&'(!)'!*#+!, -.\$/#/012!345#06!"7!*-#/2\$6!3/8-#26-9069-1:!7!;#21!<69.=!'8!"'2! 7/>1?12!@16-'A2!;77B!B'?\$0\$12!#/.!<6-#61>\$12!

! C?\$D#E16F!"#\$! <5-\$/>!GHGG! ! ! !

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'8!6#+!'-.\$/#/01!6-#/2\$6!\$/J12641/6!#/.!09--1/6!26-#61>\$12!@16-'!145?'=2!\$/!'-.1-!6'!\$45?141/6! ; 77B!5'?\$0\$128!!

*E! 7 (\$'5%#&%\$''(%7#*4%F'#4&*\$%?)(420%%

@16-'X!'-!"'2!7/>1?12!; '9/6=!@16-'5'?\$6#/!*-#/25'-6#6\$'/!796F'-\$6=X!\$2!#!59E?\$0! 6-#/25'-6#6\$'/!5?#//1-X!0''-.\$/#6'-X!.12\$>/1-2X!E9\$?.1-X!#/.!'51-#6'-!8'-!6F1!"'2!7/>1?12!; '9/6=R! @16-'!(#2!8'-41.!\$/!%UMM!'96!'8!#!41->1-!'8!6F1!<'96F1-/!:#?\$8'-/\$#!O#5\$.!*-#/2\$6!) \$26-\$06!#/.!6F1!"'2!7/>1?12!; '9/6=!*-#/25'-6#6\$'/!; '4 4 \$22\$'/R!36!0'/2\$262!'8!2\$+!?\$/12!#/.!/\$/16=c6F-11! 26#6\$ ' / 2!#/ . !-9/2!21J1/! . #=2!#! (110^M!@16-' !-9/2!6F1!6F\$- . !?#->126!59E?\$0!6-#/2\$6!2=261 4 !\$/!6F1! $0'9/6 = \frac{120}{12} - \frac{120}{1$ 210'/.!\$/!6F1!0'9/6-=!E=!-\$.1-2F\$5!#/.!2\$D1!'8!8?116^m!WF\$?1!E126!0/'(/!8'-!\$62!E9212!#/.!6-#\$/2X! @16-'!-9/2!#/.!'J1-2112!4#/=!'6F1-!0-\$6\$0#?!6-#/25'-6#6\$'/!5-'>-#42X!\$/0?9.\$/>!E\$01!#/.!8-11 (#=! 89/.\$/>!5-'>-#42X!'51/!26-1162!\$/\$6\$#6\$J12X!#/.!-#\$?!26#6\$'/!#-1#!-1#?!126#61!.1J1?'541/6^V!36!\$2!#?2'! \$45'-6#/6!6'!#..!6F#6!(F\$?1!@16-'!'51-#612!6-#\$/2!#/.!E9212X!\$6!.'12!/'6!F#J1!#96F'-\$6=!6'!4#/#>1! 26-1162R!*F\$2!#96F'-\$6=!-14#\$/2!(\$6F!?'0#?!0\$6\$12R!T9/.\$/>!8'-!@16-'!#/.!\$62!5-'>-#42!#/.!5-'K1062! #-1!E'6F!#6!#!26#61!#/.!81.1-#?!?1J1??!"7!@16-'!#?2'!21-J12!#2!6F1!6#+!#96F'-\$6=!#/.! \$45?141/6#6\$'/!#>1/0=!8'-!J'61-!#55-'J1.!2#?12!6#+!41#29-12⁸!7..\$6\$'/#??=X!4'/1=!8-'4!8'9-! "7!; '9/6=!2#?12!6#+12!#?'/1!/'(!#00'9/62!8'-!#E'96!mH!51-01/6!'8!@16-'A2!E9.>16X!290F!#2!B-'5! 7 !\$/ !\$U\HX!B-'5!; !\$/ !\$UUHX!@1#29-1!O!\$/ !GHH\X!#/.!@1#29-1!@!\$/ !GH%VR\!*F121!8'9-!F#?8c01/6!

^M!@16-'X!`7E'96!@16-'!7-0F\$J1Xa!"7!@16-'!Z@16-'X!GHGG[X!F6652^bb(((R416-'R/16b#E'96bR!

^P!*F1!&'92\$/>!3//'J#6\$J1!; '??#E'-#6\$J1!!; '?!#E'-#6\$J1!!; '9/6=!@16-'5'?\$6#/!*-#/25'-6#6\$'/!796F'-\$6=!Z@16-'[Xa!&'92\$/>!3//'J#6\$'/! ; '??#E'-#6\$J1X!75-\$?!G\X!GHGHX!F652^bbF'92\$/>\$//'J#6\$'/N0'b0'??#E'-#6\$J1b416-'bR! "!W#=N#00!@#0F\$/1X!`T#062!76!#!Y?#/01Xa!W#=E#00!@#0F\$/1^!3/61-/16!7-0F\$J1X!n'J14E1-!%\X!GH%VX!

F6652*bb (1ER#-OF\$J1R'->b (1EbGH%V%GGmH\%UmPbF6652*bb ((R416-'R/16b/1 (2b8#062c>?#/01bR!

^v!n#6F#/!<&'?412X!`'#!Q1>\$'/#?!*-#/25'-6#6\$'/X!C+5?#\$/1.Xa!@1.\$94!Z@1.\$94X!T1E-9#-=!%X!GHGH[X!F6652*bb/2F'?412G%R41.\$94R0'4b?#c -1>\$'/#?c6-#/25'-6#6\$'/c1+5?#\$/1.c#MMGmM8MVGSER!

⁸!;7";,Y¹,'2!7/>1?12!;'9/6=!@16-'5'?\$6#/!*-#/25'-6#6\$'/!796F'-\$6=!Z@16-'[⁸a!;#?\$8'-/\$#!722'0\$#6\$'/!*8!;'9/0\$?2!'8!**Y**'J1-/41/62[!];7";,Y¹]#/9#-=!%UX!GHG%¹F652'¹b0#?0'>^{*}->b?'2#/>1?12c0'9/6=c416-'5'?\$6#/c6-#/25'-6#6\$'/c#96F'-\$6=c416-'b[!]!

^{\!\!}n#6F#/!<R!&'?412X!`"#!Q1>\$'/#?!*-#/25'-6#6\$'/X!C+5?#\$/1.Xa!

\$\8-#26-9069-1R!3/!6F1!5#26X!E'6F!81.1-#?!#/.!26#61!6-#/25'-6#6\$'/!89/.\$\>!F#2!E11/!5-\$4#-\$?=! 96\$?\$D1.!6'!E9\$?.!\$\8-#26-9069-1X!?\$O1!F\$>F(#=2X!6F#6!5-'4'612!4'-1!0'/J1/\$1/6!6-#J1?!\$/!5-\$J#61! O#-2!-#6F1-!6F#/!\$/!59E?\$O!\$\8-#26-9069-1R*M!&'(1J1-X!\$/!'-.1-!6'!.10-1#21!Y&Y!14\$22\$'/2!\$/! 6-#/25'-6X!@16-'!#\$42!6'!\$/261#.!\$/0-1#21!89/.\$/>!8'-!6-#/2\$6!5-'K1062!#/.!E9\$?.\$/>!'96!59E?\$O! 6-#/2\$6!\$/8-#26-9069-1!\$/!'-.1-!6'!1/0'9-#>1!2F#-1.!4'E\$?\$6=R!*F121!26-#61>\$12!F\$>F?\$>F6!6F1! \$/0-1#2\$/>!59E?\$0!2955'-6!8'-!\$/J12641/6!8'-!F\$>F!J'?941!8\$+1.!-'961!6-#/2\$6!?\$O1!0'44961-!-#\$?X! GHHU[%]\R! * F1!5#22\$/>! '8!6F1!GHH\!6#+!'-.\$/#/01X! (F'21!-1J1/91!25#-O1.!6F1!.-\$J1!8'-!59E?\$0! 89/.1.!0'/26-906\$'/!6'!26#-6!6'!E9\$?.!'96!59E?\$0!6-#/2\$6X!.14'/26-#612!6F1!>-'(\$/>!2955'-6!8'-!6F1! 0'/6\$/9#?!.1J1?'541/6!'8!6F1!''7!59E?\$0!6-#/2\$6!2=2614!\$/!#!0\$6=!6F#6!F\$26'-\$0#??=!5-\$'-\$6\$D1.! J1F\$0?12^{%U}R!

F121!89/.2!#-1!.\$26-\$E961.!E=!6F1!"'2!7/>1?12!; '9/6=!@16-'5'?\$6#/!-#/25'-6#6\$'/!796F'-\$6=!4'/6F?=!6'!%9-\$2.\$06\$'/2!'/!#!51-!0#5\$6#!E#2\$2&@1#29-1!Q!2510\$8\$12!6F#6!6F1!\$9/.2!#-1! $96\$?\$D1.!\$'-!6-\#/25'-6\#6\$'/!59-5'212!'/?=\&@1\#29-1!Q!F\$>F?\$>F62!(F\$0F!5-'\$1062!F\#J1!1?\$>\$E\$?\$6=!\8'-!$ 89/.\$/>!#/.!`\$9-\$2.\$06\$'/2!#-1!1/0'9-#>1.!6'!#55?=!6F1\$-!@1#29-1!Q!"Q!\$9/.2!6'(#-.2!49?6\$c\$9-\$2.\$06\$'/#?!5-'\$1062\$2510\$8\$0#??=!5-'\$1062!6F#6!2955'-6!'6F1-!@1#29-1!Q!-\$?\$!E92!#/.!F\$>F(#=! $0'--\$.'-!5-'\$1062\a^{GH}!$

@ '-1 'J1-X!6F1!@ 1#29-1!Q!" '0#?!Q169-/!5- ' 4 '612!2926#\$/#E\$?\$6=! (F1/!89/.\$/>!6-#/2\$6! 5- 'K1062R!j9-\$2.\$06\$ '/2!#-1!1/0 '9-#>1.!6 '!96\$?\$D1!@ 1#29-1!Q!89/.2!8 '-!5- 'K1062!6F#6!8 '261-! 2926#\$/#E?1!0 '9/6-= (\$.1!6-#/25 '-6#6\$ '/!2=261 4 2!E=!\$/0-1#2\$/>!#?61-/#6\$J1!6-#/25 '-6#6\$ '/!0F '\$012! #/.!\$45- 'J\$/>!6F1!188\$0\$1/0=!#/.!'51-#6\$ '/! '8!6F1!26-1162!#/.!\$/8-#26-9069-1R!!3/0?9.1.!#-1! 2510\$8\$0!0 ''-.\$/#6\$ '/!#55- '#0F!?\$26\$/>2!8- ' 4 !@ 1#29-1!Q! '' 0#?!Q169-/!Y9\$.1?\$/12!#E '96! .10#-E '/\$D#6\$ '/!5- 'K1062!9/.1-!@ '565\$(%Y+&\$#*4#/*,*\$0^!!

- %R @ '-1!0'--\$. '-cE#21.!5-'K1062X!2510\$8\$0#??=!6F'21!6F#6!2955'-6!'6F1-!@1#29-1!Q!-#\$?X!E92! #/.!F\$>F(#=!0'--\$.'-2!
- GR N92!-#5\$.!21-J\$01!\$45?141/6#6\$'/!
- MR N\$01!#/.!51.126-\$#/!#00122!#/.!0'//106\$J\$6=!6'!2955'-6!6-#/2\$6!#/.!-#\$?!26#6\$'/2!

7?2'X!?'0#?!#>1/0\$12!#-1!1/0'9-#>1.!6'!4#+\$4\$D1!6F1!921!'8!6F\$2!89/.\$/>!-12'9-01!6'!-1.901! >-11/F'921!>#2!14\$22\$'/2!#/.!\$45-'J1!4'E\$?\$6=!#/.!#00122!6'!?'0#?!0'449/\$6\$12R!C+#45?12!'8!

^{8U}!" 7 !@16- 'X!`@1#29-1!QXa!" 7 !@16- 'X!@#-0F!G%X!GHGGR!

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5-'K1062!\$/0?9.1!`?\$J#E?1!26-1162X!0' 4 5?161!26-1162X!0#-!2F#-\$/>!5-'>-# 4 2X!5#-0\$/>!5-\$0\$/>! 26-#61>\$12!#/.!'6F1-!#06\$'/2!6'!-1.901!0'/>126\$'/!#/.!J1F\$0?12! 4 \$?12!6-#J1?1.R!N=!#661 4 56\$/>!6'! 89/.!4'-1!\$/8-#26-9069-1!#/.!-#\$?!5-'K1062!6'!E9\$?.!'96!#/.!26-1/>6F1/!59E?\$0!6-#/2\$6X!6F121!?\$26\$/>2! 8-'4!@1#29-1!Q!#?2'!5-'4'61!6F1!188'-62!6'(#-.!.10#-E'/\$D#6\$'/^{G%}R!!

*TE! 7 (#&+'(%7%

@1#29-1!@A2!>'#?2!#-1!6'!4\$6\$>#61!1/J\$-'/41/6#?!1881062!8-'4!Y&Y!14\$22\$'/2X!>-'(!#/! 188\$0\$1/6!#/.!2#81!59E?\$0!6-#/2\$6!2=2614X!#/.!1/F#/01!6F1!; '9/6=A2!-1>\$'/#?!6-#/25'-6#6\$'/!2=2614! E=!\$/J126\$/>!\$/!0#5\$6#?!\$45-'J141/62!\$/!@16-'A2!E92!2=2614!#/.!-#\$?!2=26142R!@1#29-1!@!('9?.! .'9E?1!6F1!2\$D1!'8!6F1!-1>\$'/2!4#22!6-#/2\$6!2=2614!#/.!95.#61!''2!7/>1?12!; '9/6=A2!F\$>F(#=X! %7?6'>16F1-X!6F\$2!('9?.!E1!#!F\$>F?=!2\$>/\$8\$0#/6!6-#/28'-4#6\$J1!\$/J12641/6!6'!E'6F!5-'4'61!6F1! 92#>1!'8!6-#/2\$6!#/.!6'!4#01!6-#/25'-6#6\$'/!\$/!"'2!7/>1?12!2#81-X!1#2\$1-!#/.!4'-1!0'/J1/\$1/68!!

TE! 7 (\$'59&%>,*6#\$(%?2\$*54%#4.%?.#1\$#\$*54%@,#4%A>??@B%

"'2!7/>1?12!; '9/6=!@16-'5'?\$6#/!*-#/25'-6#6\$'/!796F'-\$6=X!'-!@16-'X!5-15#-1.!#/!

8?116X!2 (\$60F!J#/5''?!J1F\$0?12!6'!E#661-=c5' (1-1.!J1F\$0?12X!-15?#01!/'/c-1J1/91!J1F\$0?12! (\$6F! E#661-=!5' (1-1.!J1F\$0?12X!\$/26#??!2=26142!6'!26'-1!1/1->=!0#569-1.!8-'4!6-#\$/2X!E9=!%HHg! -1/1 (#E?1!1/1->=X!\$/26#??!5F'6'J'?6#\$0!2=26142X! E1\$/>!89/.1.!E=!GHH\!@1#29-1!Q!#/.!GH%V!@1#29-1!@!#-1!\$/0'45?161!(\$6F!1/.!.#612!\$/!6F1! 61/6#6\$J1!8969-1R!W\$6F!'/?=!#!81(!5-'K1062!0'45?161.X!0'45-1F1/2\$J1!269.\$12!'8!6F1!2926#\$/#E\$?\$6=!

188\$0\$1/6!921!'8!59E?\$0!6-#/25'-6#6\$'/X!#/.!6F1!0'/26-906\$'/!'8!E\$0=0?1!?#/12!#/.!4#22!6-#/25'-6! ?#/12^{M%}R!3/!4#/=!0#212!6F#6!(\$??!41#/!\$/J126\$/>!\$/!6-#/2\$6!\$/8-#26-9069-1!#/.!F\$>FcJ'?941!8\$+1.c -'961!6-#/2\$6!21-J\$012!290F!#2!0'44961-!-#\$?X!?\$>F6!-#\$?X!#/.!E92!-#5\$.!6-#/2\$6X!#?'/>!(\$6F!-1?\$#E?1! ?'0#?!E92!21-J\$012R!!

**E! M(&*)4#\$(.\%N+4.*4)\%#&\%#\Y(2+'(\%85+\$(\%F5H#'.\%F'#4&*\$\M(2#'/54*-#\$*54\%

*-#/25'-6!10'/' 4 \$262!N#--=! I EE1?2!#/. 'B161-!n \$K0# 4 5!F\$>F?\$>F62!6F#6!2955'-6!8'-!6# / 256! \$/8-#26-9069-1!F#2!6=5\$0#??=!E11/!8-' 4 !J#-\$'92!8'- 4 2!'8!>1/1-#?!6#+#6\$'/2R!o#-=\$/>!# 4 '9/62!'8! -1J1/912!8-' 4 !#! (\$.1!/9 4 E1-!'8!29E2\$.\$12X!?'0#?!6#+12!#/.!0F#->12!F#J1!E11/!5-\$ 4 #-=!2'9-012!'8! 6#/2\$6!89/.\$/>R!72!6F1-1!\$2!9/5-1.\$06#E\$?\$6=! (\$6F!6F\$2! 4 16F'.X!6-#/2\$6!\$2! 4 '-1!J9?/1-#E?!16'!=1#-?=! 0#2F!8?' (2!0#92\$/>!#>1/0\$12!6'!5-\$'-\$6\$D1!.1J1?'5 4 1/62!#/.!4 #01!9/5'59?#-!#/.!0F#??1/>\$/>! .10\$2\$'/2!6'!096!21-J\$01!'-!-#\$21!8#-12!.9-\$/>!51-\$'.2!'8!?' (!-1J1/912&MG!72! 4 '26!'8!6F1!89/.2! '-\$>\$/#61!8-' 4 !6F1!2# 4 !!#22'-64 1/6!'8!-1J1/91!2'9-012!8'-!'6F1-!59E?\$0!21-J\$012X!?\$01!1.90#6\$'/! #/.!F1#?6FX!6F1-1!\$2!/'!.\$-106!?\$/0!E16 (11/!6F1!2'9-01!'8!-1J1/91!#/.!\$62!.1.\$0#6\$'/\$^{MM}!<90F! 9/5-1.\$06#E\$?\$6=!\$2!#?2'!#!0#921!8'-!9/5-1.\$06#E?!!5-'K106!89/.\$/>! (\$6F!/'!#229-#/01!8'-!0'/6\$/9#?! 8\$/#/0\$/>R!; ' 4 516\$6\$'/!8'-!89/.\$/>!6F1/!0-1#612!#!4 #K'-!5-'E?14! (\$6F!6F\$2!8'-4!'8!8\$/#/0\$/>&! *F\$2!E10' 4 12!5-'E?1 4 #6\$0!.91!6'!6F1!/11.18'-!2\$D1#E?1!#4 '9/62!'8!4'/1=X!'J1-!?'/>!51-\$'.2!'8! 6\$4 1X!6'!E9\$?.!#/.!.1J1?'5!59E?\$0!6-#/2\$6!5-'K10628!!*F1!/10122#-=!\$/J126 4 1/62!\$/!2926#\$/#E?!! \$/8-#26-9069-1!2=261 4 2!0#//'6!E1!4#.1! (\$6F'96!2986#E?!!89/.\$/>!4 10F#/\$2 4 2R!T'-!6F\$2!-1#2'/X! #96F'-\$6\$12!#/.!6-#/2\$6!'51-#6'-2!#-1!5-\$'\$6\$D\$/>!/1(!.12\$>/#61.!2'9-012!'8!89/.\$/>!8'/*16-#/2\$6!\$01!

$$\label{eq:source} \begin{split} & ^{M^{s}}!!C>9\$' 126^{1/2} 1126^{1/6}! 100^{1/2} 100$$

@\$//12'6#X!T1E-9#-=!GGX!GHHVR!F6652'bb(((R-121#-OF>#61R/16b5-'88?1b@\$0F#1?3#0'/'b59E\$0#6\$'/bGmmmS%%MPr)1.\$0#61.rT9/.\$/>!

r#/.rI-E#/r*-#/2%5rB1-8'-4#/01r<'41rC45%-\$0#?rCJ\$.1/01b?\$/02bHHEPUmMSG#0M8%MM\#HHHHHHb)1.\$0#61.cT9/.\$/>c#/.c

 $F=5'6F10\#61.!?'0\#?!6\#+\#6\$'/R^{MP}!\&=5'6F10\#61.!?'0\#?!6\#+\#6\$'/!-181-2!6'!\#/!#22'-641/6!'8!?'0\#?!6\#+12! \\ \#/.!0F\#->12!(F'21!-1J1/91!\$2!.\$-106?=!F=5'6F10\#61.!#/.!.1.\$0\#61.!6'!8\$/#/01!6F1!'51-#6\$'/\$! \\ .1J1?'541/6\$!#/.!\$/J12641/6!'8!59E?\$0!6-#/25'-6!#/.!\$62!0'262R^{Mm}!@'26!0'44'/?=\$!\#861-!'E6#\$/\$/>! \\ J'61-!#55-'J#?\$!?'0#?!2#?12!6#+12!Z#55?\$1.!6'!>''.2!#/.!21-J\$012[!0#/!5-'J\$.1!#!.1.\$0#61.!89/.$/>! \\ 2'9-01!8'-!6-#/2\$6!#>1/0\$12R!*F1!\$.1#!$2!6F#6!E=!F#J$/>!.12$>/#61.!89/.$/><math>\$/61.!89/.$/>$

5'?\$0=!>'#??!#/.!6-#/2\$6!5-'K1062R^{MV}!*F-'9>F!6F1!6#+12@616-!42Tc310.24000.2412589.92005091Tf(!)TjETQ0.2

!

89/.2! (1-1!#201.R!72!6F1!26-#61>\$12!6' (#-.!.10#-E'/\$D#6\$'/!6F#6!@16-'!.120-\$E12! (#2!92\$/>!6#+! '-.\$/#/01!89/.\$/>!6'!E9\$?.!'96!4'-1!59E?\$0!6-#/2\$6!\$/8-#26-9069-1X!6F1!]9126\$'/!'8! (F16F1-!6F\$2!\$2! #/!188106\$J1!26-#61>=!#/.! (F=! (#2!#201.!6'!6F121!#.J'0#0=!>-'952R!!

E! $R4\$('T^(H((\&\%C^*\&\$!$

n#41!	Y-'95!
3/61- J \$1 (11!7!	7 (\$'5^!C/J\$-'/41/6#?!<1-J\$012!) 15#-641/6!
3/61- J \$1 (11!N!	7 (\$'5^!C/J\$-'/41/6#?!; '45?\$#/01!

T'-!4 = !-121 # - 0FX!3!0' / .9061.!8'9 - !\$/61 - J\$1 (2! (\$6F!@16-'!#>1/0=!414E1-2! (\$6F\$/!6F1! C/J\$-'/41/6#?!; '45?\$#/01!)15#-641/6!#2! (1??!#2!6F1!<926#\$/#E\$?\$6=!#/.!C/J\$-'/41/6#?!; '45?\$#/01!)15#-641/62!E16 (11/!j#/9#-=!#/.!T1E-9#-=!GHGGR!7..\$6\$'/#??=X!3!\$/61-J\$1 (1.!G!414E1-2!'8! J#-\$'92!0?\$4#61!#/.!6-#/2\$6!#.J'0#0=!>-'952R!3!\$/61-J\$1 (1.!'/1!414E1-!'8!6F1!'->#/\$D#6\$'/!*Y* $$'(($&$35'%?,,!#/.!#/'6F1-!8-'4!>,*6#$($8(&5,T(R!T'-!6F1!59-5'21!'8!6F$2!5#51-X!#??!@16-'! $\61-J$1 (112!#-1!#/'/=4'92X!E96!#??!.15#-641/62!51-6#$/!6'!; 77BX!@1#29-1!Q!#/.!@1#29-1!@R!!$

*F-'9>F!6F1!\$/61-J\$1 (2!0 ' / .9061 .! (\$6F!E '6F!# . J '0#0=!>- '952!# / .!@16-'!#>1/0=! 4 1 4 E1-2X!6F1-1! (#2!#!>1/1-#?!0 ' /21/292! ' 8!#00156# /01! ' 8!6F1!\$/8-#26-9069-1!# / .! '51-#6\$ ' /2! .10#-E ' /\$D#6\$ ' /!26-#61>\$12!# / .!6F1!GH%U! ; ?\$ 4 #61! 7 06\$ ' /!# / .!7 .#56#6\$ ' /!B?# /!8- ' 4 !@16- 'R!*F1! 5?# /!# / .!\$62!0 ' /61 /62!51-6#\$ /\$ />!6 '! .10#-E ' /\$D\$ />! '51-#6\$ ' /2!# / .!5 ' ?\$0=!> '#?2! (1-1!>1 / 1-#??=! (1??c-101\$J1 .!# / .! .11 4 1 .!-1#?\$26\$0#??=!\$ 4 5?! 4 1 /6#E?1R!N '6F!@16- '!# / .!# . J '0#0=! 4 1 4 E1-2! #>-11 .! ' /!6F1!/11 .!8 '-! 4 '-1!#00122\$E?1!# / .!#88 '- .#E?1!59E?\$0!6-# /2\$6!\$ / 8-#26-9069-1!#2! (1??!#2! 4 969#?!> '#?2! ' 8!6-# /2\$6! .10#-E ' /\$D#6\$ ' /R!7 ?6F '9>F!6F1!5 ' ?\$6\$0#?!\$ 4 5?\$0#6\$ ' /2! ' /!6F1!-1#?\$26\$0!

- %R *#+!'-.\$/#/012!GHH\!@1#29-1!Q!#/.! GH%V!@1#29-1!@!5-'J\$.1!89/.\$/>!8'-! 6F1! ! N9\$?6!\$/!#00'-.#/01! (\$6F!@16-'A2!<926#\$/#E\$?\$6=!B?#/X! (F\$0F!0'/6#\$/2!; 7 7 B! (\$6F\$/!\$6X!#2!6F1! 4 #\$/!26-#61>=!6'!.10#-E'/\$D1! !
- GR W\$6F\$/!6F#6X!GH%U!; 7 7 B!5 ' ?\$0\$12!#?2 ' ! F1?5! !E=!

n '6! '/?=!#-1! (1!6-\$/>!6'!.10#-E'/\$D1!E96!/'6!6'!-1c0#-E'/\$D1 L @16-'!F#.!#! 4 116\$/>! #E'96!6F1\$-!.\$881-1/6!26-#61>\$12!\$/0?9.1.!6F1!5-'K1061.!8''65-\$/6!'8!1+5#/.\$/>!8-11 (#=2R! *F1!\$/0?92\$'/!'8!8-11 (#=!4'/1=!#/.!\$451692!8'-!1+5#/2\$'/!6F1-1!-1#??=!K1'5#-.\$D12! 0?\$4#61!#06\$'/R!*F1!]9#/6\$6=!'8!>-11/F'921!>#212!6F#6! ('9?.!E1!14\$661.!-1?#61.!6'!5?#//1.! 1+5#/2\$'/!'8!8-11 (#=2!\$2!>-1#61-!6F#/!#??!'8!6F1!\$/8-#26-9069-#?!\$/J12641/62!'8!@16-'! 0'4 E\$/1.X!6F#6!\$2! (F#6!6F1\$-!.-#86!126\$4#612!2#=R!36A2!/\$01! (F1/!='9!6\$1!#06\$J1!6-#/2\$6!6'! F\$>F (#=!\$45-'J141/62X!E96!\$8!='9-!\$/.90\$/>!.14#/.!8'-!.-\$J\$/>!\$6!5-'4'612!#!21/21!'8!#! D1-'c294!>#41R!; #/A6!1/0'9-#>1!.-\$J\$/>!#/.!-\$.\$/>!#!E\$01!#6!6F1!2#41!6\$41R!

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@1#29-1!@!\$2!#!E1/18\$6!6'!@16-'!#/.!6F1!6-#/2\$6!2=2614!#2!#!(F'?1R!*F121!6('!@1#29-12!(1-1!

#/#?=D1.!2510\$8\$0#??=!#2!6F1=!#-1!J\$1(1.!#2!6F1!/1+6!2615!8'-!6-#/2\$6!89/.\$/>!5-'K1062!\$/!"7R!

@1#29-1!@!\$2!96\$?\$D1.!#2!#/!1+5#/2\$'/!'8!6F1!'-\$>\$/#?!@1#29-1!Q!6#+!'-.\$/#/01R!36!\$2!.\$26\$/06!.91!

6'!6F1!?#->1!20#?1!'8!89/.2!#/.!/'!29/216!.#61R!*F\$2!?#->1!\$/0-1#21!\$/!#J#\$?#E?1!89/.\$/>!\$2!0-\$6\$0#?!

6'!6F1!0'/6\$/9#?!E9\$?.\$/>!'8!5-121/6!#/.!8969-1!6-#/2\$6!5-'K1062R!T'-!3/61-J\$1(11!N!26#612^!

I ?6\$ 4 #61?=!@1#29-1!@!(#2!6#0\$/>!@1#29-1!Q!6'!6F1!/1+6!?1J1?!\$/!61-42!'8!6F1!5-'K1062!\$6!(#/62!6'!5-'J\$.1!6'!"7!; '9/6=R!"\$01!6('!'8!6F1!F\$>F?\$>F62!'8!6F#6!2510\$8\$0!6#+!41#29-12!\$2!GH!'-!2'!5-'K1062!6F1=!(#/6!6'!1/#06!95!9/6\$?!GHmHR!CJ1/!(\$6F!6F'21!5-'K1062!\$/!4\$/.!(1!(#/6!6'!>16!.'/1X!6F1-1!\$2!/'!29/216!.#61!'/!6F#6!41#29-1!(F\$0F!41#/2!6F#6!\$/!6F1!8969-1!\$8!(1!26\$??!F#J1!6#+!-1J1/91!0'4\$/>!<math>%/6'!@16-'!#/.!6F1-1!\$2!'EJ\$'92?=!26\$??!/11.!8'-!6-#/2\$6!5-'K1062X!F1-1A2!#/!'55'-69/\$6=!6'!0'/6\$/91!6'!\$45-'J1!'9-!.10#-E'/\$D#6\$'/!188'-62!\$/!6F1!

#. '56\$/>!0?1#/!891?!#/.!610F/'?'>=!#?61-/#6\$J12!6'!.10#-E'/\$D1!6F1!6-#/2\$6!2=2614!E=!GHmHR^{PS}!

WF1/!#201.!#E'96!6F1!\$/61-2106\$'/!E16(11/!6F1!6#+!41#29-12!#/.!;77BX!3/61-J\$1(11!N!

.120-\$E12X!!

 $\begin{array}{l} N10\#921!@1\#29-1!@!\#/.!Q!.'12!\#!?'6!'8!6F1!F1\#J=!?86/>!'8!6F1!C@*!-1.906$'/2X!6F1! \\ ; 7 7 B!$2!F'(!(1!$45-'J1!95'/!6F#6R!&'(!0#/!@16-'!4#01!5-'K1062!4'-1!2926#$/#E?1!#/.!F1?589?!6F-'9>F!6F121!24#??1-!41#29-12:!! \\ \end{array}$

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7..\$6\$'/#??=X!#?6F'9>F!@1#29-12!Q!#/.!@1#29-1!@!.'!/'6!.\$-106?=!2955'-6!; 77BA2!5'?\$0\$12X!

6F1=!.'!'J1-#??!2955'-6!@16-'A2!#\$4!6'(#-.!#0F\$1J\$/>!0?\$4#61!#/.!2926#\$/#E\$?\$6=!>'#?2!\$/!4'-1!

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*F1!; 7 7 B!0#41!#861-!@1#29-12!Q!#/.!@X!6F1!; 7 7 B!-181-2!6'!@1#29-1!Q!#/.!@1#29-1! @!\$/!61-42!'8!\$62!?\$01!F1?5\$/>!92!6'!>16!6'!.10#-E'/\$D#6\$'/!>'#?2R!!N96!@1#29-1!Q!#/.! @1#29-1!@!.'/q6!/10122#-\$?=!.1#?!(\$6F!6F1!; 7 7 BR!36!F1?52!92!>16!6F'21!>'#?2!\$/!4'-1! 6-#/2\$6!5-'K1062X!(F\$0F!-1.9012!C@*X!(F\$0F!-1.9012!J1F\$0?1!!14\$22\$'/2!\$/!"7!0'9/6=R!W1!

Z@N<[X!\$2!0'/2\$261/6! (\$6F!'9-!GH%U!; 77B!>'#?2!'8!E10'4\$/>!0#-E'/!/196-#?!#/.!.\$25?#0\$/>! 'J1-!S\HXHHH!@16-\$0!*'/2!'8!;#-E'/!)\$'+\$.1!C]9\$J#?1/6!Z@*;,G1[!E=!GHmHR!@N<!6#->162! -1?#61.!6'!1/1->=!#/.!26-#61>\$12!-1?#61.!6'!14\$22\$'/2!.\$25?#0141/6!'96?\$/1!@16-'A2!188'-62! 6' (#-.!#!.10#-E'/\$D1.!8969-1R!

2926#\$/#E\$?\$6=!8-#41('-OR!T'-!\$/61-J\$1(11!)!26#612X!!

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@16-'A2!2926#\$/#E\$?\$6=!188'-62!#/.!\$2!29E2941.!9/.1-!6F1!E-'#.1-!@16-'!<926#\$/#E\$?\$6=!B?#/X!

T9-6F1-4 '-1X!E '6F!3/61-J\$1 (11!; !#/.!3/61-J\$1 (11!) !F\$>F?\$>F61.!6F#6!; 77B!\$2!'/?=!'/1!5#-6!'8!

.-'9>F6!-12\$?\$1/01R!

F121!41#29-12!#-1!5-'K1061.!6'!#J'\$.!4'-1!6F#6!P%VXHHH!@;,G1!#//9#??=R^{mH}!*F\$2!\$2!6F1! 1]9\$J#?1/6!'8!-14 'J\$/>!4 '-1!6F#/!\\XHHH!5#221/>1-!J1F\$0?12!8-'4!6F1!-'#.!8'-!#!=1#-X! (F\$?1! #?2'!5-'J\$.\$/>!/16!0'26!2#J\$/>2!#/.!1/J\$-'/41/6#?!0'cE1/18\$62!?\$01!\$45-'J1.!#\$-!]9#?\$6=!#/.!

; 7 7 BA2!6F\$-611/! 4 1#29-12!#-1!#??!89??=!\$ 4 5?1 4 1/61.^!

0'/61+6!'8!6F1!5-'>-122\$'/!'8!0?\$4#61!0F#/>1!\$/!2510\$8\$0#??=!"'2!7/>1?128!*F-'9>F'96!6F1!

2955'-6!'8!6F\$2!E1?\$18X!3/61-J\$1 (11!)!5962!; 77BA2!188106!\$/!51-25106\$J1!#/.!'96?\$/12!6F#6!\$8!

\$/61-J\$1 (2!; 7 7 B! (#2!J\$1 (1.!#2!#...\$6\$ '/#?!-'9612!6'! 4 #01!6-#/2\$6!5-'K1062!89-6F1-!2926#\$/#E?1R!3/!

5-1. '4\$/#/6?=!2F#51. !F' (!@16-'!J\$1(1.!'51-#6\$'/#?!5-#06\$012!4'J\$/>!8'-(#-.!(\$6F\$/!6F1!

#.#56#6\$'/L!G[!7/.!6F1/!#!?'6!'8!\$6!\$2!F'(!.'!(1!\$45-'J1!6F1!8#0\$?\$6\$12Ra!*F1!;77B!

6F-'9>F!6F1!'51-#6\$'/!5-'012212!#/.!26#/.#-.2!(F1/!E9\$?.\$/>!6-#/2\$6!5-'K1062R!*F1=!89-6F1-!26#61.X!

|\$/!61-42! '8!6F1!> '#?2! '8!; 7 7 BX!6 ('!'8!6F1!4#\$/!6F\$/>2!6F#6!#-1!2955 '21.!6'!F1?5!\$2!%[!\$/!61-42!'8!

#E?1!6'!#.#56!6'!6F1!\$/0-1#2\$/>!0?\$4#61!0F#/>1!1881062!\$/!"'2!7/>1?12!#/.!-1.90\$/>!14\$22\$'/2!

#?-1#.=!26#-61.!#/.!#?-1#.=!9/.1-(#=!#/.!>\$J1!\$6!4'-1!2510\$8\$0!0F#/>12!#/.!>'#?2&a!3/!

{ (#/62A!#2!#/!#>1/0=! (\$6F! (F#6!\$2!5 ' 22\$E?1!6' !59-291!>\$J1/!4 ' 26! '8! '9-!?#->1!5- 'K1062!F#J1!

#00'-.#/01!(\$6F!6F\$2X!C/>1?F#-.6!26#612X!`, J1-#??X!4'26!'8!6F1!0?\$4#61!#06\$'/!5?#/!\$2!>''.!#/.!

\$45?141/6#E?1R!<4#??!.16#\$?2!6F#6!#-1!0-90\$#?Ra%*F1!%M!41#29-12!?'0#61.!\$/!:77B!#\$4!#6!E1\$/>!

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^{nH}!C26\$4#61.!92\$/>! I <!CB7A2!Y-11/F'921!Y#2!C]9\$J#?1/0\$12!; #?09?#6'-!

?#->1-!]9#/6%6=!'8!0#-2!'/!6F1!8-11 (#=2&!*F121!F\$>F (#=!1+5#/2\$'/!5-'K1062!\$/F1-1/6?=!0'/6-#.\$06! 26#61 4 1/62!'8!@16-'A2!>'#?2!'8!4'J\$/>!51'5?1!# (#=!8-'4!J1F\$0?1!921R!T'-!1+#45?1X!\$/!#/!#-6\$0?1! #E'96!@16-'A2!5-'>-122!'/!6F1!3cm!n'-6F!; '9/6=!C/F#/01 4 1/6!B-'K106!6F#6! (\$.1/2!6F1!F\$>F (#=! (\$6F!#/'6F1-!&\$>F!,0095#/0=!01F\$0?1!?#/1!Z&,0[X!''2!7/>1?12!; '9/6=!<951-J\$2'-!#/.!@16-'!

N'#-.!@14E1-!h#6F-=/!N#->1-!26#612^!

36!\$2!0-\$6\$0#?!6F#6! (1!1/29-1!6F1!2#81!#/.!188\$0\$1/6! '51-#6\$ '/! '8!6F1!3cmX! (F\$0F!\$2!6F1! E#00E '/1! '8!0 ' 4 41-01!\$/!6F1!W1261-/!I /\$61.!<6#612 L *F121!\$ 4 5- ' J1 4 1/62! (\$??!F1?5! 2#81>9#-.!6F1!10 '/ ' 4 \$0!J\$6#?\$6=! '8!6F1!1/6\$-1!-1>\$ '/! (F\$?1!5- ' J\$.\$/>!01=!2#816=! \$45- ' J1 4 1/62!8 '-!#??! (F '!921!6F\$2!0 '--\$. '-R^{mm}!

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) 1 4 '/26-#61.!6F-'9>F!6F\$2!-1?1#21.!26#61 4 1/6X!5'?\$6\$0#?!#/.!10'/'4\$0!\$45?\$0#6\$'/2!8'-!6F1!

\$/0?92\$'/!'8!-'#.!#/.!F\$>F(#=!1+5#/2\$'/!5-'K1062!#-1!F\$>F?\$>F61.R!*F-'9>F'96!6F1!\$/61-J\$1(2X!

#00 ' 4 5?\$2F! 4 '-1!0 ' 4 5-1F1/2\$J1!0?\$ 4 #61!> ' #?2R! * F\$2!\$/0-1#21! ' 8!\$/8-#26-9069-1!8 '-! 4 '-1!J '?9 4 1!

'8!J1F\$0?12!/1>#612!6F1!5'61/6\$#?!8'-!?'(1-\$/>!Y&Y!14\$22\$'/2!(\$6F!59E?\$0!6-#/2\$6!\$/8-#26-9069-1R!!

*F\$2!0-\$6\$]91!\$2!2955'-61.!E=!#.J'0#0=!>-'952!?\$01!>,*6#\$(\%8(\&5,T(!#/.!Y\$'((\$\&\%5'\%?,,!89-6F1-!

\$/.\$0#612!6F#6!6F1!F\$>F(#=!1+5#/2\$'/!5-'K1062!(1-1!5#-6!'8!5'?\$6\$0#?!0'/0122\$'/2!4#.1!\$/!'-.1-!6'!

5#22!6F1!6#+!'-.\$/#/012&!7?6F'9>F!6F1-1!\$2!#!>1/1-#?!#00/'(?1.>141/6!'8!6F1!5'?\$6\$0#?!/11.!6'!

'->#/\$D\$/>!#/.!.12\$>/\$/>!5-'K1062!#/.!\$62!'51=#6\$'/2!#/.!'861/!\$6!\$2!?186!95!6'!6F1!<926#\$/#E\$?86=!
#/.!C/J\$-'/41/6#?!;'45?\$#/01!.15#-641/66'!'2'?1?=a!592F!8'-!2926#\$/#E?1!5-'K1062!!#/.!
\$/8-#26-9069-1!1J1/!(\$6F\$/!6F1!/1(1-!@1#29-1!@!5-'K1062!!@'-1'J1-X!(\$6F\$/!5-'K1062!!6F1-1!#-1!
2510\$880#6\$'/2!6F#6!0'J1-!6F1!E#2\$0!-1]9\$-141/62!E96!#/=!#..\$68'/#?!>-11/!5-'K1062!51-6#\$/\$/>!6'!
89-6F1-!>-11/!2510\$8\$0#6\$'/2X!8'-!1+#45?!10?\$4#61!#.#56#6\$'/!26-#61>\$12X!\$2!?186!95!6'!6F1!
<926#\$/#E\$?\$6=!.15#-641/6!6'!592F!8'-!#/.!88/.!6F1!89/.\$/>!8'-R!*F-'9>F!6F\$2X!4'26!'8!6F1!>'#?2!
8-'4!6F1!;77B!#-1!4#\$/61/#/01!#/.!'51-#6\$'/2!F1#J=!.91!6'!6F1!#E\$?\$6=!8'-!6F1!.15#-641/6!
(\$6F\$/!@16-'16'!#069#??=!F#J1!#>1/0=!'J1-!.10\$2\$'/2!.91!6'!\$6!E1\$/>!@16-'!'(/1.!4#.1!
0'45#-1.!6'!0'/6-#062X!72!6F1!<926#\$/#E\$?\$6=!#/.!C/J\$-'/41/6#?!;'45?\$#/01!.15#-641/62!#-1!6F1!
4#&'-\$6=!#06\$J1?=!\$/J'?J1.!(\$6F!5?#//\$/>!8'-!2926#\$/#E?1!5-#06\$012!(\$6F\$/!@16-'!5-'K1062X!6F1-1!\$2!
/'!\$/F1-1/6!0-\$61-\$#18'-!2926#\$/#E\$?\$6=!E1\$/>!E9?86!\$/!CF1!26-9069-#?!2=2614&!*F\$2!
21J1-1?=!-126-\$062!6F1!2926#\$/#E?1!5-#06\$012!(\$6F\$/!@16-'!5-'K1062X!6F1-1!\$2!
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/'!\$/F1-1/6!0-\$61-\$#1!*E?\$6=!E1\$/>!E9?86!\$!/!E1!/0=X!#/.!0'*45-1F1/2\$J1/122!(\$6F\$/!09--1/6!
#/.!8969-1!6-#/2\$6!5-'K1062!#2!2926#\$/#E?1!5-#06\$012!#-1!6F1!#..1.!#2!#/!#..\$65'/!#/.!/'6!E1\$/>!

3/!'-.1-!6'!\$45-'J1!6F1!'J1-#??!188106\$J1/122!'8!@16-'A2!26-#61>\$12!#/.!'51-#6\$'/#?!5-'K1062!6'! \$45?141/6!4'-1!#>>-122\$J1!#/.!0'45-1F1/2\$J1!.10#-E'/\$D#6\$'/!5'?\$0=!>'#?2!3!-10'441/.!6F1! 8'??'(\$/>^!

%R B-\$'-\$6\$D	1!5?#//\$/>!6F1!	PR	@16-'!145F#2\$2!'/!	mR	@16-'!0#/!0-1#61!4'-1!
8'9/.#6\$	'/!'8!8969-1!		0-1#6\$ ' / ! ' 8!2926#\$ / #E?1!		59E?\$0! ' 96-1#0F!
6-#/2\$6!5-	- ' K1062! (\$6F!		K'E2!6'!#122!?#E'-!		0#45#\$>/2!6'!F1?5!
2926#\$/#]	E\$?\$6=!#/.!		>-'952!145?'=41/6!		.1J1?'5!09?69-#?!
1/J\$-'/4	41/6#?!		0'/01-/2!6F#6!.'12!/'6!		0'/20\$'92/122!#/.!5'?\$0=!
0'45?\$#	/01!4#/.#612!\$/!		2955'-6!1+5#/2\$'/!'8!		?\$61-#0=!!
4\$/.!!			F\$>F(#=!\$/8-#26-9069-1!!		!
!			!	VR	@16-'!0#/!F#J1!0?1#-1-!
					59E?\$0!6-#/25#-1/0=!#E'96!

'	#\$!M%	
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GR	@'-1!\$/6115#-641/6#?!	6-#/2\$6!5-'K1062X!.#6#X!#/.!
	0'??#E'-#6\$'/!#/.!2955'-6!	'51-#6\$'/2!!
	8'-!6F1!\$45?141/6#6\$'/!'8!	
	26#/.#\$D1.!	
	.10#-E'/\$D#6\$'/!#/.!	
	2926#\$/#E\$?\$6=!5-#06\$012!\$/!	
	5-'K1062!	
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MR	; '/6-#062!F#J1!	
	5-1.161-4\$/1.!#/.!	
	26#/.#\$D1.!-1]9\$-141/62!	
	}!2510\$8\$0#6\$ ' / 2!8 ' -!	
	4 #61-\$#?2!#/ . !E9\$? . \$/>!	
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*E! _1('#\$*54&%

3/!'-.1-!6'!-1#?\$26\$0#??=!0'4E#6!0?\$4#61!0F#/>1! (\$6F!8969-1!6-#/2\$6!5-'K1062X!26#/.#-.\$D1.! 2926#\$/#E?1!#/.!.10#-E'/\$D#6\$'/!J#?912!#-1!J\$6#?! (\$6F\$/!\$/61-.15#-641/6#?!0''51-#6\$'/R!3/261#.!'8! -1?=\$/>!'/!'/?=!#!81 (!.15#-641/62!6'!4#/#>1!>-11/!'51-#6\$'/2!#/.!>9\$.1?\$/12!8'-!6-#/2\$6!5-'K1062X! @ 16-'!4926!26#-6!6F1!8'9/.#6\$'/2!'8!5-'K1062! (\$6F!2926#\$/#E?1!26#/.#-.2X!5-#06\$012X!#/.!'51-#6\$'/2! #6!6F1!8'-18-'/6!'8!5?#//\$/>! (\$6F\$/!#??!26#>12!'8!6F1!.1J1?'541/6R!)'\$/>!2'! ('9?.!\$45?141/6! 4'-1!0'45-1F1/2\$J1!#/.!188106\$J1!0?\$4#61!5'?\$0\$12!#/.!.10#-E'/\$D#6\$'/!>'#?2!\$8!#??!.15#-641/62! F#.!>-11/!2510\$8\$0#6\$'/2!#/.!-1]9\$-141/62!E9\$?6!\$/!#6!1J1-=!26#>1!'8!6-#/2\$6!.1J1?'541/6R!!

7 2!6F1!>,*6#\$(%?2\$*54%#4.%?.#1\$#\$*54%@,#4!145F#2\$D12!.10#-E'/\$D#6\$'/!'8!@16-'!0'/6-'??1.! '51-#6\$'/2!(\$6F\$/!6-#/2\$6!5-'K1062X!@16-'!4926!#..\$6\$'/#??=!#\$4!6'!0-1#61!4'-1!#221-6\$J1!>-11/! 26#/.#-.2!8'-!'51-#6\$'/2X!1]9\$541/6X!#/.!5-'K106!0'/26-906\$'/!(\$6F!6F1\$-!0'/6-#06'-2R!;9--1/6?=X! @16-'!F#2!-10'/26-906\$'/!6F-'9>F!5'?\$0=X!(F\$0F!-1]9\$-12!0'/6-#06'-2!6'!E-\$/>!\$/!2510\$8\$0!0\$/.2!'8! 1]9\$541/6R!;'/6-#06'-2!#-1!/'6!#??'(1.!6'!E-\$/>!\$/!1]9\$541/6!9/.1-!#!01-6#\$/!6\$1-!E#21.!'88! 21J1-#?!?#(2!E96!.91!6'!;,03)!2F'-6#>12!#/.!\$/#E\$?\$6=!6'!0F#/>1!09--1/6!1]9\$541/6!#/.! 4#61-\$#?2X!1+1456\$'/2!.151/.\$/>!'/!6F1!5-'K106!#-1!4#.1R!7?6F'9>F!6F\$2!\$2!#!5-'4\$2\$/>!26#-6X!8'-!

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-9?12!#/.!#!26-#61>=!6'!2'9-01!#/.!59-0F#21!01-6#\$/!2955?\$12!/11.!6'!E1!145?'=1.!#2!@16-'!#\$42! 6'!4'J1!6'(#-.!4'-1!#221-6\$J1!0?\$4#61!>'#?2!#/.!2926#\$/#E\$?\$6=!5-#06\$012&!!

**E! @5,*20%53%Y+&\$#*4#/,(%P5/%>'(#\$*54%

, /1!'8!6F1!4#\$/!0-\$6\$]912!'8!6F1!26=#61>\$12!145?'=1.!E=!@16-'!(#2!6F1!\$/0?92\$'/!'8!F\$>F(#=! 1+5#/2\$'/!5-'K1062!.91!6'!5'?\$6\$0#?!#/.!10'/'4\$0!0'/0122\$'/2R!72!6F1!F\$>F(#=!1+5#/2\$'/! 5-'K1062!(1-1!\$/0?9.1.!5#-6?=!.91!6'!\$62!5'61/6\$#?!8'-!K'E!0-1#6\$'/!'J1-!=1#-2X!@16-'!/11.2!6'! 145F#2\$D1!6F1!0-1#6\$'/!'8!2926#\$/#E?1!K'E2!(\$6F!#!>''.!(#>1!#/.!E1/18\$62!6'!#..-122!?#E'-!>-'952! 145?'=41/6!0'/01-/2!\$/!#!(#=!6F#6!.'12!/'6!2955'-6!6F1!1+5#/2\$'/!'8!F\$>F(#=2!(\$6F\$/!"7R!! T9-6F1-4'-1X!6F1!>??@X!@1#29-1!QX!#/.!@1#29-1!@!0'/6#\$/2!5'?\$0\$12!#/.!5-'K1062!6F#6!#.J'0#61! 8'-!6F1!4'.#?!2F\$86!'8!2\$/>?1!921!J1F\$0?12!6'!59E?\$0!6-#/2\$6R!*'!#00'45?\$2F!6F\$2X!6F1-1!/11.2!6'!E1!#! 2\$49?6#/1'92!188'-6!6'!.1J1?'5!K'E2!6'!2955'-6!6F\$2!#.J#/0\$/>!#/.!6'!.10-1#21!6F1!/11.18'-!

F\$>F (#=!5- ' K1062R!!

***E! M(T(,516(4\$%53%@+/,*2%F'#4&1#'(420%>+,\$+'#,%>54&2*5+&4(&&J%#4.%@5,*20%C*\$('#20%H*\$''% 65'(%@+/,*2%_+\$'(#2'%

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, /1!'8!6F1!01=!\$22912!1/0'9/61-1.!(#2!6F1!?#00!'8!59E?\$0!#(#-1/122!#/.!#J#\$?#E?1! \$/8'-4#6\$'/!\$/6'!@16-'A2!5-'K1062X!.15#-641/62X!'->#/\$D#6\$'/X!#/.!.#6#R!7..\$6\$'/#??=X!6F1-1!0'9?.! 5'61/6\$#??=!E1!#!>#5!\$/!51'5?1A2!#E\$?\$6=!6'!/#J\$>#61!@16-'A2!(1E2\$61!#/.!9/.1-26#/.!6F1!-F16'-\$0! #/.!.'0941/62!5-121/61.R!I/?122!'/1!(#2!.\$-106?=!5'\$/61.!6'(#-.!#!2510\$8\$0!?\$/0!'-!.'0941/6X!\$6! (#2!0F#??1/>\$/>!6'!8\$/.!51-6\$/1/6!\$/8'-4#6\$'/R!@#K'-\$6=!'8!6F1!?\$/02!6F#6!0'/6#\$/1.!59E?\$0! \$/8'-4#6\$'/!#E'96!5-'K1062!(1-1!'/!6F1!'88\$0\$#?!(1E2\$61!=16!.\$.!/'6!('-OR!38!'/1!#\$41.!6'!0'/6#06! #!2510\$8\$0!.15#-641/6!#6!@16-'X!6F1-1!(#2!/'!-10'-.2!'8!(F'!2510\$8\$0#??=!(#2!\$/!6F1!.15#-641/6! '-!\$/!0F#->1!'8!(F\$0F!5-'K1062R!38!'/1!#\$41.!6'!>'!5F=2\$0#??=!\$/6'!6F1!@16-'!?\$E-#-=!6'!#0]9\$-1! .#6#X!6F1!?'0#6\$'/!(#2!5F=2\$0#??=!0?'21.R!!7..\$6\$'/#??=X!#661456\$/>!6'!251#0!(\$6F!#!@16-'!#>1/0=! 414E1-!8-'4!.15#-641/62X!?\$01!<926#\$/#E\$?\$6=X!6''0!49?6\$5?1!6-\$12R!*F1!2F11-!/94E1-!'8! .'0941/62!#/.!J'?941!'8!610F/\$0#?!?#=1-2!(\$6F\$/!6-=\$/>!6'!#00122!\$/8'-4#6\$'/!#/.! 0'449/\$0#6\$'/!F\$>F?\$>F62!6F1!/11.!8'-!@16-'!6'!0'/2'?\$.#61!#/.!6-#/28'-4!6F1\$-!(1E2\$61!(\$6F! #00122\$E?1X!-1?1J#/6X!#009-#61X!#/.!('-0\$/>!?\$/O2!6F#6!5-'4'612!.#6#!#/.!0'449/\$0#6\$'/! 6-#/25#-1/0=R!W\$6F'96!6F\$2!?1J1?!'8!6-#/25#-1/0=X!\$6!4#012!\$6!1+6-141?=!.\$88\$09?6!8'-!@16-'!6'!E1! F1?.!#00'9/6#E?1!#/.!E1!0'45-1F1/2\$E?1!6'!\$62!0\$6\$D1/2R!! 6F#6!@16-'!96\$?\$D12!6' (#-.2!5'?\$0=!>'#?2!'8!.10#-E'/\$D#6\$'/!0#/!E1!E10'41!89-6F1-! 0'45-1F1/2\$E?1R!!

T'9/.!(\$6F\$/!\$/61-J\$1(2!(\$6F!@16-'!414E1-2X!6F1!4#\$/!26-#61>=!'8!E9\$?.\$/>!'96!6-#/2\$6! \$/8-#26-9069-1X!6F#6!(#2!89/.1.!E=!@1#29-1!Q!#/.!2510\$8\$0#??=!@1#29-1!@X!(#2!\$.1/6\$8\$1.R!7...\$6\$'/#??=X!(\$6F\$/!6F121!6-#/2\$6!5-'K1062X!@16-'!F#2!\$45?141/61.!#/.!#.'561.!6F1!GH%U!; 77BR! 7!5?#/!(F\$0F!\$2!8'0921.!6'!145F#2\$D1!6F1!.10#-E'/\$D#6\$'/!'8!'51-#6\$'/2!\$/!6-#/2\$6!5-'K1062R!WF\$?1! 6F121!'51-#6\$'/#?!5'?\$0\$12!#-1!.1141.!E1/18\$0\$#?X!6F1!?#->1-!0'/0156!'8!E9\$?.\$/>!6-#/2\$6! \$/8-#26-9069-1!6'!0'4E#6!Y&Y!14\$22\$'/2!6F-'9>F!4'.#?!2F\$86!0#/!E1!4'-1!0'45-1F1/2\$J1R!*'! 4#01!E9\$?.\$/>!59E?\$0!6-#/2\$6!\$/8-#26-9069-1!#2!#.J#/6#>1'92!#2!\$6!0'9?.!5'22\$E?=!E1X!@16-'!/11.2! 6'!#..-122!6F1!5'?\$6\$0#?!#/.!10'/'4\$0!0'/012212(\$)0.2(J1)0.2(R!*)0.2('!)]TJETQ\$0.24TQ\$0.(0)0.2(!(2))

&91-6#X!;?#9.\$#!BR!`*-#/2\$6!T9/.\$/>!x!WF=!6F1!B'?\$6\$02:!7!;'45#-#6\$J1!<69.=!'8!B9E?\$0! *-#/25'-6#6\$'/!3/8-#26-9069-1!T9/.\$/>!\$/!n1(!i'-0!;\$6=!#/.!"'2!7/>1?12Ra!*F12\$2X! ;,"I@N37!In3oCQ<3*iX!GH%GR!!

&=4 '/X!<61J1X!`@16-'!Q16\$-12!"#26!)\$121?!N92X!N10'412!W'-?.q2!T\$-26!@#K'-!*-#/2\$6!7>1/0=!6'! ,51-#61!,/?=!;?1#/!T91?!N9212&a!*F1!<'9-01X!j#/9#-=!%GX!GH%%R! F6652^bb6F12'9-01&A16-'&/16bGH%bH%b%Gb416-'c-16\$-12c?#26c.\$121?cE92cE10'412c('-?.2c8\$-26c 4#K'-c6-#/2\$6c#>1/0=c6'c'51-#61c'/?=c0?1#/c891?cE9212b&!!

- "\$/6'/X!j'1X!#/.!)#4\$1/!n1(6'/R!`3/61-J\$1(!(\$6F!@\$0F#1?!<0F/1\$.1-X!T'9/.1-!'8!<6-1162!8'-! 7??Ra!<6-1162E?'>!"'2!7/>1?12X!n'J14E1-!SX!GH%UR! F6652^bb?#R26-1162E?'>R'->bGH%Ub%%bHSb\$/61-J\$1(c(\$6Fc4\$0F#1?c20F/1\$.1-c8'9/.1-c'8c26-1162c 8'-c#??bR!!
- " '2!7/>1?12!; '9/6=!@16-'5'?\$6#/!*-#/25'-6#6\$'/!796F'-\$6=R!Q15R!7(\$'5\N+4.*4)\Y5+'2(&\V+*.(\ ;;:;R!" '2!7/>1?12!; '9/6=!@16-'5'?\$6#/!*-#/25'-6#6\$'/!796F'-\$6=X!@#=!GHG\R! F665^bb 4 1.\$#R 4 16-'R/16bGHGHb@16-'cT9/.\$/>c<'9-012cY9\$.1cGHGHR5.8R!!

 $\begin{array}{c} @\#/J\$??1X!@\$0F\#1?R!`@C7 < I QC!@!7n)!*\&C!B, *Cn*37"!*Q7n<T, Q@7*3, n!, T!!!!!!\\ @, N3"3*i!3n!", <!7nYC"C<Ra!I/\$J1-2\$6=!'8!; \#?\$8'-/\$\#!3/26\$6961!'8!*-\#/25'-6\#6$'/!<69.\$12X!j\#/9#-=!GH\%UR!F6652^{bb}(((R\$62R90?#R1.9b(5c)))(0)) (R\$62R90?#R1.9b(5c))(0)) (R\$62R90?#R1.9b(5c))(0)) (R\$62R90?#R1.9b(5c))(0)) (R\$62R90?#R1.9b(5c))(0)) (R\$62R90?#R1.9b(5c))(0)) (R\$62R90?#R1.9b(5c))(0)) (R\$62R90?#R1.9b(5c))(0)) (R\$62R90?#R1.9b(5c))(0)) (R$62R90?#R1.9b(5c))(0)) (R$62R90?#R1.9b(5c)) (R$62R90?#R1.9b(5c))(0)) (R$62R90?#R1.9b(5c)) (R$60R90?#R1.9b(5c)) (R$60R90?#$

- `@1#29-1!@Ra!Q1E9\$?.<'; #?X!<1561 4 E1-!GGX!GHGHR!F6652^bb-1E9\$?.2'0#?R'->b\$/\$6\$#6\$J12b 4 1#29-1c 4 bd^e^61+6 f W\$6F g GH6F1 g GH2955'-6 g GH '8 g GH/1#-?=X216 g GH6' g GH1+5\$-1 g GH\$/ g GHGHMUR!!
- @16-'X!" 7R!`@16-'!N-1#02!Y-'9/.!'/!3cm!n'-6F!; '9/6=!C/F#/0141/62!B-'K10&Ra!*F1!<'9-01X!) 1014E1-!GX!GHG%R!F6652^bb6F12'9-01R416-'R/16bGHG%b%GbH%b416-'cE-1#O2c>-'9/.c'/c\$cmc /'-6Fc0'9/6=c1/F#/0141/62c5-'K106bR!!

@16-'R!`7E'96!@16-'!7-0F\$J1Ra!"7!@16-'R!@16-'X!GHGGR!F6652^bb(((R416-'R/16b#E'96bR!!

- `@16-'!T9/.\$/>!<'9-012!Y9\$.1!GHGHa!Z"'2!7/>1?12!; '9/6=!@16-'5'?\$6#/!*-#/25'-6#6\$'/! 796F'-\$6=X!@#=!GHG%[X!F665^bb41.\$#R416-'R/16bGHGHb@16-'cT9/.\$/>c<'9-012cY9\$.1c GHGHR5.8R!
- @ 16- 'R!` @ 1#29-1!Q!#/.!6F1!T\$/#/0\$/>!B?#/Ra!@ 1#29-1!Q!, J1-J\$1 (!c!@9/0!<0F''?!'8!Y?'E#?! 7 88#\$-2R!" '2!7 />1?12!; '9/6=!@ 16- '5'?\$6#/!*-#/25'-6#6\$'/!796F'-\$6=R!7001221.!@#-0F!MHX! GHGGR! F6652^bb 4 9/020F''?R96'-'/6'R0#b\$ 4 8>b95?'#.2b%U%b 4 1#29-1r-r'J1-J\$1 (r5-121/6#6\$'/r 4 #-0 FrGH%Gr0#6DrGR5.8R!!
- @16-'R!Q15R!7(#&+'(%8%C52#,%8(\$+'4%V+*.(,*4(&R!"'2!7/>1?12!;'9/6=!@16-'5'?\$6#/! *-#/25'-6#6\$'/!796F'-\$6=!X!GH%HR!F6652^bb(((R.-'5E'+R0'4b2bGVMG>\$K9KVm8DV8bGHHUc @1#29-1cQc"'0#?cQ169-/cY9\$.1?\$/12R5.8:.?fHR!!
- @ 'J1!" 7 R!` 7 E '96! I 2^!@ 'J1!" 7 Ra!@ 'J1!" 7 R! 7 001221.!@#-0F!GUX!GHGGR! F6652^bb (((R4 'J1?#R'->b#E '96r92d^e^61+6 f @ 1#29-1 g GHQ g GH (#2 g GH# g GHMHXGMV g GH 4 \$? 12 g GH#/. g GHGHH g GH26#6\$ ' /2R!!
- $n 1 (6'/X!) #4\$1/X!#/.!j'1!"\$/6'/R!`@16-'!N'#-.^!"16!6F1!B1'5?1!o'61!'/!C+61/.\$/>!<#?12!*#+Ra! < 6-1162E?'>!"'2!7/>1?12X!j9/1!G\X!GH%GR!F6652^bb?#R26-1162E?'>R'->bGH%GbHVbG\b416-'cE'#-.c ?16c6F1c51'5?1cJ'61c'/c1+61/.$/>c2#?12c6#+bR!!$

- $I EE1?2 \\ X!N \\ \#-=X! \\ \#/.!B161 \\ -!n \\ XO \\ \#45 \\ R! \\ I \\ /0' \\ /J1 \\ /6 \\ '/ \\ \#?! \\ T9 \\ . \\ />!'8! \\ I \\ -E \\ \#/!B9 \\ R? \\ 0! \\ *-\#/25 \\ '-6 \\ Ra! \\ C22 \\ \#= \\ R! \\ R! \\ C22 \\ \#= \\ C22 \\ \#= \\ C22 \\ \#= \\ C22 \\ R! \\ C22 \\ \#= \\ C22 \\ R! \\ C22 \\ C22 \\ R! \\$ 3/!*F'#4&15'\$#\$*54\\8(&(#'2''\@#'\$\M0\\F'#4&15'\$\\#4.\\Z4T*'546(4\$*!SX!m6F!1.RX!S^M\\$sGUR! 7 4 261-. # 4 X! n 16F1-?#/. 2^!) 15#-64 1/6!'8!Q1>\$'/#?!C0'/'4\$02X!T-11!I/\$J1-2\$6=X!GHHGR!!
- $W #= N # 00! @ # 0F \$ / 1R! T # 062! 7 6! #! Y ?# / 01 Ra! W #= E # 00! @ # 0F \$ / 1^! 3 / 61 / 16! 7 0F \$ J 1 \& n + J 1 4 E 1 ! \% \\ \& H = N # 00! @ # 0F \$ / 1 \& h = 1 + M \\ h = N # 0 \& H \\ h = N # 0 \&$ GH%VR!F6652^bb (1ER#-OF\$J1R'->b (1EbGH%V%GGmH\%UmPbF6652^bb ((R416-'R/16b/1(2b8#062c >?#/01bR!!
- !
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! a+(&\$*544#*'(0)

3/61-J\$1 (!_9126\$'/2!8'-!7>1/0=!@14E1-2^!

- %R &'(!('9?.!='9!.120-\$E1!='9-!-'?1!(\$6F\$/!6F1!#>1/0=:!!
- GR WF#6!.15#-641/6!(\$6F\$/!6F1!#>1/0=!.'!='9!('-0!\$/:!&'(!?'/>!F#J1!='9!('-01.!(\$6F\$/! 6F1!#>1/0=:!
- MR WF#6!\$2!='9-!8#4\$?\$#-\$6=!(\$6F!6F1!:;<=%>,*6#\$(%?2\$*54%#4.%?.#1\$*54%@,#4%A>??@B%5'?\$0=! 5?#/:!
- PR & (!\$2!@16-'!#\$4\$/>!6'(#-.!>'#?2!'8!.10#-E'/\$D#6\$'/!E#21.!'88!6F121!; 77B!5'?\$0\$12:!
- mR WF#6!\$2!='9-!8#4\$?\$#-\$6=!(\$6F!@1#29-1!Q!#/.!@1#29-1!@:!
- VR

!

<u>3/61-J\$1(!_9126\$'/2!8'-!7.J'0#0=!Y-'952^!</u>

%R