$/$%%<.5 V@0W %,!1 J<//$% <. !3$<% %$1+".1<>$.$11 !" $!3, ."4I 0%$1$.!$J ,! - $$!<.51 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ?, . B%, . <1 "I

:&8I j ; "%J.$% i CE @<a3.<M"> OGE 0$!%"> G?E ?+$,% @G V&' '&W N".!<.K,4 $S+"1K%$!" $!3, ."4 <. .$L#"%. %,!1 <. !3$ 1K M4<.5 ".!$S!I 0%$1$.!$J ,! - $$!<.51 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ?, . B%, . <1 "I

:&UI j^%KS$44 GE ?+$,% @G V&' '&W Q./, .! , .J +$%<,J"4$1 $.! %,!1 +%$/$% 3<53 ". آسخي ṅ ṅ†

: : : I j@<a3.<M"> OGE 0$!%"> G?E Y,%4<.1M,2, GQE ?+$,% @G V&' ' :W 0%$.,!,4 $S+"1K%$!" $!3,."4
- "J</<$1 %$1+".1<>$.$11 !" $!3,."4 $,%42 <. 4</$I 0%1.!$J ,! - $$!<.51 "/ [1,% 3
?" <$!2 ". C4 "3"4<1 - E ZK.$E B"%! d,KJ$%J,4$I

: :)I jB$%.,.J$a9Y<J,4 ZOE jO$44".< NE ?+$,% @GE O"4<., ZN V&' ' :W Q.!$%, !<".1 #$!L$$.

:RUI ;"%J.$% iCE *$,M ^E ?+$,% @G V&''RWI G><J$. $/"%<.>"4>$-$.!"/$.J"5$."K1 "+<"<J1<.
%$1+".1$!" .$".,!,4$!3,."4$S+"1K%$I 0%1.!$J ,!!3$,..K,4 -$$!<.5 "/!3$
?" <$!2/"% @$K%"1 <$. $E ` ,13<.5!".E *NI

:RFI j?,.J$%1 ?iE j;"%J.$% iCE j^%KS$44 GOE ?+$,% @GE O"4<.,ZN V&''RW G.3,. $J $!3,."4
".1K-+!<". /"44"L<.5 %$+$,!$J $!3,."4$S+$%<$. $1<. >,%2<.5 1" <,4 ".J<!<".1
JK%<.5<./,.!<4$ J$>$4"+-$.!I 0%$1$.!$J ,! -$$!<.51 "/Q.!$%.,!<".,4 ?" <$!2/"%
*$>$4"+-$.!,4 012 3"#<"4"52E @">$-#$%E ` ,13<.5!".E *NI

:7'I j^%KS$44 GOE j0". $dE ?+$,% @GE O"4<.,ZN V&''RW C++$!<!<>$ %$1+".1<>$.$11!"
3$-"1$.1"%2 K$1 ,11" <,!$J L<!3, K!$ $!3,."4<.!"S< ,!<". <.<./,.!%,!1I
0%1.!$J ,! -$$!<.51 "/Q.!$%.,!<".,4 ?" <$!2/"% *$>$4"+-$.!,4 012 3"#<"4"52E
@">$-#$%E ` ,13<.5!".E *NI

:7(I j;"%J.$% iCE jO2$%1 OdE jT"!!$1-,. *E ?+$,% @G V&''RW 4/, !"%2 4$,%.<.5<. !3$ ".$9
J,2 "4J %,!6 [$<./"% <.5 $//$!1 "/<1"+%"!$%$."4I 0%1.!$J ,! -$$!<.51 "/
Q.!$%.,!<".,4 ?" <$!2/"% *$>$4"+-$.!,4 012 3"#<"4"52E @">$-#$%E ` ,13<.5!".E *NI

:7&I i"a4"> C0E i%,-1M,2, ^CE ?+$,% @G V&''RW N4,11< ,4 ".J<!<".<.5<. !3$<./,.!%,! L<!3
$!3,."4 "J"% ,1!3$ N?I 0%1.!$J ,! -$$!<.51 "/?" <$!2/"% @$K%"1 <$. $E
@">$-#$%E ` ,13<.5!".E *NI

:7:I @<a3.<M"> OGE Y,%4<.1M,2, GQE 0$!%"> G?E ?+$,% @G V&''RW [$<./"% <.5 +%"+$%!<$1 "/
$!3,."4<. .$".,!,4%,!16Q.>"4>$-$.!"/!3$ "+<,!$ 121!$-I 0%$1$.!$J ,! -$$!<.51 "/
?" <$!2/"% @$K%"1 <$. $E @">$-#$%E ` ,13<.5!".E *NI

:7)I i"a4"> C0E Y,%4<.1M,2, GQE ?+$,% @G V&''7W @$L +%"#$/"%!,1!$ %$1+".1<>$.$11!"
$!3,."4<. !3$<./,.!%,!I 0%1.!$J ,! -$$!<.51 "/[1,% 3?" <$!2".C4 "3"4<1-E
ZK.$E ;,4!<-"%$E O*I

:7RI @<a3.<M"> OGE O"4<.,ZNE ;"$3- ?dE ?+$,% @G V&''7W G//$!1 "/$!3,."4,.J -<J,a"4,-
".K4!%,1"K.J $-<11<".1<. !3$<1"4,!$J <./,.!%,! +K+I 0%$1$.!$J ,! -$$!<.51 "/
[1,% 3?" <$!2".C4 "3"4<1-E ZK.$E ;,4!<-"%$E O*I

:77I jO,% 3?OE C#,!$ 0E \,2-,4 ;E ?+$,% @GE O"4<.,E ZINI V&''7W +$%,.! ".J<!<".<.5<.
.$".,!$%,!1,1, /K. !<". "/,. $!3,."49-$J<,!$J ,11" <,!<>$/$!,4 -$-"%2I
0%1.!$J ,! -$$!<.51 "/[1,% 3?" <$!2".C4 "3"4<1-E ZK.$E ;,4!<-"%$E O*I

:78I j?,.J$%1 ?iE ?+$,% @G V&''7W G//$!1 "/%$+$,!$J $!3,."4<.5$1!<". ".!3$4,!$. 2!"
%<53!<.!3$<./,.!%,!I 0%$1$.!$J ,! -$$!<.51 "/[1,% 3?" <$!2".C4 "3"4<1-E
ZK.$E ;,4!<-"%$E O*I

:8(I C%<,1 NE j?, .J$%1 ? iE N3"!%" OTE O"4<. , ZNE ?+$,% @G V&' '7W *<//$%$.!<,4 - "!<>,!<". ,4
+%"+$%!<$1 "/ , 3<53 $!3, ."4 J"1$,1 , /K. !<". "/ $,%42 +"1!. ,!,4 J$>$4"+ - $.!I
0%1.!$J ,! - $$!<.51 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ZK.$E ; ,4!< - "%$E O*I

:URI j ; "%J.$% i CE j [< 3$2 dOE *$,M ^E ?+$,% @G V&''8W C11$11 - $.! "/ #%,<. "+<"<J9%$4,!$J
- [@C<. !3$ ".$9J,29"4J<./,.!%,!/"44"L<.5 +%$.,!,4 ,.JX"% +"1!.,!,4 $!3,."4
$S+"1K%$I 0%1.!$J ,! ,..K,4 - $$!<.5 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ZK.$E
N3< ,5"I

:U7I j ?,.J$%1 ?i V&''8W G!3,."4<.!"S< ,!<". 3,1 4<!!4$ $//$! ". $!3,."4<.!,M$<. !3$<./,.!
%,!I 0%1.!$J ,! ,..K,4 - $$!<.5 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ZK.$E N3< ,5"I

:U8I jO2$%1 OdE jO<44$% ??E O"4<., ZNE ?+$,% @G V&''8W \<53 ,//<.<!2 /"% $!3,."4<.5$1!<".
JK%<.5 !3$ "K%1$ "/ $,%42 ".!"5$.2<. 5$.$!< ,442 3$!$%"5$.$"K1 %,!1I 0%1.!$J ,!
,..K,4 - $$!<.5 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1 - E ZK.$E N3< ,5"I

:UUI j0". $ dBE 0,K!,11< [OE ?+$,% @GE O"4<., ZN V&''8W +$%,.!<./,.!<4$ 1$4/9
,J -<.<1!%,!<". "/ $!3,."46 ["4$ "/ +%<"% $K,4 - = O "4

:F8I i "a4"> C0E Y,%4<.1M,2, GQE i%, -1M,2, ^CE ?+$,% @G V&' '8W 03,%-, "4"5< ,4 $//$!1 "/ $!3,."4 ". <.5$1!<>$ #$3,><"% "/ !3$ +%L,.4<.5%,!I 0%1.!$J ,! ,..K,4 -$$!<.5 "/ ?" <$!2 /"% @$K%"1 <$. $E @">$-#$%E ?,. *<$5"I

:FUI j?,.J$%1 ?iE jI,%-".E j?+$. $% [dE ?+$,% @G V&' '8W .!"5$.$!< J<//$%$. $1 <.1$.1<!><!2 ,.J , K!$!"4$%,. $!" $!3,."4<. <./,.!%,!1I 0%$1$.!$J ,! ,..K,4 -$$!<.5 "/ ?" <$!2 /"% @$K%"1 <$. $E @">$-#$%E ?,. *<$5"I

:FFI jO,% 3 ?OE C#,!$ 0E ?+$,% @GE O"4<., ZN V&' 'UW BK%!3$% $S,-<.,!<". "/ .$".,!,4 4$,%.<.5 -$J<,!$J #2 $!3,."4 ,1 , /K. !<". "/ +%$.,!,4 $S+$%<$. $ L<!3 !3$ J%K5I 0%1.!$J ,! ,..K,4 -$$!<.5 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1-E ZK.$E ` ,13<.5!".E *NI

)''I 0,K!,11< [OE @<a3.<M"> OGE O"4<., ZNE ?+$,% @G V&' 'UW Q.3,4$J $!3,."4<.JK $1 ".J<!<".$J +%$/$%$. $,.J ,>$%1<". <. <./,.!%,!1I 0%1.!$J ,! ,..K,4 -$$!<.5 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1-E ZK.$E ` ,13<.5!".E *NI

)'(I j?$" ;E 0,K!,11< [OE O"4<., ZNE ?+$,% @G V&' 'UW C K!$,.J ".J<!<".$J $//$!1 "/ $!3,."4 K+". #%$,!3<.5 +,!!$%.1<. +%$L$,.4<.51I 0%$1$.!$J ,! ,..K,4 -$$!<.5 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1-E ZK.$E ` ,13<.5!".E *NI

)'&I j;"%J.$% iCE *$,M ^E ?+$,% @G V&' 'UW 0%$.,!,4 $!3,."4 $S+"1K%$6 C5$9J$+$.J$.! ,4!$%,!<".1<. 4,!$% $!3,."4<.!,M$I 0%1.!$J ,! ,..K,4 -$$!<.5 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1-E ZK.$E ` ,13<.5!".E *NI

)':I C%<,1 NE O4$L1M< GNE O"4<., ZNE ?+$,% @G V&'ŞUW @,4"S".$,.J .,

) : : I i "a4"> C0E @<a3.<M"> OGE Y,%4<.1M,2, GQE ?+$,% @G V&' ('W G.J"5$."K1 , !<><!2 ,! - K
"+<"<J %$ $+!"%1 , .J $!3, ."49<.JK $J $//$!1 <. +%L, .4<.5 %,! +K+1I 0%1.!$J ,!
, . .K,4 - $$!<.5 "/ ?" <$!2 /"% @$K%"1 <$. $E @">$ - #$%E ?, . *<$5"E NCI

) :)I C $>$J" O ;E ?+$,% @GE 0,K!,11< [O V&' ((W ?$.1<!><!2 !" $!3, ."4 1!< - K4,!<". , .J $!3, ."4
<.!,M$ <. ,J"4$1 $.! , .J ,JK4! %,!1I O

))RI B,#<" ONE ?+$,% @GE 0,K!,11< [O V&'(&W CJ"4$1 $.!#K! ."! ,JK4! ,4 "3"4<.<!<,!<".
<./4K$. $,4 "3"4 ".1K-+!<". ,/!$% , 13"%! +$%<"J "/ J$+%<>,!<".I 0%1.!$J ,! ,..K,4
-$$!<.5 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1-E ZK.$E ?,. B%,. <1 "I

))7I C $>$J" O;E @<a3.<M"> OGE ?+$,% @GE 0,K!,11< [O V&'(&W C11$11-$.! "/ ,.S<"42!< ,.J
-"!"% 1!<-K4,.! $//$!1 "/ $!3,."4<. ,J"4$1 $.! ,.J ,JK4! `<1!,% %,!1I 0%1.!$J ,!
,..K,4 -$$!<.5 "/ [1,% 3 ?" <$!2 ". C4 "3"4<1-E ZK.$E ?,. B%,. <1 "I

))8I O<%,.J, O"%,4$1 [?E ?+$,% @GE C#,!$ 0 V&'(&W O"JK4,!<". "/