"#!\$%&'()*+%,)-!./0&*.%.

 $A3"\#\)\ 664\#\ a"\#\ (\ ;5\ 9>5546\#;5\#;\#G3=E455=3\#;68\#9>5:C:;6\#PS=54\#74;CS:6F\ b\#5CS=M;35S:G\ b\#G43E=3\ 9\ ;6C4b\#;68\#543<:C4\#C=65:57467\ MH\#4d4\ 9\ GM:EH\#G435=6; \ M\#C=9\ 9:79\ 467\#;68\#G3=E455:=6; \ M\#4dC4\ M46C4"\#\)\ 5\#;6\#4786=9>5:C=M=F:57\ b\#5S4\#848:C:745\#S43\#C:3443\#7=\#7S4\#57>8H\#=E\#9>5:C\#=E\#7S4\#P=3M8e5\#G4=GM45"\#\ .S4\#P=3U5\#P:7S\#57>84675\#=E\#; \ MM\#M4<4M5]\#S>683485\#=E\#>6843F3;8>;745\#:6\#7S4\#47S6=9>5:C=M=FH\#C>33:C>M>9\#7S:7\#5S4\#84<4M=G48\#;68\#6>37>345\ M\#S=6=35\#;68\#3454;3CS\#>6843F3;8>;744\#;8<:5445\ M\#57>84675\#:6\#S43\#:66=<;7:<4\#4dG43:467:;M\ M4:36:6F\#G3=F3;95\#:6\#\&9;6\#=3\#J;5S:6F7=6\#A","W\#;68\#F3;8>;74\#57>84675\#;68\#9>6:=3\#C=MM4;F>45\#:6\#7S4\#B.\#;68\#;03=;8\#PS=\#0464E:7\#E3=9\#S43\#9467=35S:G"\#0=7\#7=\#04\#E=3F=7746\#;34\#7S4\#;>8:46C45\#PS=\#S;<4\#4dG43:46C48\#7S4\#G43E=39;6C45\#5S4\#F:<45\#;5\#;\#S=M=\#;37:57\#;68\#P:7S\#7S4\#J:M::9\ MPD:3H\#D:88M4\#@;57436\#D>5:C\#@65490M4"##$

(;59>5546e5#:67436;7:=6;#34G>7;7:=6#;5#;5CS=#;3#:5HO>:M7#>G=6#7S4#f>;M:7H#;68#4d7465:<4#3;6F4#=E#S43#3454;3CS"#+43#G>M:C;7:=65#46C=9G;55#9>5:C#=E#7S4#D:88M4#@;57b#N5M;9:C#P=3M8b#.=>7S4;57#)5:;b#)3;O#)6943:C;b#;68#9>5:C#;68#C=99>6:7H#:6#;#9>M7:C>M7>3;M#B6:748#.7;745"#(4C:G:467#=E#7P=#L>M03:FS7#L4MM=P5S:G5#E=3#3454;3CS#:6#M68=645:;b#;68#;.>M7;6#g;O==5#,>M7>3;M#,46743#L4MM=P5S:G#E=3#3454;3CS#:6#&9;6b#;4EL4MM=P5S:G5#E=3#3454;3CS#:6#&9;6b#;4EL4MM=P5S:G5#E=3#3454;3CS#:6#&9;6b#;4EL4MM=P5S:G5#E=3#3454;3CS#:6#&9;6b#;4EL4MM=P5S:G5#E=3#3454;3CS#:6#&9;6b#;4EL4MM=P5S:G5#E=3#3454;3CS#:6#&9;6b#;5B3+2A\$+19943:C;6#,=>6C:M#=E#-4;3648#.=C:47:45#E=3#343#C>33467#O==U\$G3=Y4C7b#>6843#C=673;C7#P:7S#7S4#B6:<435:7H#=E#,;M:E=36:;#*3455b#S43#;P;38XP:66:6F\$G>OM:C;7:=65#:6CM>84#9=34\$TS;6#\$2T\$G443X34<:4P48#;37:CM45#;68\$ES;G7435b#;68\$E=>3\$O==U5\$P:7S\$#;\$E:E7S\$#:6\$#G3=C455"#.S4#:5\$#:6\$\$S:FS\$#849;68\$#P:7S\$#=<43\$#1T!\$5G4;U:6F\$#:6<:7;7:=65\$#8=C>946748\$#;68\$#:5\$#;6\$#;C7:<4\$#G;37:C:G;67\$#:6\$#:67436;7:=6;M\$\$C=6E4346C45\$#;68\$\$\$C=MM=f>:;"#

A3"#(;59>5546e5#4EE=375#7=#:67436;7:=6;N:h4#;68#8:<435:EH#7S4#>6:<435:7H#;68#:75#C=99>6:7H#S;<4#0446# 73;65E=39;7:<4#E=3#JND"#.S4#S;5#0446#C=65:57467MH#34C=F6:h48#E=3#S43#=>757;68:6F#;CC=9GM:5S94675#:6# 74; CS:6Fb#3454; 3CSb#; 68#M4; 8435S:G"#. S4#S=\\85#; #6; 948#G3=\\E455=\\35S:Gb#7S4#J:\\\1; 9#; 68#\) 66:4#\$:CU435# *3=E455=3#=E#D:88N4#@:57436#.7>8:45#05:6C4#?!1KRb#34C4:<48#7S4#*N>943:#)P:38#E=3#L:C>N7H#@dC4NN46C4# 0?!1KRb#P;5#54N4C748#7=#84N:<43#7S4#2;CU#L;C>N7H#-4C7>34#0?!1 Rb#;68#P;5#:6:7:;748#:67=#7S4#*S:#\$47;#a;GG;# .=C:47Hb#) MGS;#,S;G743#=E#[:3F:6:;#0?!1IR#7S46#5>O54f>467MH#4M4C748#;5#:75#S:FS457#G345:8:6F#=EE:C43# 0?!1^R"#(;59>5546e5#345=\\>74#C=99:79467#7=#7S4#5>CC455#=E#JND#:5#4<:8467#:6#S43#34C=38#=E#F=<436;6C4"# . \$4\pmu_48\pmu_54\pmu_6\pmu_5\pmu_5\pmu_6 @;57#.7>8:45b#;68#*3=F3;9#A:34C7=3#E=3#)D@.1#)5:;6#;68#D:88\\d{1}4#@;57#.7>8:45\\d{1}4.54\\d{2}5.5#543<48\\d{2}4.54\\d{3}6.546 ;\!\!\!#=E#\$\!43#A4G;\;379467\!e5#;\;68#*3=F3;\;9e5#C=99:\!77445#;\;68#\$;\;5#7;\!U46#;\!#3=\!\!4#:6#C;\;9G>5#\!\!4;\!8435\$:\!G#7\$\!3=>F\$\!\#E=3# 4d: 9 GN4b#543<:C4#=6#7S4#L: C>N7H#) EE::35#, = 9 9:7744b#7S4#*3=<=57e5#A4:6#,4:3CS#, = 9 9:7744b#;68#7S4# C; 9G > 5XP : 84# (47467 := 6b#*3 = 9 = 7 := 6b#; 68#246 > 34#, = 99 : 7744#= 3#C=X, S; :3:6F#7S4#) 375#g > ;3743#J = 3U:6F#7S4#'3=>Gb#PS:CS#5S4#S4\\G48#7=#46<:5:=6#;68#:6:7:;74#:6#?!??"#JS47S43#7S3=>FS#:6:7:;7:<45#:6#4dG43:467:;\\# M4:36:6F#=3#C=:CS:6F#S43#57>84675#:6#7S4#C=6573>C7:=6#=E#:#P405:74#=3#:#G=8C:57\\(\text{h}\)5S4#:5#:#34C=F6:\(\text{h}\)48#\\(\text{h}\)4:843# 9 = 57#:66=<;7:<4#57>8H#;03=;8#G3=F3;95b#;EE4C7:=6;74MH#6:CU6;948#i(=CUb#D>5:Cb#&9;6"j#0=7;0MHb# *3=E455=3#(;59>5546#P;5#7S4#54C=68#JND#E;C>\\TH#7=\#74;CS\#;7#7S4\#JND\#J;5S:6F7=6\#,46743\#;68\\#S;5\# 347 > 3648 #7 = # = > 3 # A . #C: 9 G>5#7 P:C4# 9 = 34#7 = #

```
1#!*&. \(\)2\(\)&\(0!!\)\
                    *3=E455=3#=E#D>5:C#;68#@7S6=9>5:C=M=FH#
                     J:\m:; 9 \pi D'\pi; 68\pi) 66:4\pi \pi \pi: CU435\pi \pi 3=E455=3\pi=E\pi D:88\mathbb{N}4\pi@; 57436\pi. 7>8:45\pi
                    A:34C7=3b# J:\\M::9 #\N#D:3\H#\D:8\\A\H@:57436\HD>5:\C\H@6549\O\\4\\0457\\H1\`\KR\H
                    0)55:57;67#*3=E455=3#1``I\\#246>34#;P:3848\#A4C49043\#1``\\\#*3=9=748\#7=\#L>\\\\\#*3=E455=3\#?!1?\#
) 3 4 565789:85;<!*=7585=67!:8! > 5??5: 4!@!A:9B!
V;6>;3H#?!??! L;C>\\TH#A:34C7=3\\! J:\\\!!.;9 \\#\D;3H\\# J;5S:6F7=6\\\A, \\\#, 46743\\\\#i J;5S:6F7=6\\\#;68\\\\TS4\\\#) 375\\\!!
?!1`X?!??#
                                        *3=F3; 9#A:34C7=3#;68#L;C>N7H]#) D@.#k#*3=F3; 9#:6#)5:;6#;68#D:88N4#@;57436#.7>8:45##
                                       L;C>\\7H#A:34C7=3b! J:\\0.15S:6F7=6#A, #,46743\\1i J:5S:6F7=6#;68\\17S4\\1) 375\\1!
. G3:6F#?!1`#
?!1^X?!?!#
                                         [:C4#*345:8467b#*S:#$47;#a;GG;b#) MGS;#,S;G743#=E#[:3F:6::#0S:FS457#C;9G>5#=EE:C43R#
?!11X?!1K#
                                         , S;:3b#A4G;37 9 467#=E#D>5:C#
                                         , S;:3b# J:\\\\:;9#\N#D;3\H#\D:\88\\\4\H@;57\H:.7>\8:\45\HL;\C>\\7\H\\\\
?!!ZX?!1!#
?!!`X?!1!#
                                         , =XA:34C7=3b# J :MI:; 9 #N#D; 3H#) 5:; 6#. 7>8:45#\6:7:; 7:<4##
.G3:6F#?!!^#
                                       L:C>N7H#A:34C7=3b! J:WN::9 #N#D:3H# J:5S:6F7=6#A.#.467431#i J:5S:6F7=6#:68#7S4#) 375 i##
(<C<68!) 3 4565789:85;<!.<9;5C<!8=!8D<!*9=E<775=6!
                                        $=;38#949043]#)%L%.#)943:C;6#%657:7>74#E=3#%68=645:;6#.7>8:45#
?!?1X#X#X#
?!1?#X#X#X##
                                        @8:7=3: \text{M} = :38 \text{ D} + 9.043 \text{ PB} + 6:435:7H = \text{E} = (=CS45743 \text{ M} * 3455 \text{ M} * .43:45 \text{ H} :6 \text{ M} = 9.5:C = \text{M} = \text{FHb} = 1.5 \text{ M} = 1.5 \text{ M}
                                        @M46# a = 5U = EEb#A; 9;5C>5# a;E>904b# '4643;M#@8:7=35#
                                        *345:8467b#.=C:47H#E=3#@7S6=9>5:C=M=FH#*345:8467X4N4C71#1#H4:3\\#*345:8467\\#?\#H4:35b\#*:57\X
?!1KX?!1 #
                                        *345:8467]#1#H4;3\\D49043\\$=;38\=E\23>57445\\)) 943:C;6\\L=\U\\:E4\,46743\\-:03;3\\=E\
                                         =6F3455W#A4M4F;74b#) 943:C;6#,=>6C:M#=E#-4;3648#.=C:47:45#
*9<;5=F7!2<:CD56G!*=7585=67!
111``?X1``I#
                                        [:5:7:6F#-4C7>343b#B6:<435:7H#=E#24d;5#;7#)>57:6]#A4G;379467#=E#D>5:Cb#,46743#E=3#04;3#
                                        @;57436#.7>8:45\\#A:34C7=3\\#B6:<435:7H#=E#24d;5#D:88\\4#@;57436#D>5:C#@6549 O\\4#\
1``!X1``1#
                                        [:5:7:6F#) 55:57:67#*3=E455=3b#&043M:6#, =\M4F4\\#A:34C7=3b#&043M:6#D:88\\M4#@:57\\@654.9.0\\M#
```

 $?!1I\# (4C=38:6F\#(4<:4P]\#>@'$\%*@'\%A,T'\&)\%='*\%d'\%=,00l'\%J/)*'\&$\%=!),.\%R\%F\%A/.Ke\%>')*'\&$\%O\&.@')*\&/l\%=!),.\%F/6')\%H'*'\&)\#$\%-H3:CS=38\#-/(,+\#^KT`\#\%6\#J*@$\#6!),.\#l\#3K\%$

```
1``K# (4C=38:6F\#(4<:4P)\#N\#!\$0)\%\#-\%@'\%>\#\&10\%=!),.\%\#-\%@'\%=,001'\%J/)*L\R&/S\%
H'&),/$g<&/$,/$%\$O\M!&9,)@\M&/O,*,#$)\\,$\*@'\\X$,*'O\\N*/*')\\#2S344#C;5547145#P:7S#;#57>8H#F>:84#
OH#.;\MH#D=65=>3#;55:5748#OH#*;94\\;#A=36\\#1``!"#D>5:C\#@8>C;7=35\#0;7:=6;\\\#,=6E4346C4\#
0D@O,R"#J*@$#6!),.#1#3K\\I 1?#*G"#I !XI I"##
84#D>5:f>4#*=G>M;:34b# ' 464<;b#. P:7h43M;68b#1``!"# [ A@#A , #Z1I"# ) O A#RI'&S/K7/$LM=!),(!'M
M&/O,*,#$$'11'"#-4#, S;67#8>#D=684b#-Ac#?^K#`!1b#1`_`"#J*@$#6!),.#1#3K#IZ1?#*G"#?^IX^_"#
1``!# i@CS=\\=FH#:5#&>7\| j#H/.,-,.\\\A'T,'8\\#-\\J*@$#6!\),.\#\#3K\\Kb#*G\\#1!TX1!^\#
UJ#!*FT?5C:85=6!*9=[<C87!56!*9<77!!
B6843#C=673;C7#P:7S#B6:<435:7H#=E#,;M:E=36:;#*3455]#=#$)##$%='1#0,')L\(\(\)2,\(\)*'\$,\(\)3\(\)*'\$,\(\)3\(\)*'\$
<$0#$')./\\.$\\/$\\$\\.$0./$\\O.'/$\\>#&10\\\) 6#=G46X:CC455# 9 48::#3:CS#0==U#=6#7S4#B.#*3455#->9:6=5#
*M;7E=39"#
!
%6#*3455"##i2:3;0#:6#7S4# '3==<45]#(4C=65:843:6F#;#23:65:7:=6;\\#D=9467#:6#7S4#)3;0#)943:C;6#)375#
@C=6=9H"j#\6#M/&/SL\=!),.?\J.)*/)K?\J6#*,#$\/$O\H'&-#&6/$.'#;#<=\>94#:6#S=6=3#=E#*3=E455=3#)"V"#
(;CH"#D:CS;4\\(4.35:5N=GE\)#AP:FS7#(4H6=\\(85\)#;68#.C=77#D;3C>5\\(4.35:7H#=E#24d;5\)#*3455"#
UI#!\%6!J<;<?=L4<68V##
```

 $\label{eq:control_problem} $$ 11?11??#iD=65==6\#D>5:C]\#2S4\#. =>685C;G4\#=E\#\%68=645:;6\#\%5M; 9\#:6\#;6\#\%68:;6\#\&C4;6\#J=3M8j\#,46743\#E=3\#(4M:F:=>5\#;68\#,3=55X)$$

```
. G:3:7>; N:7Hb#; 68#249 G43; 6C4#:6#7S4#) 3; O:; 6# '>NE#; 68# . =>7S4; 57# ) 5:; j#E=3#N#! $0,$3\\\@ '\\$O,/$\\O. '/$L#
D>5:C#=E#D>\N7:C\n7>3:\\#) 943:C;\bi#E=3#. H9G=5:>9#=6#7S4#-40;6454#-4F;CH#=E#'4=3F47=P6#,=>67Hb#.=>7S#
 , ;3=M:6; \# 4=3F47=P6\#, =>67H\#-:03; 3H\#
1!1?T11 #*43E=39;6C4#E=3#7S4#, =MM4F4#=E#, S;3M457=6b#.=>7S#,;3=M:6;"#)457S47:C5#J=3U5S=Gb#P:7S#):CS;#
(48=>;64#;68#+;0:0#/;99:64"#+=57#*3=E455=3#V=6;7S;6#04>E4M8b#A4G;379467#=E#*S:N=5=GSHb#;68#
D:CS;4\|\delta\exists 3:46\|\delta\AG;379467\|=\text{E\pm}D>5:C\|\delta\In\| 1:7S\|\delta\:5:7\|\delta\|\delta\CS;4\|\delta\exists 8:3:46\|\delta\In\| 1:7Z\|\delta\:1\|\delta\|\delta\|
1!1?K11 #D>5:C=\|=FH#.G4;U43#.43:45\|#0=37S#,;3=\|:6;#.7;74\|B6:<435:7\|"#i J = 946\|#&>7\|#-=>8\|\perp 2S4\|# ' 4684348\|#
-;685C;G4\#=E\#\%5M;9:C\#*43E=39;6C4"1\#J:7S\#;\#CM;55\#<:5:7\#E=3\#*3=E5"\#)\ M:5=6\#)\ 36=M8\#;68\#V=6;7S;6\#a3;943"\#MS=6;7S;6\#a3;943"\#MS=6;7S;6\#a3;943"\#MS=6;7S;6\#a3;943"\#MS=6;7S;6\#a3;943"\#MS=6;7S;6\#a3;943"\#MS=6;7S;6\#a3;943"\#MS=6;7S;6\#a3;943"\#MS=6;7S;6\#a3;943"#MS=6;7S;6\#a3;943"#MS=6;7S;6\#a3;943"#MS=6;7S;6\#a3;943"#MS=6;7S;6\#a3;943"#MS=6;7S;6\#a3;943"#MS=6;7S;6\#a3;943"#MS=6;7S;6\#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6#a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;943"#MS=6;7S;6*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;95*a3;9
1!11Z11 #i ' \|=0:\\|#2:GG:6F#\*=:675\|#2S4\|#D>5:C\|#:68\|#.>\\|7>34\|=E\|#&9:6\|\\|\$:=8:<435:7\|#:68\|#7S4\|\|68::6\|&C4:6\|
 .=>685C;G4"j#J=3M8#)EE;:35#,=>6C:M5#=E#)943:C;#:6#D;6CS45743b#O4P#+;9G5S:34"#J:7S#CN;55#<:5:75#;68#
 \texttt{G345467}; 7 := \texttt{651P} = \texttt{3U5S} = \texttt{G51}: 6743 < :4 + \texttt{P5\#}; 7 + : \texttt{M5}: 84 + \texttt{D}: 88 + \texttt{M4\#} . \texttt{CS} = \texttt{M#}, \\  = \texttt{6C} = \texttt{38\#} + : \texttt{FS\#} . \texttt{CS} = \texttt{M\#A}; 37.9 = \texttt{7S\#A} 
 = MM4F4b#:68#D:6CS45743#(:8:=#.7:7:=6#1!^"^#2S4#*>M54"#
1!1`11 #1K'<sup>"</sup># J :M:; 9 #N#D; 3H#2; CU#L; C>M7H# - 4C7>34"#i J = 9 46#&>7# - =>8]#2S4# ' 4684348# - ; 685C; G4#=E#
%5N; 9:C#*43E=39;6C4j#P:7S#;#G34N>84#=E#34N4<;67#9>5:C#0H#7S4#JND#D:88N4#@;57436#D>5:C#@65490M4"#
`1?`11_#i D>5:C#;68#7S4#&9;6:#) 375#@C=6=9Hj#J=3N8#) EE;:35#,=>6C:\\S#=E#) 943:C;\#:6\#A;\\\\;5\\#24d;5\#;7\#7S4\#
A:M:5#)37#D>54>9"#
_{1K11_{\#}}; _{64M:57b}; _{1L:68:6F}; _{1E:C4}; _{1E:C4}
*$ a #0 ;7:=6;\\#.4C347;3\\#;68\#,@&"\#23:466:;\\#,=>6C:\\#=E\#7S4\#0;7:=6;\\\#H@,\\Z'\*/\\G/'''/\\+=6=35\#.=C:47\\\\#
)>F>57#?XKb#$=57=6b#D;55;CS>54775"##
}Z11T11_#B6:<435:7H#=E#) 957438; 9b#A4G;379467#=E#D>5:C=M=FHb#i,=MM=f>:>9]#,>33467#3454;3CS#:6#
68=645:;#;68#7S4#%5N; 9:C;74# J =3M8j##
?1?111_#.>\7;6#g;0==5#,>\7>3;\\#,46743\\#J;5S:6F7=6\\#A,\#iD>5:C\#;68\\#7S4\\&9;6:\#)375\\\@C=6=9H\\#i
?1?111 #L=34:F6# . 43<:C4#%657:7>74b#B" . "#A4G; 37 9 467#=E# . 7; 74# ) 3N:6F7=6b# [ ) ]#%6<:748#48>C; 7=3#07S344XS=>3#
M4C7>341P=3U5S=G#=6#47S6=9>5:C=M=FH#=E#7S4#D:88M4#@;57R"#%6<:7;7:=6#OH#A3"#V=S6#%5U;68;3"#
?XII1 #2 P=XG: 37#345:846CHb# J: U4#L=3457#B6:<435:7H"#L403>:3H#?ZX? 1#1R# ) 3:0#9>5:C#P=3U5S=G#:68#
34S4;35;\\|P:7S\|J;\U4\|L=3457\|.73:6F\|&3CS4573;\\|PR\|*>O\\\:C\|-4C7>34\|i(4\\:F:=>5\|D>5:C;\\|\|*43E=39;6C4\|;68\|\71S4\|
```

```
 J: \text{M:}; 9 \# \text{N} \# D; 3 \text{H} \# 0 = <49043 \# 12 \text{R} \# \\ \# 11112 \# 673 = 8 > \text{C7} = 3 \text{H} \# , = 994675 \# . = \text{C:} 47 \text{H} \# \text{E} = 3 \# @ 786 = 9 > 5: \text{C} = \text{M} = \text{FH} \# * 34 \text{X}}, = 6 \text{E} 4346 \text{C} 4 \# = 6 \# * > \text{OM:} \text{C} \# @ 786 = 9 > 5: \text{C} = \text{M} = \text{FH} \text{B} \# + \text{C} = 3 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347 = 6 \# 347
```

```
I11Z111#. S:3M=7745<:MM4b# [ ) L\( .&3, $./\( A' \) *. T/1\\( H-\)\( &0 \) \( Z##\)\( M-\)\( 6<:748\)\( :5\)\( 6=7:0\)\( 0 \)\( A\)\( 64:0\)\( P\)\( :>7S=3\)\( :68\)\( 1=\)\( 56:0\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\)\( 1=6\)\( 1=6\)\( 1=6\)\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\( 1=6\)\
7S4\#G; 64N\#i D>5M: 9\#J = 9461\#*43C4G7:=65\#; 68\#. 4NEX*43C4G7:=65"i\#
) 375#;68#7S4# J =3N85#=E#%5N; 9 1# . H643FH#;68#A:5C=664C7#:6#7S4#%68;;6#&C4;6#23;84# J :685" j#
} 11?K111#2S4#) 9 43:C; 6#%67436; 7:=6; M#. CS==Mb#D>5C; 7b#&9; 6]#n \( \mathbb{R}\$! / \lh4 ')*, T/\lh4 '\#. \( + \@\#, & \)#0 P:7S#
G;37:C:G;675#E3=9#:67436;7:=6;M#5CS==N5#:6#.;>8:#)3;0:;b#-40;6=6b#2>6:5:;b#;68#7S4#B6:748#)3;0#@9:3;745"#
%6<:748#48>C;7=3b#G345467;7:=6#7:7M4]#i2S4#)457S47:C5#=E#)3;O#.:6F:6F"j#
*=P43b#*43E=39;6C4#;5#b67467:=6]#J=946e5#b5M;9#:6#b68=645:;"j##
11?!11#B6:<435:7H#=E#D:CS:F;6b#)66#)30=3b#D%]#+#$)#&*,!6\#-\^&\O!/*\\N*!O'$*\\,$\=,001\\J/)*\
<)1/6,.%=!),.%,$%<$0#$'),/\#
 #!*) *I(.!*(I.I02IJ!)2!*(&OI..%&0)-!AII2%0'.!ZZ!*:78!1"!B<:97!=6?BV!H"11ZH"H1
             P7<?<C85=6!TB!L<<9!9<;5<R$!^5635C:8<7!568<96:85=6:?!;<6F<"#
1?1?1??b#D:88\\d#@;57\\d#.7>8:45\\d#) 55=C:;7:=6\\d#QD@.) R\\d#A46<43b\\d#, &\\d#\\d#\G;64\\\d#CS;:3b\\d#8:5C>55;67\\d#;68\\d#
G34546743b#=3F;6:h48#OH#@M:h:O47S#.:HM=3#;68#/=>554E#@MX$433:CS:1#M'/.@.$3%2/$3!/3'\\8.*@\=!)..\/$0\
*;G43#G34546748b#i .:6F:6F#:6#)3;O:Cl#@dG43:46C4b#@6N:FS7469467b#@90=8:9467b#@9G=P439467j#;5#;#G;37#
=E#7S4#=3F;6:h48#G;64N"##
111111??b#.=C:47H#E=3#@7S6=9>5:C=M=FH#0.@DR#O4P#&3M4;65b#-)"#%6<:748#CS;:3b#3=>687;0M4#=3F;6:h48#0H#
/>:U=#)5:0;#;68#)9;64#a;5;:]\\A'*\@,$9,$3\\=/\&,*,6'\\U,)\*\\\&,')\\\\-\\H\\''!1/\&\\=!),.\\\
}^1??1??#%67436;7;=6;\\dot\m .=>6C;\\dot\m =3#7S4#.7>8H#=E#23;8;7;=6;\\dot\m D>5;C\\dot\m D>5;C\\dot\m \.2 D\\m +:50=6\\dot\m *=37>F;\\dot\m *=:63#
G34546748b#i2S4#A;H#7S4#.>\\7;6#A:48#;68#D>5:C;\\#*;73=6;F4#:6#&9;6j#G;37#=E#7S4#*\\46;3H#(=>687;0\\4#
R1)#%G;64M#CS;:3b#V>MH#?Zb#?!?I"#
```

111^11`#

```
 \begin{array}{l} \#\\ \text{K11\_11?\#L=39}; \& \text{M\#C}=6\text{C437\#P}: \text{7S\#E}: <4\#\text{F}>45\text{7\#}; 37:575\#\text{E3}=9 \#\text{7S4\#} . > & \text{N7}; 6; \text{74\#=E\#\&9}; \text{6b\#@P4M\#} (4\text{C:7}; \& \text{\#}+; \& \text{Mb\# J ND}" \# \\ \#\\ \text{III!11?\#}' ; \& \text{M; \#*43E=39}; 6\text{C4\#P}: \text{7S\#F}>45\text{7\#}; 37:575\#\text{E3}=9 \#\text{D}=3=\text{CC}=\text{b\#0}; 53488:64\#, S;; 0; 64\#; 68\#) 9:6; \#\$465; ; 8\text{b\#J}: \& \text{MN}:; 950>3\text{F\#[]} \text{b\#-:03}; 3\text{H\#2S4}; 743" \# \\ \#\\ 1!11111 \#\text{L}> & \text{MXM46F7S\#C}=6\text{C437\#=E\#)} \text{M\#+}; \text{P}; 6:9 \#\text{Q}) 664\#(; 59>5546b\#) 664\#\text{QM}: 54\#2\text{S}=9; 5b\#\$3:8\text{F47\#} (=00:65b\#\text{D}; 3\text{H}; 9\#\text{QM}: \text{b\#QM: b\#QM: b}; 047\text{S\#}) \text{HH}=>\text{ORb\#-}; 689; 3\text{U\#2S4}; 743b\#\$\text{M}; \text{CU50}>3\text{Fb\#[]}) \# \\ \#\\ ?1?\text{T111}\#\text{L4}; 7>348\#o>8\#5=\text{M}=:57\#\text{E}=3\#7\text{S4\#\text{CS}=3}; \& \text{M\#G}: 4\text{C4\#i 2}; \& \text{M}=>\text{b}j\#; 33; 6\text{F48\#\text{OH}\#A3}" \#\text{V}=\text{S6\#*43U:65\#=E\#.S}; 3\text{Y}; \text{S\#} \\ \end{array}
```

```
.8F3<68! ) 3 :57<<7!PRD=!D: :<!LF97F<3!:3::6C<3!3<G9<<7!56!<8D6=4 F75C=?=GB!=9!9<?:8<3!357C5L?56<78!!
) 664#@M:54#2S=9;5#1``Z#Q$3=P6#B6:<435:7Hb#*S"AR#
.>66:#L;55#1``^#Q%68:;6;#B6:<435:7Hb#*S"AR#
A:;6;#-;67h#1``_#QB6:<435:7H#=E#,;M:E=36:;b#.;67;#$;30;3;b#-:6F>:57:C5b#*S"AR#
;3=M:64\#A:4554M\#1 **1004P\#/=3U\#B6:<435:7Hb\#) 67S3=G=M=FHR\#
2455# . M= 9 :65U:#1``T#0B6:<435:7H#=E# - : 9 43:CUb#%34N; 68b#D ) W#04P# / =3U#B6:<435:7H#*S"A"R#
A40=3;S#V>57:C4#?!!?#0 J 45N4H;6#B6:<435:7Hb#D ) N#M68:;6;#B6:<435:7Hb#*S"A"R##
-: M:4#'=38=6#?!!?#QB6:<435:7H#=E#,;M:E=36:;b#.;67;#$;30;3;b#*S"ARb#
+4;7S43#.;F;3#?!!?#0B6:<435:7H#=E#24d;5b#D)R##
-;>3;#.9:7S#?!!Z#0G=57X>6843F3;8>;74#L>MO3:FS7#.CS=M:3#:6#.G::6#?!!^X! W#'4=3F47=P6#B6:<435:7Hb#D)#
) 375#D;6;F49467R##
0;6CH#D;35846#?!!^#0B6:<435:7H#=E#+;P;:e:b#D) Rb##
S:68M43\#D==34\#?!!Z\#02>M:64\#B6:<435:7HR\#
D4F:6#$:6643#.>7S43N:68#?!1!#0D49=3::W#B6:<435:7Hb#D) R##
2:EE;6H#.CS=640==9#?!1?#0\%68:;6;#B6:<435:7H#D)R#
L:=6;#$; M4573:43:#?!1?#().&).#-:6F>:57:C5#D) W#B[)#*S"A"R#
+;33:5=6#L4:643#?!1`#0; M:E=36:;#%657:7>74#=E#)375W#D)R#
$3;68=6#D>\M:65#?!!!#0;CC4G748\#84E43348\#X\#B6:<435:7\H\=E\HO=37S\\,;3=\M:6;\\,S;G4\\\\+:\\\\\\\D)1\*S\\AR\\
11#!* (&OI . . %&0 ) -!) , 2% | %2% I . V! A : 6F7C95L8!9<; 5<RV!<; :?F:85=6!=E!C=??<: GF<?!E=9!8<6F9<! : 63!
L9= 4 =85=6\!<358=97D5L7\!C=67F\856G\!=8D<9\!7<9;5C<\!LFT\!5C\!DF 4:6585<7\:C85;58B\!
. G3:6F#?!?I#
       %6<:748#F>457#48:7=3b#1/1' "\F#!&$/!\#-\\=!),.\/$0\\A'1,3,#$]#1F=A#[=\\"+`b#6="#?]#i.;C348#(4C:7;7:=6#
       :68#(:7>;M#:6#A:F:7;M# J =3M85"j#
L; MH? ! ??##*3=9=7:=6#34<:4Pb#2>E75#B6:<435:7H#
.G3:6F1.>9943\#?!??\#
       D; 6 > 5C3:G7#34 < :4P#E = 3# < $0#$'), /%; <math>68\% = !), . %/$0\\H\H\I,\*, .)\#
       *3=Y4C7#34<:4Pb#. 9:7S5=6:;6#L=NUP;H5#(4C=38:6F5#
        '3:67#G3=G=5:M#34<:4Pb#%53:4M:#.C:46C4#L=>68:7:=6#
       A:55437;7:=6\#4<;M>;7:=6b\#B6:<435:7H\#=E\#+;:E;\#
       *3=9=7:=6#4<;M>:7:=6b#2>E75#B6:<435:7H#
. G3:6F#?!??"#*;64N:57#E=3#'4=3F47=P6#B6:<435:7H#P=3U5S=G#E=3#E;C>N7H#949043b#V455:C;#(=8;"#%6<:748#;5#
       N@ 'K*1L\\>#6 '$\\\\H'&-\\&6 \$. ')\\\SO\\*@ \\\A')@/\'\$3\\\\H\O&\@#O\\\K\\,$\\*@ \\\.,3,*/\\\\\R3 \\\\D;\\\\\?\\?\\
. G3:6F#?!??"#@d7436;\\#:6<:748#949043\=E\#7S4\#54;3CS\#C=99:7744\#E=3\#;\#546:=3\#47S6=9>5:C=\M=F:57\#;7\#7S4\#
       4<;\mathbf{M}>;7:=6\psi:6\psi*;3:5\psi\D;\mathbf{D};\mathbf{H}\psi11b\psi?!??\psi\psi
. G3:6F1.>9 9 43#?!?!##, =65>\\T;67\\\E=3\\\@dS:0:7:=6\\\=\\E\\\@;3\\\H\\) ) 3;0\\\) 9 43:C;6\\\\, >\\T>34\\\X\\\\
       S77G5]llPPP"7>3;7S?!?!"=3F19>5:C"#This Exhibition of Early Arab American Culture was curated
       by Dr. Akram Khater, Khayrallah Center for Lebanese Diaspora Studies at North Carolina State
       University. This virtual exhibit includes materials from and interviews with me about my research
       on Arab American music and community.
`1?!1?!#$$,#(4G=3743#.=GS::#.9:7SX';M43#G3=8>C48#;6#4dC4M467#G3=F3;9#=6#L49;M4#(4C:7435#=E#7S4#
       g>3e;6#7=#PS:CS#%#C=673:0>748#9H#3454;3CS#=6#E49;M4#34C:7435#:6#%68=645:;"#
       S77G5]11PPP"00C"C=">U1G3=F3; 9 9 451P IC7!dZI#
```

S77G5]115:745"F==F\\(\)4"C=91<:4P15495=>6857>8:4515=>68:6F0=;38!11849=6573;7:=6\(\):6\(\)5=\\(\)=\\(\)#

- 1?!?!# J:M:; 9 #N#D; 3H# J; 5S:6F7=6#, 46743#?!7S#) 66:<435; 3H#X#S77G5]llH=>7>"041-S14^3: / [fK# 2S4# JND# J; 5S:6F7=6#, 46743#:6743<:4P48#A, #, 46743\$5#E:357#7P=#54 9 45743#G3=E455=35"#
- ?!?!# *3=9=7:=6#34<:4Pb#B6:<435:7H#=E#O=37S#, ;3=M:6;b#, S;G4M#+:MM"#=18.5

- ?!1`# *3=9=7:=6#34<:4P5b#.P;37S9=34b#,=M4F4#=E#,S;3M457=6b#D:CS:F;6#.7;74#B6:<435:7H"#
- ?!1`# ,S::3b#.=C:47H#E=3#@7S6=9>5:C=M=FHb#\$=:38#=E#A:34C7=35#0=9:6:7:6F#.=99:7744"#
- $?!1_{\#}$, S;:3b#D433:; 9#Q0==UR#*3:h4#, =9 9:7744b#.=C:47H#E=3#@7S6=9>5:C=N=FH"

#

, S;:3b#D:88\|d+\|\(\text{0}; \text{57#}. 7\) 8:45\|\(\text{L}; \text{C}\|\text{N7Hb#}?!!ZX1!'\|\(\text{4}\)\(\text{6}<; \text{34}\)\(\text{47}=\text{E}=XCS;: 3\)\(\text{17}=\text{0}\)\(\text{L}; \text{C}\)\(\text{74}\)\(\text{18}=\text{0}\)\(\text{68}=\text{C}\)\(\text{56}=\text{65}: 0:\text{M}: 7\)\(\text{58}=\text{6CM}\)\(\text{84}\)\(\text{89}: 6:5743: 6F\)\(\text{47} I:\text{17}\)\(\text{17}\)\(\text{17}\)\(\text{18}=\text{9}: 7\)\(\text{68}=\text{67}\)\(\text{68}=\text{9}: 7\)\(\text{68}=\text{67}\)\(\text{48}=\text{17}\)\(\text{84}\)\(\text{4675}\)\(\text{17}: 5\)\(\text{56}=\text{C}: \)\(\text{748}\)\(\text{17}: 5\)\(\text{56}=\text{68}\)\(\text{18}: 4\)\(\text{68}=\text{68}\)\(\text{48}\)\(\text{4675}\)\(\text{18}=\text{9}: \)\(\text{9}: 6\)\(\text{68}=\text{11}\)\(\text{88}\)\(\text{44}=\text{68}\)\(\text{68}=\text{7}: \)\(\text{68}=\text{68}\)\(\text{48}\)\(\text{68}=\text{68}\)\(\text{68}=\text{68}\)\(\text{68}\)\(\text{68}=\text{68}\)\(\text{68}=\text{68}\)\(\text{68}\)\(\text{68}=\text{68}\)\(\text{68}=\text{68}\)\(\text{645}\)\(\text{48}=\text{645}\)\(\text{645}\)\(\text{48}=\text{645}\)\(\text{48}\)\(\text{645}=\text{44}\)\(\text{64}=\text{64}\)\(\text{645}\)\(\text{48}=\text{645}\)\(\text{48}=\text{68}\)\(\text{68}\)

 $.43<:C4\#;5\#G3=F3;9943\#;68\#G34546743\#7=\#1S4\#P:843\#C=M4F4\#C=99>6:7Hb\#=6F=:6F\#)90:7:=>5\#;68\#467S>5:;57:C\#=3F;6:h43\#=E\#14C7>345b\#C=6C4375b\#;68\#=7S43\#4<4675\#P:7S\#;\#FV=0;M\#;68\#C=99>6:7H\#E=C>5b\#=G46\#7=\#7S4\#G>0M:C\#;68\#E4;7>3:6F\#;6\#;33;H\#=E\#F>457\#5CS=N;35\#;68\#;37:575\#7=\#7S4\#,=M4F4\#=E\#J:MN:;9\#N\#D;3H"#@<4675\#=3F;6:h48\#E=3\#E=>3\#0;M9=57R\#C=654C>7:<4\#H4;35\#=E\#C4N4O3;7:=61C=9949=3;7:=6]\#?!1_#X\#&64\#+>68348\#/4;35\#=E\#J=946\#;7\#JNDW\#?!1^*X\#L:E7H\#/4;35\#=E\#)E3:C;6\#)943:C;65\#:6\#(45:846C4\#;7\#JNDW#?!?1X\#2S4\#)5:;6\#,467466:;MW#?!??#\$2S4\#I!!7S#)66:<435;3H#=E\#7S4\#$3;EE437=6\#N68:;6\#.CS==N"#$

*;57#543<:C4#=6]#, =\M\4F4X J :84# J 3:7:6F#, = 9 9:7744\PL;C>\N7H#) EE;:35#, = 9 9:7744\PL; 8 \times 5:5=3#7=#7S4\PLA;6b\PL) 375#;68\PL;C:46C45\PL; = 9 9:7744\PL;C>\N7H#) EE;:35#, = 9 9:7744\PL;C>\N7H#) 8 \times 5:5=3#7=#7S4\PLA;6b\PL) 375#;68\PL;C:46C45\PL;E=1.57\PL;C=1.57\PL;E=1.57

1H) #!) J A %0%. 2() 2%] I!. I(]%, I!2 &!2 + I!*(&OI..%0!

.=C5<8B!E=9! I 8D6=4 F75C=?=GB#

*345:8467#.=C:47H#E=3#@7S6=9>5:C=W=FH#Q?b!!!#r1X#9490435#P:7S-1(:W2(7)-)-1(6)-1(#)-1(#00.(#)-1(7)004612