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! "#$%&'#()#*+,"*)#
 - . & "#/0"12)%"#
3) #*0) #56, 06#7% 89') #) 6#*%&:) '6;#*% 88) #7<\\dagger*, 44, 06#") 02) '#(<&"#0"76, "6#=#4<, &6')>#?, 07#, &#40) &#()#
 ")02);#*<)76#&")#0")#A4&0)#0"%0()#B&0#6%89,06#7,"7#')4C*+);#A'%$)6,"6#7)7#2%&66)4)66)7#=#8%005#
2)45)7#7&'#4)#7%4>#
D%&'#E08#F+G81\0;#B&0\(\frac{4}{6}\); \(\frac{1}{6}\); \(
 ()#4<H76;#*)#$%&'#56,06#4)#A4&7#*+,"*)&I#B&40#,06#*%""&#()A&07#4%"26)8A7>#J%&6#,:,06#
 *%88)"*5#4)#8,60";#4%'7B&4#,**%8A,2",#4,#KL8,(,8)LM#()#4,#8,07%"#(<)"#0,*)#$&7B&<=#4,#
402")#()#6', 8N, .;#:07094) 8) "6#A%&'#) "6') '#) "#:044)#08P8)#70;#6)*+"0B&) 8) "6;#*<56,06#) "*%')#=#
40"65'0)&'#()7#')8A,'670>#H"7&06);#(,"7#4<)7A%0'#()#6'%&:)'#(<,&6')7#*40)"67;#04#56,06#')765#A'R7#
 ()#k,''P6#(&#6', 8;#4, "S, "6#()7#')2,'(7#A')7B&)#7&AA40, "67#=#*+,B&)#A,77,2)'#B&0#)"#
 ()7*)"(,06>#T0",4)8)"6;#&"#+%88)#:P6&#=#4<%**0()"6,4)#U#7,"7#(%&6)#&"#)"7)02","6#U#4&0#
 ()8,"(,#()#4)#*%"(&0')#=#45*%4)#J%"22N,"2#0! " #$Q;#)6#E08#,**)A6,#,:)*#$\%0)>#
V4#2,2",#6') "6)#$)%"#7&'#4,#A') 80R')#*%&'7)#)6#*0"B&, "6)#$)%"#7&'#4,#7)*%"()#U#&")#7%88)#
! "#$%&%' (%)! #' ")(*)+, +)-. / ()0. )1#' "/2%3)4/)52"*+26)0. )78. /7%)0' *)(#' "*. *+3)9%! ' *()
! ": ()-%)-*; )1#' "(6)*0)/'.5.*+)! ". <=' %$%/+)!.()5' )0.)7#' 0%' ")-%)0'. ">%/+3)?0#"(6)
='./-)-%()!*:7%()-%)-*;)1%#/)#')!."@#*()-%)7*/=)1%#/)</+.*%/+)-./()(.)!.'$%6)*0)
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!#'5.*+)('8'$%7+%")0.)>#">%)-''/)5%""%)-%)5*/)-%)"*F)E#/)$."7826)('*0)0%)
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- ' #()-%)EI '@)! #'")(.)%$$%)$.0.-%3)
K.) @ $$%)+#'((.*+)-%!'*()!0'()-''/)$#*(3)L#$$%)*0()/'.5.*%/+)(#'5%/+)$M$%)
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7%((%3)K' *5. /+)7%)! "*/7*! %)! %"(#//%06)*0)/%)0 ' . 5. *+)1. $ . *()%$$ \$/2%)78%F)0%)
$2-%7*/6)(*)E*%/)=' ' '*0)*>/#". *+)+#' +)-%)(.)$.0.-*%3)R.*()D)0.)5#*")-2(#"$.*()
7#'782\%)D)!0.+)-#(6)*/7.!.E0\%)-%)(%)+#'"/%"6)*0)2+.*+)70.*")='%)7%0.)%$!*".*+3)S%)
$.0)('2+.*+).>>".52)'/%)-*F.*/%)-%)1#'"()!0'()+,+,
 , A'R7#B&<)4)#)&6#8, "25#(&#804)6#8, 4#*&06#B&0#4&0#,:,06#*,&75#&")#75:R')#*%"760A,60%">#W#*)#
 8%8) "614=;#E08#,:,06#00",4)8) "6#A&#7)#A'%*&')'#&"#A)&#(<,'2)"6;#,*+)6)'#&"#A)606#7,*#()#
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@,06#9%&040'#(,"7#&")#8,'806)LM>#3)#@)&#56,06#@,094);#)44)#56,06#A')775);#)6#4)#8044)6#"<,:,06#A,7#
90) "#*&06>#D%&'6, "6;#KL*)66)#(,8"5)#0) 88)LM#,:,06#7,070#()#A4)0")7#A%02"5)7#()#804)6#)7#
 ,:,06#)"0%&'"5)7#(,"7#7,#9%&*+);#*%88)#70#)44)#*',02",06#B&<%"#:0)"")#4)#4&0#,'',*+)'>#H44)#
 ,:,06#*%"00"&5#$&7B&<=#,:%0'#4)7#$%&)7#2%"45)7#*%88)#()7#A%0"27>#3)#7%0'#8P8);#)44)!
258077,06LY#)4)#,:,06#8,4#=#4,#A%06'0");#7)#7)"6,06#%AA')775);#)6#'%&4,06#()7#.)&1#*%88)#)"#
A4)0")#*'07)>!
T&'0)&I;#E08#,:,06#+&'45LY#
\label{eq:klZ%"#7,"2;#0} KLZ%"#7,"2;#0) 8 8 ) \\ L[\#J\&\#6\% 89) \\ 7\#8,4,()\#B\&,"(\#6\&\#")\#8,"2) \\ 7\#A,7;\#) \\ 6\#6\&\#6\% 89) \\ 7\#)"*\%') \\ \#B\&,"(\#6\&\#")\#8,"2) \\ 7\#A,7;\#) \\ 6\#6\&\#6\% 89) \\ 7\#)"*\%') \\ \#B\&,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"2) \\ 7\#A,7;\#) \\ 6\#6\&\#6\% 89) \\ 7\#0,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\&\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#8,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6\#")\#6,"(\#6,")\#6,"(\#6,")\#6,"(\#6\#')\#6,"(\#6,")\#6,"(\#6,")\#6,"(\#6,")\#6,"(\#6,")\#6
 8,4,()#B&,"(#6&#8,"2)7L[#\&<)761*)#B&)#$)#7&07#*)"75#0,0')L]#^&:')#(%"*#4)7#.)&IL[LM#
V4#,:,06#20045#4,#$%&)#()#7,#0)88);#B&0#2)02",06;#,44%"25)#=#7)7#A0)(7>#H44)#,:,06#)"6'%&:)'6#&"#
A) &#A4&7#4) 7#.) & 1;#8,07#() 7#4,'8) 7#.#9'04R') "6#, &7706_6>#H6#E08;#4&0#, &770;#7) "606#7) 7#.) & 1#4)#
9'`4)'#
D\% '6, "6;#8 P8)#(, "7#*)6#56,6;#)4)#"<,:,06#A,7#A)'(&#<,AA5606*#a)A&07#6'%07#$%&'7;#)4)#
7&AA40,06#7%"#8,'0#()#4&0#',AA%'6)'#&"#A)&#()#9%&044%"#()#!"#$$"#%&'(%&>#
O!L%&%)$.'-*+%)@$$%!T)N')/%)('!!#"+%()$M$%)!.()0%)>"'.')-%)$*00%+)%+)+')
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5%';)-')!"#\$"#%&'(%&!U)L'%(+)!#'")"%+#\$E%")\$.0.-%)+#'+)-%)('*+%).!":(!U!P)

V0)0'.5.*+)(%"\$#//2%).*/(*6)\$.*().')@#/-)-%)0'*6)0%)@.*+)-%)/%)!.()!#'5#*")0%)0'*)
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92(#"\$.*(6)*0)0%)! #' 5.*+)%/W/3)V0)! #' "".*+)\$M\$%). 78%+%")-%)0.)E#' *00*%)! #' ")0%' ")
W0()-%)+"#*(). /(6)X.%&#/>6)=' *)! 0%' ".*+)-%)@.*\$)! ": ()-%)(.)\$: "%)\$. 0. -%3)Y' .+"%C
5*/>+()1%#/)%/)! #78%6)Z*\$)L8[\$C1*)(%)(%/+.*+)D)0' .*(%6)! "%(=' %)"*78%3)

R.*()(.)78./7%)/%)('.""M+.)!.()0D3)?0#"()='.'*0)('%(('A.*+)0.)('%'")%+)0.)!0'*%)('")

0.)/'='%).5%7)'/)78*\#/)(.0%6)D)!%*/%)-*>/%)-'M+"%).!!%02)'/%)(%"5*%&%6)%+)

='.'*0)('.!!"M+.*+)D)(#"<")-%)0'%/7%*/+%)-%)0'27#0%6)'/%)5#*;)0'*/+%"!%0.)

(#'-.*/)!."C-%""*: "%!]O!B#'((%C!#'((%!T!P)

E08#7088%9007,#)6;#)"#7)#')6%&'", "6;#, A)'S&6#&"#54R:)#()#*)66)#8P8)!5*%4)#B&0#, **%&',06;#
3)#\$)&")#2,'S%"#4, "S,LY#
KLF%890)"#\$&7B&<=#4,#2,')#()#b,8(,)8&"L]LM#

F<56,06#7,"7#(%&6)#&"#A)"70%"",0')#B&0#')"6',06#*+) C#4&0#A%&'#4)7#:,*,"*)7#(<+0:)'>#V4#,:,06#(`#A'5:%0'#()#A,'60'#*)#\$%&'14=;#8,07#)"6')#4,#A4&0)#)6#7)7#9,2,2)7;#04#")#7,:,06#A,7#*%88)"6# 0,0')>#D&07#04#,:,06#:&#E08;#*%&',"6#7%&7#4,#A4&0);#*+,&775#()#7%&40)'7#=#()80#&757#)6#:P6&# (<&"#+,906#%**0()"6,4#54085>#

 $KLJ\&\#: \)\&I\#, \#)'\#=\#4, \#2,')\#()\#b, 8(,) 8\&"L]LM\#$

KLb)#7%'7#A,7#,&\$%&'(<+&0>#d)76)#=#4,#8,07%";#\$)#7&07#6'%A#8,4eLM#

f:,061)44)#8&'8&'5;#4,#')7A0',60%"#'CA)&7)>#X,"7#.#A'P6)'#,66)"60%";#E08#,:,06#'5A40B&5LY#
KLZ%"#7,"2;#0)88);#6&#(540')7L]#X0#\$)#')76)#4=;#B&0#:,#"%&7#"%&''0'L]LM#

V0). 5. *+)E#/-*)! #' ")! . "<"6)\$. *()%00%). 5. *+). >*+2)@. *E0%\$%/+)0%()E". (6)7#\$\$%)! #' ")
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O!a%)7"#*()='''*0)A).)'/)+".*/)!#'")V/78%#/)D)#/F%)8%'"%(6)!'*()'/).'+"%)5%"()
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S%() \$#+()0' *)278. ! ! : "%/+). 5. /+) \$M\$%) = ' ' *0)"2. 0*(%3)S' *C\$M\$%)@' +)(' "! "*()-%)0.) (#\$\$%)20%52%) = ' ' *0)5%/. *+)-%)! "#! #(%"3)W0)A). 5. *+)(*)0#/>+%\$! ()=' ' *0)/' . 5. *+) ! . ()-%\$. /-2). ' +. /+)- ' ' /)7#' ! 3)K#/)%(! "*+6)D)0' *-2%)-%)>. >/%")' /%)(#\$\$%) ! . "%*00%6)%/)#' E0*.). ' ((*+, +)0%)(#' 7*)-%))