



Syntaxe et Traitement Automatique des Langues

Christian Retoré

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C * 7 * 8 % 10 \$) 9 , * 8 , & & A ,) 9 , 88 ; 1 E 0 * 9 -) & \$ % & < , 9 * A (' \$ * 7 , ' \$ & *) ' 9 - 8 7 > 89 -) ' %) * 8 , 7 - 8 \$ \$ * 8 , * F I G H * 6 - ' 88 % 10 \$) ' & J D \$, & 1 7 . 9 # % 84 * 5 (* ? \$ @ % 7 % * A ; >) * \$ 7 , ' * 8 , * 9 (' . B - \$ % & 8 -)) . * & * \$ (7 & * & > & 7 * D \$, * 8 ; >) * \$ 7 , ' * 8 , * 6 - ' 88 , < %) *) > 7 , * ? - > \$ *) - 6 @ * 8 , * \$ 7 , ' * 8 , 6 - ' 88 9 (% 7 2 * (* \$? * 8 , * \$ 7 , ' * 8 ? - > \$ * A ; % & %) * ' - > & ? \$ &) ' 88 () & 7 , * 9 - 8 7 > 88 ; (? ? \$) ' 88 B , 4 1 < , 9 * , & F I G H * 6 - ' 88 > 9 - 8 7 > & * 7 , & * \$ 7 , ' * 8 ? - 88 @ , & 8 , * 6 - ' 88 &) * (> *) - 6 @ * 8 , * L I G H ' () 8 % A ; >) ' 9 - 8 7 > 88 , * G H 6 - ' 89 -) ' %) * (> 88 F I G H M F K \$ 7 , ' * 8 , * 6 - ' 88 % , & * 8 -) 9 * A (& 8 , \$ (% * A , 8 , & * \$ 7 , ' * 8 , * 6 - ' 88 ? - > \$ () ' * ? - 88 @ , &) , * 1 B > \$) * Q 6 (% 88 () & 7 , * 9 - 8 7 > & * , *) 9 - \$ * 6 - % 88 () & 7 , * 9 > 88 ; (? ? \$) ' 88 B , * A > % > \$ * . ' . *)) - ' . * 7 * 6 (% 4

" , ' , * 8 9 %) * 8 \$ 7 , 86 - 8: 7, 88 , * Q (\$ R - < 9 (9 # . & & &) 88 - > , >) * ? , > * 7) B , * ? - > \$ 9 -) 9 7 > \$ A , * 7 , * 82 ' (9 %) * , > * 9 -) ' % > , \$ * 7 , & * 8 - \$ \$ T 7 , * , & * 6 - % , * ? (\$ * 7 * 10 88 % (%) * A , * Q * 9 -) U & ' , * 9 # , 1 8 , 89 - 7 : B , & , * (6 % 88 B > & , & ? - > \$ 9 , & () 9 %) , & 6 . ' # - 8 , &) < < , 7 , 6 ,) ' * (? ? 7 A , * , & * 7 * 7 B > 88 A , * 8 % * 8 , * 9 - 8 7 > & (7 - 88 A ; %) ; 2 * ? (& 88 () 8 ; 9 # - & * P , *) , & . \$ \$? - > \$ * 7 , & A , & %) & A > % , > \$ % ? - \$,) ' 4

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_ %) * : < % , 6 6 ,) ' = 7 * 7 B > 88 A , * ? \$? - & * 8 % 10 \$) ' , & (? ? 9 # , 88 , * 7 * 82 ' (3 , = , * 8 % 10 \$) ' & 6 - 8 : 7 , & &) * > % 8 & & ? - > \$ * 7 , * Z 1 5 = , * 9 , 88 10 \$) 9 , & , * \$ & 6 @ () 9 , & &) ' * 8 -) 9 * P * 7 ' % % \$ ' () *) , * Z 1 5 * A ; ,) * 7 B > 88 A , = & % () * >) * 9 , \$ (% *) - 6 @ * 8 ; - ? ? - 88 %) & * ,) 9 - 6 6 ,) ' () * ? (\$ >) , * 8 % 9 %) * & < ,) * @ > \$ * 8 () & 7 * 9 - 6 6 >) (> . * 8 > * Z 1 5 4

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" , ' , * 8 % 9 %) = ? - > \$ () * : < % ,) , * ,) ' \$ * # . - \$ % 8 , * 7 * 82 ' (3 , * , * D \$ (7 & , * 82 ' (3 % A , * 6 , & 6 @ , * 88 . 10 > * 8 () & 7 * \$ (% 6 ,) ' * > - 6 (' A , * 8 , & () B > , 84

W > \$? \$) 8 \$ * >) * , 3 , 6 ? 7 * (@ > ? ' = Y W a b * ? - > < () ' * 8 . 9 \$ % * - > & 7 , & 7) B (B , & 8 9 > 88 , 6 ,) ' .) > 6 . \$ (@ & *) * , > * , 9 \$ % * - > , & 7 , & B (6 6 (% &) * Y W a b * 1 1 b & * B (6 6 (% & 8 , * 8 . ? ,) U 8 () 9 , = , * 9 Y W a b *) ; , & 8 -) 9 * (&) * & % , * # . - \$ % 8 , * 7 * 82 ' (3 , 4

C * 6 -) * &) & 7 2 * (? , > * 8 , * B () 8 , & # . - \$ % 88 , * 7 * 82 ' (3 , * P (< - % 10 % . 9 - 7 , = & \$ - > * & 7 , -) * & \$ & \$ % * > 3 * # . - \$ % & > % 8 , & ? - > \$ * 7 , * Z 1 5 4 , * 8 % % A , * & > 7 , & & @ & ,) * 8 , & * 9 , & 1 8 , * 7 B (6 6 (% B .) \$ ' % , * , * 7 , & B (6 6 (% & 8 , * 8 . ? ,) 8 () 9 , * 1 9 , 88 , \$ % \$ & () 9 -) \$) * >) * 1 9 () 9 * & 9 U 9 : 88 () & 7 , * \$ (% 6 ,) ' * > - 6 (' A , * 8 , & () B > , 84

5 (* B (6 6 (% B .) \$ ' % , * , & * - > * P * 7 * D * P * 7 - \$ % 8 , * 8 , & B (6 6 (% & D \$, 7 , & ? (& & > 7 , U 6 ,) ' * ? - > \$ * 7 , * Z 1 5 I < * ? - > \$ () ' * , > % \$ &) , * J ,) * - > * 9 (& 8 % 9 , 6 ,) ' I 8 () & 7 , & 6 - 8 : 7 , & D \$, & 9 > \$ () ' & 1 E " b = Y W a b * , * Z 1 b 4 5 (\$ %) * , & 9 7 % * , * 9 -) > , * 8 , ? > & 7 , & () . , & & % () , * 1 7 , & \$ () & D \$ (%) & 7 , & 8 . ? 7 9 , 6 ,) ' & , * 7 , & 7 . 6 ,) ' & < % , & ; (% ,) * ? (& P * 7 * 8 . \) % 6) * 8 ; >) * () (U 7 & > \$ * 10 8 (9 , 4 T * 9 - 6 6 , *) * 7 (* 8 % , * \$ 8 % * 7 , * Z 1 5 * , & * ? - > \$ (% & 8 % * D 9 (7 & * & * 7 () (7 & = (7 - 88 A , * 7 * B (6 6 (% B .) \$ ' % , * ,) & *) * , \$ 6 , 88 , B .) \$ ' %) = 9 - 6 6 , * &) * - 6 * 7 % 8 A , 4

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V\$5#85, #R/ 5, 08\$, #R/ #5#-3, 5#-/, , #B -5\$5\$#WXY#R/ <\$#-6C/ + 0#R/ 5#5, 0#0-5#85, #. 4B\$0945, 85#*# F\$0*A5:

! '#! 12 3-40356. *;##*/0\$1*2 3 4, #5-06+;54#5#-5\$505#071345, #50#2 389-5, #: < \$5#-40#5, #2 ?2 5, 5\$# \$5#342 5#73\$3-3C#R/ 5#B\$#-5/ 0# 5#852 *\$854# #*#2 34-73-3C5#-5A3\$55-5#8564*0B/ #B3\$?05#5\$01C415#B\$*, #*# F\$0*A5:

[\$#@, 0*054#R/ 5#@40*\$, #645, #85#, F\$0*A5# 3\$0#-5/ #2 5\$08\$#85#2 34-73-3C5#-5A3\$55-5>@2 2 5#5, #C4*2 2 *45, #85#81=5\$8*#@B5#) 5-<@E#H(]) 0#R/ #5\$#-0# \$#63-/ 2 5#Z#-40B/ #5-645#85#) / -54#K _^0#85#2 ?2 5#R/ 5#@40*\$, #342 *-+2 5, #, F\$0*A5#R/ 5, #02 2 5#5, #C4*2 2 *45, 85#81=5\$8*#@B/ #5, #WXY, #55#*#-45\$5\$0#*, #5\$#@2 =05: #, \$, #0, #*=-4B@5, #*#2 34-73-3C5-5A3\$55-5#5, 06/ 5#@2 2 5# \$#2 38/ -5#@405, #5\$#*=-3402 *; #/ 0\$32 5:

' #<3=3, 1# \$5#6+; -B\$#/\$654, *-+; 0#85#*# F\$0*A5#2 =3, 5#85#@\$, -81454#*#2 34-73-3C5-5A3\$55-5#@2 2 5#-405#5\$01C4*05#85#*# F\$0*A5#-# / + R/ 5#-< \$#3/ #-<*/ 045#-4B@81#-5/ 0#?06 / 0+; 1#-3/ 4#81@45# \$#2 ?2 5#-71\$32 9\$5#K5#652 =, #5, 0#2 *4R/ 1#-4# \$#2 30#5\$#@-3+; #0*\$8+; R/ <\$#4*\$a*+; #05, 0#*#81, \$5\$#@654J *-5#R/ #-5A-42 50#D540*\$5, #071345, #, F\$0*A5#R/ 5, #5\$0C45\$0 83\$#@*#2 34-73-3C5#-5A3\$55-5#@2 2 5#5#*0#B/ #2 3\$, #5\$#-4\$@-5#*#C4*2 2 *45#C1\$14*065 K\$#*0#*#<C0#-/, #B< \$#@583#R/ 5#B< \$5#415-5#5#@4-34*08\$0B*# -5A3\$55, 0#*#41*-+; *03\$#85 @01C345, #8<@@48#@2 2 5#5#*8+@-#5, 0#*#41*-+; *03\$#8< \$5#@01C345#85# \$, 5:# \$#-5/ 0#/, , + 63+4#*#*#02 2 5#< \$-P@08\$#5\$05#6*4#J-5, #50#@\$, 0*\$05, #09, #5..+@#B #@5, 0#/, , #*#-\$, #R/ 5 -<\$#0#*6#<@@48#B\$*, #5, #WXY#B/ #5, #C4*2 2 *45, #01C345-5, :#Y<=-4B@5# 5#8+; 0#C/ 5#*, 5I \$5052 5\$08/ #2 1@+; 2 5#8< \$-P@08\$#R/ #*#4B4#-5/ 0#-3404# / 4#85, #0542 5, #8-34845# / =145/ 4 5083\$#@05#3/ 4@#B< \$5#@2 =5A01#-C34072 -R/ 5#A-5615#63+5#B<\$81@8*J+-01:

S*42 #5, #2 389-5, #342 5-, #5, #C4*2 2 *45, #B< \$-P@08\$#5\$0C45\$0#85#-0#*#2 34-73-3C5-5A3\$55-5#50#<@@48#B@0#=-34085# [Y[U#5, 0#< \$5#85#-5/ 4 #4*+; 3\$, #) *; #*#41@4 -6-01 85#@, #04 @ 45, #08/ -0#Z#<\$81@8*J+-01#85#<=-405\$#@B< \$5#74*, 5#*#*#C*5#50#Z#85, 05@5#R/ 5, #B<\$*-F, 5#83\$0#*#02 =5A01#5-5, 0#*, #2 *04; 15:

[\$#3054#R/ 5#5#@-@-#5..5@#85, #342 5, #-1@-5, #*085#B/ 05#*a3\$#=-5#Z#85, #05@5#R/ 5, 45-0652 5\$08+; .145\$05, #B*/ 0B2 *05, #B<10*Q #P\$+; #50#0*\$, 8/ @5/ 4 #0*\$8+; #R/ 5#*# F\$0*A5#5R/ -540*/ #2 6-2 / 2 #85, #/ 0B2 *05, #Z#-+5:

! '#! \$%&()*+,-./:;<=>?@A[B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\] ^ _ ` { | } ~ ¡ ¢ £ ¤ ¥ ¦ § ¨ © ª « ¬ ® ¯ ° ± ² ³ ´ µ ¶ · ¸ ¹ º » ¼ ½ ¾ ¿

; / #01#85, #342 *-+2 5, #5, #C4*2 2 *45, #01C345-5, #50#J -5\$#, e4#*#C4*2 2 *45#85#) 3\$0*Q C/ 5#83\$0#5, #*40#@5, #3\$0#45C4B/ =1, #8*#, #W732 *, 3\$#H(! ' 0#B, 3\$0#5*0 45-52 5\$0#-05, #-3/ 4 10 8-5485#5-5, #R/ 5, 08\$, :# #*#40#5, #C4*2 2 *45, #01C345-5, #50#5, #05\$0*065, #85# 342 *-+; *03\$ 85#*#C4*2 2 *45#C1\$14*065\$(-5, #/ 045, #2 389-5, #F\$0*A5#R/ 5, #5-\$5\$0Z#5\$845#@2 =05#85#*# 04 @ 0 45#-418+@065#85#*#74*, 5#B-5, #, DU#B/ #T SHU#\$5#-542 505\$0#*, #85#*#, , *C5#Z#-34845# / =1Q 45/ 4#2 3\$015#85#F=-5#3/ 4#5, #5A-45, , -B\$, #R/ \$*0: +15, 00*\$8+; #R/ 5#5, #WXY#B, 3\$0#05\$01, #-*4# \$5 04#8/ @B\$#654 #5, #C4*2 2 *45, #01C345-5, #B<3, 7+G(g / -+@#H((! 0#B #*#4045, =3\$8*#@5\$05 *4J 45#85#B146*03\$#50# 04 @ 45#-418+@065#45, 0*\$0#- / , #BJ, @45#2 *-C41#<*40#@5#85#H@*J5, (G H7-5J54#H((' O

" " \$%& &{

2 () 84 434 (\$6, 87- 88 (388, 893.;,) '5, 38 - 653 & 8 () %5, %6.4,) 6 () %; , & 4 (845 = > 8- %8) > & % (44- \$- ; , > 3 * 8 - 653 %2) ' @65, AB, \$ 83 (%6:5), % () 3 & * 85), 85>5\$ %6: (95 %-) % * 4- 588 %; 84. \$ %65 %5), & 5>5\$ %4 6 % (%, 9&) & 6; - %8) %5 () 6 % - 8 8 ,) ' AB (%-) 85> %6, %5 4\$ &) ' (%) & 8 () %5, & 8 & %4- 5\$ () '9? * > 8 4\$ 86:5) 4- %6, %5, %1\$ %65, 95), % @, 33) ' %8& 6- (%) %6, 88 - 6F3 87- 88 , 384 (\$ 44- \$ %5 @! "# \$ % & ' # (!) *+, %15\$ 8 () 3 & 854, \$E-%3 8A

B, &G(8 8 (% &6, *6. 4,) 6 () > , * >>54,) '5), *43 > , *5) *4, 5 *H4 (\$ *6 () & > , *6. Q 'AB, & &5 = '5\$, &8 8 () '%5, & C ,) 5, &H4 (\$ *6, &5 3 '%) &6, *6. 4,) 6 () > , 9 < 5 *B 13) * - '%) & &) '(@65, & , * & 8 () '%5, & & , ' * & J * 3 5, & & 3 & & (44 (\$ ' ,) *H6, &G 4 #, & >) > , 4'5, & & & & 6, & C (5 @ D 5 &6, *3 / ,) 3G > > , *1 \$ % > > 3 & &) * , - %8 (3 > - 8 8 ,) * \$) 6 \$ > - 8 4' , *6, *3 *4 \$ - , *6, & , @4 \$ & & & (*5 () '%6, &6, *3 > \$ > 7. \$) > , 9' > A * , : , & * &) &6-5' , *3 * (3) *6: 1 # &6 * , > , *8 - 6F3 * 3 = Q) '9 & 543 * , * ; > E > > , A

-./.,0,1 (#2 2 #)(3,44),f544,L *,-53 %6.38 % \$9'x) '(@9-)\$ 6.>5; \$ *6,5@,)' ('%)&-)=
 '\$ % 8x6:5), 4(\$9' *51', *6:5) 7-88 (388 , *3 G) *4-5\$9'x) '(@&\$%- &.) 898 (8x6:(5\$
 4(\$9' 4; , *6:)>5\$ *-588 8) %, (5@6, 9'9) G, 6() 89' G 88 (% 945%&5, 94(\$, @8 43 99
 \$ 4\$ &)' ('%) *6, &-)) (88x)>, 89'75, *8\$9'3*3; , , *6, &(8 C6M 8A" : , &*4-5\$<5- %.) *4,5'
 &5# (% 99;) *4(\$'53\$96() &5), *-4'65, 9443%5. , 99)> \$4-\$ \$*6() &3 *8-6F3 *8)' (@65,
 '-5', &8\$ \$, &6: %7-88 ('%) &6-)'9'9) ('5\$ &.3 %G, 3) ',8,) *8 (888 8 ,) *6, 9'x) '(@K
 4\$ &6%99-) ('%) 94\$ G ('%5, 9\$ 4\$ &)' ('%) *6, &-)) (88x)>, &.) ?>3 4.6%5, 8A0) *)- , \$
 <5, *3 &G 88 (% &6:5) 77x ('%) 9G 88 (% &6, >-) &5>%) , *P QRS 94, 88 , ,) *6, *, &
 .>(\$88, *5:-) \$ '\$ 5; , 9(%&5), *6, &-\$8%5, &6\$ 88, 95@1 T0 *6, U--6&WYZA

3%5A

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

/3, &*7(44() *6, >) &*, <5, #. - 9%&, *8 - 6F3 &&) *3 *45&&5;,) *;,) &G &&5&3
 &53() G3 *6, *3() (3&9*, *5, >) 7-5, *3 - Q5C9% *6:/) *, >), 'AR, 53 *3 *G(88 (% *G). &%,
 , &*) *74B(*#99#*+5#+3*4\$ &)*, > &*) '@&5&3() G3 *6, *1*#) *R8 %*#;,*5*6%* *(:,*>3 &
 8 - &&W.&*A *2, >,*4-%*6,*5,*3H?(**)53*(C\$%)*(3G\$*#8 %5,*H>) &&.\$ \$*6,&
 &*) &-3B(%) &6,&6.43>,8,)*&,*6,&*>,&<5%*,)*\$;()#,*9>-843%5,)*>) &&.\$ G3 =
 8,)*&3() (3&A2,*>,*4-%*6,*5,*3H-5-),)*>#>,8,)*3 &8 - &*,)*,*4(&&G).\$ \$*,&
 &&)*%3A

15*>-'\$%&'5), *C8 8 8 (%&4-5\$3() (3&*&4,5'*&*&4,\$8 ,''\$&'5), *45&8C8(6, *&543&& *K
3-\$6\$ *6, 888 -'8&4,5'1'\$ (*8&J 365 945&5, '3.)-> *H((3&5'8\$8\$, *(:, >5) *- \$6\$ *6, 8&8 -'8
C8) *6. E) 8&,*&5:8 4-\$, *&5, *3 *3 -6F3 *((3&*6, 8&.)-> 8&)-) *(', & 8&45&85:8&), *&8
(443%5. *<5:H6, 8&.)-> 8&(', & 8&AB, 8&C8 8 8 (%& 8&6, *6.4.) 6(>,&8) '*8 %58(6(4', &H
3() (3&98 18, *8&6, \$(%, 87-\$8 (3&8'%) 8&3 8&6. E) 8&8) '*>8 8, *6, 8&C8 8 8 (%& 8&6, \$.>8\$5
5&6, 3 8&8(:, >6:5), *4(\$*3(8C8 *6, 8&6.4.) 6(>,&8,*&6:(5'\$ *4(\$*>, 3&6, 8&-) &8&() '&8, *6,
3-\$6\$ *3). (%& *6, 8&8 -'8& *; *- 8&4(\$, @8 43 *3(\$8&3 *6, *8&) #F&*6, *2 %-; 8&? *b *c -6%
VZZZZA

!!! 1-'2+'3 (84,-),4+3 5%-84-64+'570,-),-8-3 5.-0,9(:)/5*;7-0

B(*G\$ 8 8 (%*(68 , *6%7.\$)' , &~> , 4%() 885%() '*(*6. 7%%)%*5, *3-) *&*6-)) , *6, *3
3) G, AR#.# ('%5.8 ,)' %* - %> , , *6. 7%%)% & %3\$, ' \$ 6.5 @ @ \$ 8 , &A

1), 4-88%) 46% 3985;,) '\$) >) '\$, 6() 83 6-8 (% 443% 78; &6, 6. E) 33 3) G, H6. >98; *, '() (3&\$ >- 88, 5);) &8 C3 6, >- 54584 33 *, &6-) >3 3) G, 6:5), >- 88 5) (5'. (>, 4() >, &- 54584-58 >- 54584e %) *, '), 659 >,, '44\$ #, &*, 6)., >(\$3 &.) -) > &- \$ \$ >88) *4-',) %33 8,) *;.) -8 C5 %6E) 11 '8 I8, 883-) \$ >5 &*, %6E) %4-',) %3& 5& 4\$, @, <5, 4, \$8)), *, 4\$-) >, 6, 4#5 &6, 43586, 8 88 8 -' & * (5<5, 3> (88? * (&) & 6-5', 8 -%86, WZ 4#5 & & 3 84#5 &88) * -5'6, 8 I8, %C%) 8 (36. >8% 84 \$5) * (5' = 8 (', 6.: '(E) 98 54% *) > \$ 94 (\$5), 38, 5' : , & >- 88, 885) >- 5886: 7-88 (%65, 4\$ &) = '(%) * \$6% (1.5\$ >- 88, 5) * (5'-8 (', &.: >5) -8 C5 6.: '(8E) 88 (88 5885) 64, <5: 8, 819

" " # \$ % & ' &

!"#\$%&'()*+,-./:;<=>?@A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\] ^ _ ` { | } ~ ¡ ¢ £ ¤ ¥ ¦ § ¨ © ª « ¬ ® ¯ ° ± ² ³ ´ µ ¶ · ¸ ¹ º » ¼ ½ ¾ ¿

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) *# - / 01 *#23045467 *#*#.5.6.789 *#561 *\$.#7.5\$57; +*#; \$.5<89 *#1 *#9<# 5\$6-3 *#59 , 06 *#1:9\$*#253 *#7 *#5 @7-3 *\$.#*#230 @++9 *#1:5\$57; +*#*#236A7- B6\$.#7.5\$57; +*#7#29 *#2304C 547 *#896 @2 *\$15\$.#*#+.25 *#103 @, *\$.#7.5\$57; +*#103 *#F *#.1:59.3 *#253 *#7 *#2 *9A *\$.#5 @9- 3B +93 *#1039 *#7 *#B *#7 *#9323045467- #1:G3 *#522789- *#H

I 77 *#20 *#\$.#5- \$5, 06 *#1 @3.56 *#23047- , *#*#7 *#5\$57; +*#230196 *#1 *#0\$.#25 *#0.57 *\$, J 547 *#*#. @\$.6 *\$ *\$.#5 +*#142 *9#1:6103 5.0\$20937.6. *323- 5.0\$ *#- , 5\$.89 *#*#.5\$16 *#89 *#7 @\$.+39 @0\$ *#1 *#7 *#B35 , 56 *#1\$- @++6 *#1:5\$0. *3# 5\$9 *7 *\$, *\$.#9\$ *#1039 *#10\$ +89 *\$.# @89650\$ *#10\$ *#9, 56 *#6 2035\$.H

M\$23047- , *#29 *#10\$15, *\$.57 *#20 *#11N *#1:40 *\$5.93 *#1:9.66 *#31 *#23045467- +*#*#.0\$ +56 *#9 *#7.G3 *#9, 56 *#*#.0.66 *#*#E *#6A *\$, *\$.#20935\$57; +*#3 *#2 / 35 *#*#89:67 *\$. *\$1110 56 *#2093 G3 *#110 @++7 *#B35 , 56 *#23045467- *#106A *\$.#56 *#1 *#; 20. / =+*#1:6\$1- 2 *\$15\$ @#896 *#0\$. 159 +*#*#753- 570.5.0\$ *#1:9\$ *#*# @. - B03 *#6E9 *#93 *# @77 *#1 *#59.3 *#*# @. - B03 *#A06 *\$ *#11M\$ * , 5\$6-3 *#1 *#B *\$13 *# @, 2. *#1 *# @+6E9 *\$ @+*#+. #1 *#.09. #35, *\$359 *#6A *\$59 *#7 *#6 @7 *#*#+. #37.6A *C , *\$.#110 @#2093 *#36 *#31 *#3 *#1:36 @0\$ *#1 *#1 *#- 7 *# @0\$ *#09 *#1 *#75 *#7 *#1:5, 46892- 1110Q\$ *#04.6 *\$. 56 *#6 *#1 *#B35 , 56 *#23045467- *#*# <6 @7- *#15\$ *#7 *#89 *7 *#7 *#230236- . +236 *#*# *# @, 2. *3 *#7 *#A *\$.#29.R.#1 *#75 *#- , 5\$.89 *#7 *# <6 @7 *#89 *#1 *#75 *#; \$.5 < *#9\$ *#106 *#1 *#29 *#0\$ *#*#+. # @0\$ *#10\$- #5 9\$ *# 01 =7 *#5\$ *# 019736-H

!! " # \$ % & ' () * + , - . / : ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\] ^ _ ` { | } ~ ¡ ¢ £ ¤ ¥ ¦ § ¨ © ª « ¬ ® ¯ ° ± ² ³ ´ µ ¶ · ¸ ¹ º » ¼ ½ ¾ ¿

T 09 *#5A0\$ *#209356 *#616 *#2 *92537- #1 *# / - 033 *#*#. #, 01 =7 *#89 *#509 *#235.690\$ *#1 *#230C B35 , *# 66 570 *#1 *#U / 0 , +V; #D ((W *#09 *#253X#3- 20\$13 *#59 <#04Y @0\$ *#.35160\$ *\$7 *# + @\$.3 *#75B35 , 56 *#B- \$- 35.6A *#D7 , *\$.#A61 *#+. #35 @+*#*#. #1- 27 @, *\$.#B *\$1 *\$.#7 *#57B036 / , *+ 1:5\$57; +*#6\$ *#110 @+ *#A06 *#6 20 +64 *#1110 , *#70\$ *#. 0\$.3- # *03- (Z ([.547 *#3D]] *#H @#230C B35 , *#*#52230 *#1 *#B35 , 56 *#*# @. - B03 *#7 *#*#. #B35 , 56 *#*#1 *#; 2 *#70B89 *#1 *#5 4 *#V D (& *#*#.0 003B5. #D ((_ *#0.5 , *\$.#B3 @#75 *#103 570.5.0\$ *#89 *\$ *#5 #10\$ - # .547 *#3D ((a *# b 5\$ *# @+ *#52230 *#*#+. #75 *#; \$.5 < *#3 *\$1 *# @, 2. *#1 *#75 *#1:39 @93 *#23- 16 @.6A *#1 *#- \$0\$ @+ *#*#. 1 *296 *#*# *#35A59 < *#10 0\$.5B9 *#12 / 0 , 5 +0 *# (a *#H @5 @0\$ *#56 *#89 *#7 *#B35 , 56 *#*# @. - B03 *#7 *# + +0\$.#23- @- , *\$.#56 *#2093 *# @75 *#516 *#89 *#*#70\$ *#U / 0 , +V; # \$ % & @]] \ F *# @+ *#89 *# +0\$ *# +0\$. 253. #7 *#29 *#10\$- 3 *#+5\$. *#5 @9 *7 *\$, *\$.# *\$2 *# \$ % & *#103- E 3 *# @7203- *#1 *# +895\$. @ @. *93 *? @0\$.3R *#1 *#6\$J \$66A *#7 *#. @1

) *#B35 , 56 *#*#. 66 570 *#1 *#1 .547 *#3D ((a *#0\$.# *\$56 *#7.9\$ *#1 *#23 * , 6-3 *#6 275.5C .0\$ *#E @ @+ *#1 *#75 *#0.0\$ *#1 *#35 *#103 5.0\$111 \$ *#E *#.7 *#1- 27 @, *\$.#89: *7 *#9.66 *\$ *# +0\$. 3 *#5.6A *\$, *\$.#6 27 *#*#. #9309. #2 *9A *\$.#G3 *#6 97 *#253 *#1 *#B35 , 56 *#*#5\$ *#1- 27 @, *\$.#11V +.5B6 *#1:59.0, 5. *#526 *#1 *#26 *#1:0d *#3- +97 *#9\$ *#5\$57; +*#*# * , 2 *#207. \$0, 67 *# @ , *# @7 * 1 *#7 . \$589 / , : / # *\$ e f +10 6 *# < *# @3 *#7 *#5343 *#*#2 *9A *\$.#1- @6 *#15\$ *#7570B89 *# 0C \$51689 *#19 *# @0\$1 *#0313 *# *#0\$ *#5 *#10\$ @9\$ *# / - 033 *#896 *#+. #575 *#106 *#1- 36A5.0\$ *\$7 *#D *# *\$ *#8 ' #. , ' *\$6; ' (2' *# \$ % & *#. #3- +*\$.5.0\$ *\$7 *#D / 1' 33 < / *\$ = (2' *# \$ % & *# @ , *#70\$ *#. 0\$.3- #0 gC \$6 @# \$ % & @]] *#H

) *#B35 , 56 *#*# @. - B03 *#7 *#*#. #29 *#23- @- , *\$.#7 *#A536\$. *#6 +9 *#1 *#7570B89 *#75- 56 *\$ *#. #9 *# @7 @7 *#5 5, 4 *#V2 *9A *\$.#3 *\$23- *\$ *3 *#*#B35 , 56 *#*#. 66 570 *#1 *#1 .547 *#3D @59 +6 *#75 16 *# @0\$ *\$ *\$.3 *#I [*#. #0 c [*#1 *#1979, (Z ([@07 *#D]] ! *#*#+. #, 6 *#S *#, 57 *#253 *#9\$ *# / - 03- , *#1 * @, 27.91 *#5227 *# @. *#106 *#1- 89 *\$.670.5.0\$ *#*# *#5\$57; +*#*#0\$. #.09. #S75 *#106 *# @77 *#104. *\$9 *+ 253 *#1 *#B-7 *#1 *#1- 36A5.0\$ *\$52536 *#19 *#; 2 *#1 *# 0. +1103 97 *#10923 *9A *#+2536 *7 *#H 56 *#59 +6 7. *\$ *+, 47 *#1 *#B352 / *#15.6 *#56 *\$5. #9\$ *# @0\$160\$ *\$5227 *# @6 =3 *#1 *# @3 *# @0\$H

):61- *#*#+. #1 *# @0\$ +.39 *#9\$ *#*#.39 @93 *#9\$ *#75, 415C *3 *#75- 56 *#1 *#75B35 , 56 *#1 *#0 0\$.5C B9 *#19\$ *#23 *9A *# *\$70B89 *#75- 56 *#F *#896 *#1- @6 *#7.5 +* , 47B *#10\$ @0\$ *\$ *#1 *# +09 *# @0\$ +.695\$. + *\$ *# @0\$ +.695\$. +11 *# @. *#*#.39 @93 *#0\$.# *# < .356 *#75 *#103 *#2 / 0\$070B89 *#1 *#75 *#2 / 35 *#110 / 22 / , / 1 / 75 *#96 *#1 *# 0. +896 *#75 *# @, 20 *#F *#. (+ *#103 *#70B89 *#11) 5 *#103 *#70B89 *#*#+. #1-J \$6 * @ , *#9\$ *#75, 415C *3 *#S75 *#0 0\$.5B9 *# @#896 *#+. #5\$ *#109. *#29 *#3 *#+. 3 *#. #, 56 *#29 *#6\$. *7B8C 47 *#89 *#523- +*\$.5.0\$ *#15\$ *#7 *#109A35B *#1 *#B35 , 56 *#B- \$- 35.6A *#11) *# @7 @7 *#1 *#75 *#103 *#2 / 0C \$070B89 *#*# *#56 *#253253 @93 *#*#. #.89 *#.5B *#1 *#75 *#1:39 @93 *# @356 *#*#. 52 *#*# @3 *#+20\$15\$.#S *#1 *+ 1- 27 @, *\$.#110 *# @, *#Z *# *\$.03- # [] ! i f e , 47331 *\$ % & @]] W *# *\$.03- # []] \ F

U *.. *#52230 *#*#+. #35160\$ *\$7 *# @3 *#75, 415 *#3 *#75- 56 *#2 *9. #G3 *#A9 *# @ , *#75 *#1:39 @93 * 23010\$1 *#09 *#.39 @93 *# *# @0B35 , 5.6 @7 *#1:0d *#*#1- 36A *\$.#1:9\$ *#253 *#75 *#.39 @93 *#1 *# +935 @#09

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-4*'54"A12" ; *B+ - "= + , 6*\$&'C-5*1&; *\$G.-."D+ '6- "E0'4'5" / 01\$'6 1\$4'\$-6 (.1\$-4' *..-59
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&6+&+) +7 & &) 8& +(\$- . %EB0*+ B\ 34&%+9& % +@04/ -(.'4"*5&' =83*5(-4'"5" .H ">?59
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d -E' -%+ 9& % +H '3' -K'80+ " , 1'8&57"LM#) 7 ? %86- >= 2 +R= 0c F% 'BG @ "J
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\\ - '48' >Y) * @ & % +G SSHJ+R) *57*7-4" // 6 (. '84'6'571-4'5* .1\$-66-4' -." (075' . '05BF) %&+R
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() &BX+ \$* ' . - + -5. '=1.0+ * . 'A1- "8&4") *571-4+! ! GJBG] ^S' J
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A?BB?/3@4\$+>-+%?/3 %CDEP\$CUP -+>%6\$+*3. -O) 8' (, '#\$% *?' 2' #9\$# #(/ 74*% ;
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Z% B3/3 %\$#/\$+>\$@%>5/>C\$) %\$, '#\$- . \$, %\$0. ' (1' 2(3%#4. ' 208 '6' 9\$57! [' ' 9
\\ ?%>4\$H2-3% . 52+-\$V \$ 3%3@>\$Wc/d+\$)) 9\$G/ . #1%\$# #2(/ 72\$62\$6%(\$%\$ %%(4%4. 4%'
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\\ . . /A?/O 3@?+4\$)) N\$ \$ \$H?/+A -34\$K+\$4 A3@CDEP\$U\$M\$P +%2+B \$V\$<\$/+>\$ +G4%O
+*3. ->O\$ %#1D / K/ 73/ 4+6(%#1(3%#4. 4%' O\$ B>+*?B \$R4+M\$-C\$@?5/+-\$ \$) "[! YY9
\\ G4+<CH4G'+\$678879\$\$ \$' 2(D' 2(1' (42'#\$&I (2'#\$&(6/ #/\$%2\$E (7%#1%2(M'4. ' 2(E' -2+
' 2\$H. 4+@8 % 3/AC3/3@C. -*+?G \$ \$ -+>+>\$ %M->3?3+>\$+P. -*+?G_C
\\ G-Q+%O\$ +32'-\$6788(9\$\$ \$W+5?-/3/ASK%?_ \$%\$@B=3@/. -3@3\$@/+A -34A?BB?-CDE%
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I E7! O\$W?T -*\$ \$ 3/AC3/3@C%3G+C
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6' 3/-3-G+* \$ K\$H?B=>3*A+\$ %M->3K\$-+>C
1G4CB \$ +. T\$+K\$V \$P?=>?-\$W@. 4\$6788! 9\$\$ \$m\$2+\$*3/3@B %\$=S /+>B. *+4O2. -+3@%\$
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, . A-%3+2)5 -' +E 99FI+?+V; (%Q+; [7?%A4>)%?+; . Q>, -Q A*&)6>DX+0*+ \$D, -(.%+E 99FID
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