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U!IO)$5!?'85!/&&'80)!603'5(/)6'0!=$:.:!$E<65/)6'0!,/)$J!9$&856)?!&',$>!!
U!D$%$&)!)*$!A$5636&/)6'0!'<)6'0!60,6&/)$,!@$%'H!/0,!&%6&2!-'0)608$F!!
X!
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&/5,!/)!98&*!/! (\$5&*/0)J!?'85!<85&*/9\$!H6MM!@\$!,\$&M60\$,:!Q/0/.\$(\$0)!*/9!(/,\$!/0!\$33'5)!
)'!\$0985\$!)*/)!)*\$!A\$0,'59698<<M6\$59!89\$,!,8560.!)*\$!0'5(/M!&'859\$!'3!@8960\$99!/5\$!0')!
5\$9)56&)\$,:!!!C3!?'85!&/5,!69!5\$389\$,!/)!/!(\$5&*/0)!H*\$5\$!?'8!@\$M6\$A\$!6)!9*'8M,!*/A\$!@\$\$0!
/&&\$<)\$,J!?'8!9*'8M,!&'0)/&)!?'85!7-/5,!4,(6069)5/)'5!/)!MNO"PPP"PMNMJ!
43)\$5!*'859!&89)'(\$5!9\$5A6&\$!/9969)/0&\$!69!/A/6M/@%\$!bc!*'8596,/?J!P!,/?96H\$\$2F!!
-'0)/&)!&89)'(\$5!9\$5A6&\$!/)!V"ddd"cce"bbPO:!R'8!(/?!@\$!<5'(<)\$,!3'5!?'85!A\$5636&/)6'0!
08(@\$5J!H*6&*!69!?'85!+\$\$,!CY!08(@\$5:!</pre>

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Y\$<\$0,60.!'0!)*\$!5\$98%)!'3!?'85!60K865?J!?'8!(/?!H/0)!)'!,69&899!)*\$!6998\$!385)*\$5!H6)*! ?'85!98<\$5A69'5:!!f\$69*\$!H6%%!/,A69\$!)*\$!7-/5,!4,(6069)5/)'5!)'!(',63?!)*\$!5\$9)56&)6'09!'0! ?'85!89\$!'3!)*\$!7-/5,:!

 $\frac{\& / 7869, :91}{1000} !! 4 \frac{1000}{1000} !! 4 \frac$

- '80)5?!&%8@! (\$ (@\$59*6<9!
- /9*!H6)*,5/H/%9!
+\$&5\$/)6'0/%!A\$*6&%\$9!=@'/)9J!+B\9J! (')'5&?&%\$9J!\$)&:>!
Y65\$&)! (/52\$)60.!

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SO%62\$!<\$59'0/%!&5\$,6)!&/5,9J!)*\$!1/02!'3!4 (\$56&/!7-/5,!75'.5/(!69!*/0,%\$,!/9!&'5<'5/)\$! %6/@6%6)?:!!R'85!<\$59'0/%!&5\$,6)!*69)'5?!*/9!0')!@\$\$0!)/2\$0!60)'!/&&'80)!H*\$0!/!&/5,!*/9! @\$\$0!6998\$,!60!?'85!0/(\$:!

;*\$!4&&'80)9!7/?/@%\$!Y\$</5)(\$0)!69!5\$9<'096@%\$!3'5!</?60.!)*\$!75'.5/(!60A'6&\$!\$/&*! ('0)*:!R'8!/5\$!0')!5\$9<'096@%\$!3'5!,65\$&)!</?(\$0)!80,\$5!?'85!/&&'80):!

 $\begin{array}{l} \label{eq:constraints} C)!69!? & 85!5\$9 < & 096@6\%6)? 2!6 ((\$, 6/)\$\%?!8 < & 0!5\$\&\$6 <)! & 3!? & 85!\$ (/6\%!35' (!)*\$!T - 4J!) & !96.0! & 0! & 0! \\ \ /0, !5\$\& & 0\&6\%\$!? & 85!9)/)\$ (\$0)! & 0\%60\$!!? & 10\%60\$!!!!!? & 10\%60\$!!!!!? & 10\%60\$!!? & 10\%60\bullet!!? & 10\%60\bullet!!$

 $\begin{array}{l} R & 8!H6\%!*/A\$!/0!/\% &))\$, !08 & (@\$5!'3!, /?9!)'!5\$A6\$HJ! (/2\$!/0?!0\$\&\$99/5?!\&', 60.!\&*/0.\$9J! \\ /0, !g96.0!'33 & (0!?'85!9)/)\$ & (\$0)!!!43)\$5!)*69!)6 & (\$!?'85!9)/)\$ & (\$0)!69!3'5H/5, \$, !)'!?'85! \\ 7 & -/5, !/<<5'A\$5!!!R'85!7 & -/5, !4<<5'A\$5!5$\&\$6A\$9!/!\&'<?!'3!?'85!9)/)\$ & (\$0)!$\%\$b'5'06\&/\%?!/9! \\ H\$\%J!/0, !*/9!/!<5\$, \$)\$5 & (60\$, !/('80)!'3!)6 & (\$!)'!5\$A6\$H!/0, !/<<5'A\$!6):!!R'85!7 & -/5, ! \\ @/\%/0&\$!69!5$<\%069*\$, !'0&\$!<5!('0)*!'0!)*\$!VW :! \\ \end{array}$

R '8!/5\$!5\$9< '096@%\$!3 '5!)*\$!3 '%% 'H60.F!

,\$)/6%60.!(\$5&*/0,69\$!<56&\$J!9/%\$9689\$!)/EJ!35\$6.*)J!\$)&:!@\$!60&%8,\$,!H6)*!)*\$!.'',9! (/6%\$,69*6<<\$,:!!C)!69!5\$&'((\$0,\$,!?'8!5\$K8\$9)!)*\$!5\$&\$6<)!@\$!\$(/6%\$,!)'!?'8J!<56'5!)'!)*\$! .'',9!@\$60.!9*6<<\$,J!)'!\$0985\$!?'8!*/A\$!/!5\$&\$6<)!3'5!9)/)\$(\$0)!5\$&'0&6%6/)6'0:!!= F!/! (\$5&*/0)!9*'8%,!0')!5\$]\$&)!)*69!5\$K8\$9)J!/9!6)!69!/!B69/!<'%6&?>:!!C)!69!\$E)5\$(\$%?!6(<'5)/0)!)'! 5\$K8\$9)!/0,!5\$)/60!<85&*/9\$!5\$&\$6<)9J!/9!)*69!69!)*\$!'0%?!'56.60/%!,'&8(\$0)/)6'0:!! !

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<u>>0'=(.+\$%-#%?#''(\$(<+).%!@''#3+'1</u>%

C3!)*\$5\$!69!/!,69&5\$</0&?!'0!?'85!9)/)\$ (\$0)J!6)!69!6 (<\$5/)6A\$!)*/)!)*\$!6998\$!69!/,,5\$99\$,!

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F 29*&)&*7--&*:%//-G-*&-()&-*#%*H.\$#)()H.#-*)''*.*4:.\$&*4\$%G\$.8I*

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j 62\$! ('9)!&' (</06\$9!)', /?J!H\$!/5\$!\$E<% '560. !H/?9!)'!9)5\$/ (%60\$!!

<5'&\$99\$9!/0,!5\$,8&\$!&'9)9:!!^5\$K8\$0)%?!)*\$!\$E<\$09\$9!60&855\$,!)'!<5'&\$99!/!9(/\\!,'\!/5! <85&*/9\$!&/0!580!/9!*6.*!/9!)*\$!<56&\$!'3!)*\$!6)\$(!6)9\$\!2!

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6)*!/!7 - /5, J! (/0?!'3!)*\$!)?<6&/%!<85&*/960.!9)\$<9!9*'8%, !@\$!\$%6 (60/)\$, !60&%8, 60. J! .\$0\$5/)60.!/!5\$K8696)6'0J!<5\$</560.!/!<85&*/9\$!'5,\$5J! (/)&*60.!/!</&260.!9%6<!)'!/! <85&*/9\$!'5,\$5J!&5\$/)60.!/0!60A'6&\$!A'8&*\$5J!9\$0,60.!6)!)'!)*\$!,\$</5) (\$0)!3'5!/<<5'A/%! /0,!5\$)85060.!6)!)'!)*\$!18960\$99!Z336&\$!3'5!</? (\$0):!

F 2.#*)0*#2-*H\$%(-&'\$-*J2-''*!*H.9*K%\$*0%8-#2)''G*J)#2*89*4:.\$&I*

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I99\$0)6/%%?J!)*\$!<5'&\$99!69!)*\$!9/(\$!/9!H*\$0!8960.!?'85!<\$59'0/%!&5\$,6)!&/5,:!R'8!(89)! /%H/?9!/92!3'5!/!5\$&\$6<)!3'5!?'85!5\$&'5,9J!</5)6&8%/5%?!3'5!<*'0\$J!3/E!/0,!(/6%!'5,\$59:!

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1\$-*#2-\$-*.''9*\$-0#\$)(#)%''0*.00%().#-&*J)#2*#2-*'0-*%K*89*:.\$&I*

 $\begin{array}{l} R\$9J!60!/, \ , 6)6'0!)'!+\$\$, !-'\$\$\$.\$\langle9!<'\$6\&?!9\rangle/)60.!)*\$!)?<\$!'3!<5', 8\&)9!?'8!\&/0!@8?J!\\ ')*\$5!\&'0)5'\$9!/0, !\$6(6)9! !@\$!<\star{1}/2.5, !60&\$8, 60.F! \end{array}$

- 4! ('0)*%?!, '%%/5!%6 (6)*
- 4!!`<\$5!)5/09/&)6'0a!, '\\/5!\%6(6)*
- •

R '8!H6^{*}¹/₅^{*}¹/₆, \$5!/⁴/₆, \$5!/⁴/₆, \$5!/⁴/₆, \$5!/⁴/₆, \$5!/², \$5!/⁴/₆, \$5!/², \$5!/⁴/₆, \$5!/², \$5!/⁴/₆, \$5!/², \$5!/²

L%J*J)//*89*8%''#2/9*4:.\$&*Q)//0*Q-*H.)&I*

- ! R'8!/5\$![Z;!5\$9<'096@%\$!3'5!)*\$!</?(\$0)!'3!?'85!7 /5,!@6%%9:!!;*\$!('0)*%?!9)/)\$(\$0)! ?'8!5\$&\$6A\$!69!3'5!?'85!5\$A6\$H!'0%?:!!4&&'80)9!7/?/@%\$!H6%%!(/2\$!'0\$!</?(\$0)!)'!1/02! '3!4(\$56&/!&'A\$560.!7 - /5,!\$E<\$09\$9!3'5!/%%!+\$\$,!-'%%\$.\$!\$(<%'?\$\$9!8960.!)*\$!&/5,:!</pre>
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F 2%*8.9*!*#./M*#%*)K*!*2.N-*R'-0#)%''0I**

;*\$!7 - /5,!

* * *

 $I / \& *!7 - /5, !H6\%! @ \$! \$ (@ '99\$, !H6)*!) * \$!60, 6A6, 8/\%! \$ (<\% ' ?$\$ \9!0/ (\$!! ; *\$! \$ (<\% ' ?$\$!69! 5$9< '096@\%\$!3'5!) * \$! <5 ' <$5!89\$! '3!*696*$5! \& /5, :!, .\%) - \%.05 + \%'@ - (<\$\%'') - .@ + #\0) $0A0$ (''<\% (.0<0B+\%C - (#\7 ! ''#$$

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