B4 6H O@ J8

;vNc%Y!<%9JBNs%W%m%0%i%_%s%0
$N
<B83$HI>2A !UI!K

;a L> !'JFED7r<#

3X@RHV9f !'2210940376-1

;XF3650w !';3:j>!9065<x

Ds =P F| !'1998G/27n20F|

N)L?4[Bg3XM}9)3XIt>pJs3X2J

FbMF9<35

2>A[6&M-%a%b%jJBNs%^%7%s>eGN%W%m%0%i%_%s%0$O!$=>Mh$NJ,;6%a%b%j7?%^%7%s$G$N%W%m%0%i%_%s%0$KHfYFMF0WG"kH$O8@$(!$J*M}E*$KJ#?t$N%W%m%;%C%5$r;HMQ7F$$$k3HKJQojOJ/!$JBNs%W%m%0%i%_%s%0$OOJA0H7$F:$FqG"$k!%3F%W%m%;%C%54V$NDL?.$O6&M-JQ?t$rMQ$$$k3HKh$j<B8=$5lk$,!$$=$NF14|$N<h$jJ}$JIO%f!<%6$,M[$K5-=R9k!%3FLdBj$NE,@Z$J2r$H==J,$JJBNs8z2L$rF@$k$?$aKO!$%?%9%/J,3d!$F14|!$Aj8_GS=|!$%9%l%C%IKBP9$kCN<1$,I,MWG"$k!%

K\8&5f<<GO;vNc%Y!<%9?dO@!JCase-Based Reasoning:CBR!K$N9M$(J}$r;29M$K7?;vNc%Y!<%9JBNs%W%m%0%i%_%s%0%7%9%F%`$NDs0F$r9TCF$$$k!%CBR$OLdBj2r7h$K2a5n$N;vNc$rM-8z3hMQ9k$?$a$KDs0F$5l?!%D^$j!$@lLgE*$JCN<1$r;vNcH7$FC_@Q$7!$:FMxMQ$9k3HG$"$k!%JBNs%W%m%0%i%_%s%0GO!$Ii2Y6Q9U$N<B8=$H%W%m%;%C%54V$N>pJs<x<u$N%*!<%P!<%X%C%I$N7Z8:$,:G$b=EMWG"$k!%$=lrC#@.9k$?$aKO%W%m%;%94V$NF14|!$Aj8_GS=|!$%9%l%C%I$J$IJBNs%W%m%0%i%_%s%0$K4X9kCN<1$,I,MW$HJk!%K\%7%9%F%`$G$O!$?7$?$JJBNs%W%m%0%i%`$r:n@.$9$k:]$K!$2a5n$NJBNs%W%m%0%i%`$+$i9=@.$5$l$k;vNc%Y!<%9$NCf$+$i:G$bN`;w7?JBNs%W%m%0%i%`$r8!:w$7!$$=lr:FMxMQ9k3HKhCFJBNs%W%m%0%i%_%s%0$NIiC4$r7Z8:5;k3HrL\;X$9!%

3N%7%9%F%`$G$O!$2a5n$NJBNs%W%m%0%i%`$r:FMxMQ2DG=$J7A$G;vNc%Y!<%9$KJ]B8$7$F$*$-!$?7$?$JLdBj$KBP7F$O!$$=$NLdBj$K:G$bE,$7$?JBNs9=B$$rbD;vNc$r;vNc%Y!<%9$NCf$+$i8!:w9k!%$=$7$F!$8!:w;vNc$K=$@5!&FyIU1r2C$($k3HKh$j!$?7$?$JJBNs%W%m%0%i%`$r40@.$5$;$k!%$3$N$h$&$JJ}K!$K$h$j!$JBNs%W%m%0%i%_%s%0$NIiC4$r7Z8:$7!$@53N$G8z2LE*$JJBNs%W%m%0%i%`$N:n@.$rL\E*H7$F$$$k!%

K\O@J8$O,$3$N;vNc%Y!<%9JBNs%W%m%0%i%_%s%0%7%9%F%`$N;vNc$r,4{$KC_$($i$l$F$$$k2a5n$N;vNc$r$b$H$K:n@.$7,2a5n$N;vNc$N:FMxMQEY$rI>2A$7$F$$$k.;vNc:n@.$O,C`<!%W%m%0%i%`:n@.!$JBNs2=J}K!$N8!F$!$N`;w;vNc$rC5$9,N`;w;vNc$r$b$H$KJBNs%W%m%0%i%`:n@.!$JBNs8z2L$rD4Yk,$H$$$&<j=g$G9T$&!%$3$3GO%S%8%M%k0E9f,%i%s%l%s%0%905=L,C_@QK!$N#3$D$N;vNc$K$D$$$F=RYk!%

L\<!

1 O8aK

:G6a$O, %3%s%T%e!<%?$N@-G=$b>e$,$j, $=$N=hM}B.EY$O9bB.$KJCF-$F$$$k$,, %^%7%s$N@-G=$N8~>e$HHb$K, MW5a$5lkLdBj$b5pBg2=$7$F$$$k. Nc$($P, 5$>]M=B,, N.BN7W;;, ?M9)CNG=,3<!852hA|$N@8@.$JIN=hM}$O, B?Bg$J;~4V$,$+$+$j, :#$^$G$NC`<!E*%"%W%m!<%A$G$O8B3&$,$"$k. JBNs=hM}$O, J#?tB f$N%W%m%;%C%5$rJBNs$KF0:n5;k3HG9bB.2=rO$+$k5;=QG"$j, MW5a$5lkLdBj$N5pBg2=$KBP9k2r7hK!$N#1$DKJkH9M$($ilk.

JBNs%W%m%0%i%`$r:n@.$9$k;~, %f!<%6$O3F%W%m%;%C%54V$G$NF14|, %?%9%/J,3d, Aj8_GS=|$d%9%1%C%I$J$I$r9M$($J$1$l$P$J$i$J$$!%$7$+$7, $3$l$i$OJBNs%W%m%0%i%_%s%0$NCN<1$H7P83$,$"$^$j$J$$%f!<%6$K$O, Hs>o$KM}2r$7$E$i$/, $^$?, JBNs2=$r9T$&C`<!%W%m%0%i%`$K4X$7Fb=OCN7F$$$kI,MW$,$"$k.

K\8&5f<<GO;vNc%Y!<%9?dO@!Case-Based Reasoning:CBR!K[1] $N9M$(J}rbHK;vNc%Y!<%9JBNs%W%m%0%i%_%s%0%7%9%F%`$r9M0F$7$F$$$k!%CBR $O2a5n$N;vNc$rM-8zMxMQ$7$F$=$NLdBj$r2r7h$7$h$&$H$$$&$b$N$G!$@lLgE*$JCN<1$r;vNc$H$7$FC_@Q$7!$$=$l$r$J$s$i$+$N7A$G:FMxMQ$9$k$3$H$G?7$?$JLdBj$r2r$3$&$H$$$&$b$N$G$"$k!%K\%7%9%F%`GO!$?7$?$JJBNs%W%m%0%i%`$r:n@.$9$k;~$K!$%7%9%F%`$KC_$($il?JBNs%W%m%0%i%`$N;vNc$NCf$+$i:G$bN`;w7?bN$r8!:w$7!$$=lr:FMxMQ9k3HKhCFJBNs%W%m%0%i%`$N:n@.$r%9%`!<%:$K9T$J$($kh&K9k3HrL\;X7F$$$k!%

K\%7%9%F%`$G$O!$:n@.$7$?JBNs%W%m%0%i%`$r#1$D$N;vNc$H7F;vNc%Y!<%9$KC_$(F"$k!%#1$D$N;vNc$K$O!$LdBj$ND j5A!$%$%s%G%C%/%9, %9%1%l%H%s, %W%m%0%i%`, JBNs8z2L$N3F9`L\$K$D$$$F5-:\$5lF$$$k!%%$%s%G%C%/%9$O1~MQ, ;EMM!$%"%k%4%j%:%`!$=*N;>r7o!$%G!<%?9=B$!$%?%9%/J,3d!$%H%]%m%8!$%$%s%?%i%/%7%g%s!$JBNs2=<jK!!$<B9T9=B$$N#1#09`L\$K$D$$$F5-:\$5lF$$$k!%%9%1%l%H%s$OJBNs%W%m%0%i%`$N9|3J$D$^$j!$$=$NJBNs%W%m%0%i%`Cf$G;Hol$k%G!<%?9=B$!$%?%9%/J,3d!$F14|!$Aj8_GS=|!$%9%1%C%IJI0lO"NbN,5-:\$5lF$$$k!%?7$?$JJBNs%W%m%0%i%`$r:n@.$9$k:]$K!$%f!<%6$O$"$kM?$($i$l$?LdBj$K$D$$$F!$%$%s%G%C%/%9$N3F9`L\$K1hCF2r@O$r9T$$$J$,$i!$%$%s%G%C%/%9$r:n@.$9$k!%%7%9%F%`$O$=$N%$%s%G%C%/%9$rMQ$$$F;vNc%Y!<%9$NCf$+$i:G$bN`;w$7$?;vNc$r8!:w9k!%8!:w5l$?;vNc$N%9%1%l%H%sK=$NLdBj$KI,MW$JJQ?t$d7W;;ItJ,JI$NFyIU$1!?=$@5$r$7!$JBNs%W%m%0%i%`$r40@.$5$;$k!%40A4$K%^%C%A$9$k;vNc$,8!:w$5$l$J$$>l9g$G$b!$>r7o$r4KOB$7!$:G$bN`;w7?;vNc$,8!:w$5lkh&K7!$LdBj$K9goJ$$ItJ,$O<jF0$GItJ,E*$K=$@5$7!$JBNs%W%m%0%i%`$r40@.$5$;$k!%$3$N$h$&$K$7$F$G$-$?JBNs%W%m%0%i%`b^$?!$;vNcH7$F;vNc%Y!<%9$KC_@Q5l$k!%$3Nh$&$JJ}K!Kh$j!$JBNs%W%m%0%i%_%s%0$NI iC4$O7Z8:5l!$@53N$G8z2LE*$JJBNs%W%m%0%i%`$N:n@.$,$G$-$kh&KJ$k[11][12].

K\O@J8$O, 3N;vNc%Y!<%9JBNs%W%m%0%i%_%s%0%7%9%F%`$N;vNc$r, 4{$KC_$($i$l$F$$$k2a5n$N;vNc$r$b$H$K:n@.$7, 2a5n$N;vNc$N:FMxMQEY$rI>2A$7$F$$$k. ;vNc:n@.$O, C`<!%W%m%0%i%`:n@.!$JBNs2=J}K!$N8!F$!$N`;w;vNc$rC5$9, N`;w;vNc$r$b$H$KJBNs%W%m%0%i%`:n@.!$JBNs8z2L$rD4Yk, $H$$$&<j=g$G9T$$, >e5-$N7A<0$K=>CF#1DN;vNcH7F^Ha$k!%$3$3$G$O#3$D$N;vNc$K$D$$$F=RYk!%%S%8%M%k0E9f, %i%s%l%s%0%905=L, C_@QK!G"$k!%

%S%8%M%k0E9f$O, 0E9f2=<jK!$N#1DG, %"%k%4%j%:%`$O," C;$$%-!<%o!<%I$r7+$jJV$7MQ$$

$F, 3F%9%F%C%WKh$K80$N1Q;z$NHV9f$HJ?J8$N1Q;z$NHV9f$NOB$r0E9fJ8$N1Q;zH9$k”[2] $H$$ $&$bNG$"$k. JBNs2=$O, KMP K!$N;vNc$r%9%1%1%H%s$H7F, %W%m%;%C%5%U%!!<%`$GJBNs2= $r9T$C$?.

C_@QK!$O, #1Kg$N2hA|NCfKB?$/$NE@$,B8:_$7$F$$$F, E@$N:BI8CM$H, $=$1iN3FE@$N;} $DIUB0>pJs$H$r5-21$9$kJ}K!$G$"$k[4]. :n@.7?%W%m%0%i%`$O, #12hLL$r#4J,3d$7, $=$1$> 1NItJ,2hLIFb$NE@r^$HaF5-21$9$k, 3NJ,3d$5$1$?3F2hLLKbF1MM$N=hM}$r9TCF$$ $-, #1$D$N%V%m%C%/Fb$NE@$N?t$,$"$k0lDj$N?t0J2<$KJ1$P, =hM}$r=*N;9k, $H$$$&bN$G $"$k. JBNs2=$O, %/%$%C%/%=!<%H$N;vNc$r%9%1%1%H%sH7$F, J,3dE}<#K!$GJBNs2=$r9T$C$?.

%i%s%1%s%0%905=L$O, %G!<%?05=L$N<jK!$N#1$DG"$k. %F%-%9%HCf$K8=1kO"B3$7$?F1$8 J8;z$NJBSr, $=$NJ8;z$H2?8DB3$$$F$$$k$+$rI=$9?t;z$H$N#2%P%$%H$GI=8=$7D>$9$3HG05 =L9k%"%k%4%j%:%`$G$"$k[3]. JBNs2=$O, KMP K!$N;vNc$r%9%1%1%H%s$H$7$F, %W%m%;%C%5 %U%!!<%`$GJBNs2=$r9TC?.

$^$?!$K\8&5f$O2>A[6&M-%a%b%j7?JBNs%^%7%s KSR-1 $rBP>]$K7F$*$j, K\O@J8$G=R$Y$k #3$D$N;vNc$O3N%^%7%s>e$G<B9T$7$?$bNG$"$k!%

2 JBNs%W%m%0%i%_%s%0$HJBNs%"%k%4%j%:%`

2.1 JBNs%W%m%0%i%_%s%0

JBNs%W%m%0%i%_%s%0$O, $^$:C`<!%W%m%0%i%`$,$9GK:n@.5l$F$$$k3H$,A0Ds$HJj, $=$lrI$NJBNs%"%k%4%j%:%`$rMQ$$$FJBNs2=$9$k$+$r7hDj$9$k$3$H$+$i;O$^$k. JBNs%"%k%4%j%:%`$r%W%m%;%C%5%U%!!<%`, J,3dE}<#K!, %W%m%;%9%M%C%H%o!<%/, 7+$jJV$7JQ49$N$$$:$l$+$K7hDj$7$?8e, <B:]$KJBNs%W%m%0%i%`$N:n@.$K$+$+$k. #4$D$NJBNs%"%k%4%j%:%`$N>\:Y$O#2.#2$G=RYF$$$k.

2.2 JBNs%"%k%4%j%:%`$NJ,N`

2.2.1 0lHIE*$JJ,N`

?^1$K<($9h&$K!$0lHIE*$KJBNs%"%k%4%j%:%`$O%W%m%;%C%5%U%!!<%`!Processor Farms!K$J,3dE}<#K!!Divide and Conquer!K$%W%m%;%9%M%C%H%o!<%/!Process Networks!K$7+$jJV$7JQ49!Iterative Transformation!K$N#4$D$KJ,N`$G$-$k!%

- %W%m%;%C%5%U%!!<%`

  $^$:!$A4BN$N@)8f$r%^%9%?!<$,9T$&!%M?$(il$?LdBj$rJ#?t$NFHN)$7$?7W;;$KJ,3d$7!$3F%9%l!<%V$^$?$O%^%9%?!<$,$=$l$rC4Ev$9$k!%$=l>l,$=$NM?$($il?7W;;$rFHN)$K9T$$!$$=$N7k2L$r%^%9%?!<KJV9!%%^%9%?!<$,$=lr$^$H$a!$$=$NLdBj$N2rEz$rF@$k!%3F%9%l!<%V$^$?$O%^%9%?!<$OFHN)$K7W;;$r9T$&$?$a!$9b$$JBNs8z2L$,F@$ilk!%

- J,3dE}<#K!

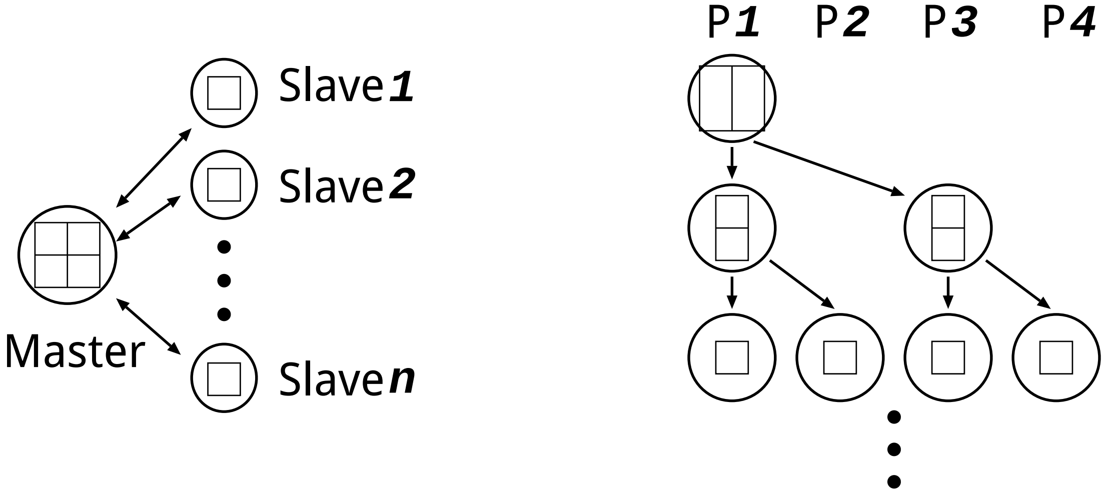
  M?$($il?LdBjKD$$$FJsi+$N7W;;$r9k!%$=$7F"$k>r7o$NbHK=lrJ,3d$7!$$^$?!$$=$N7W;;$r9T$&!%$=7FJ,3d!!&&$H!$:F5"E*$K7W;;!$J,3d7J$,$i2r$+$l$k!%$=$NLdBj$N2r$OJ,3d$5l?ItJ,2r$r2s<}$7!$$^Hak3HKhjF@il$k!%

- %W%m%;%9%M%C%H%o!<%/

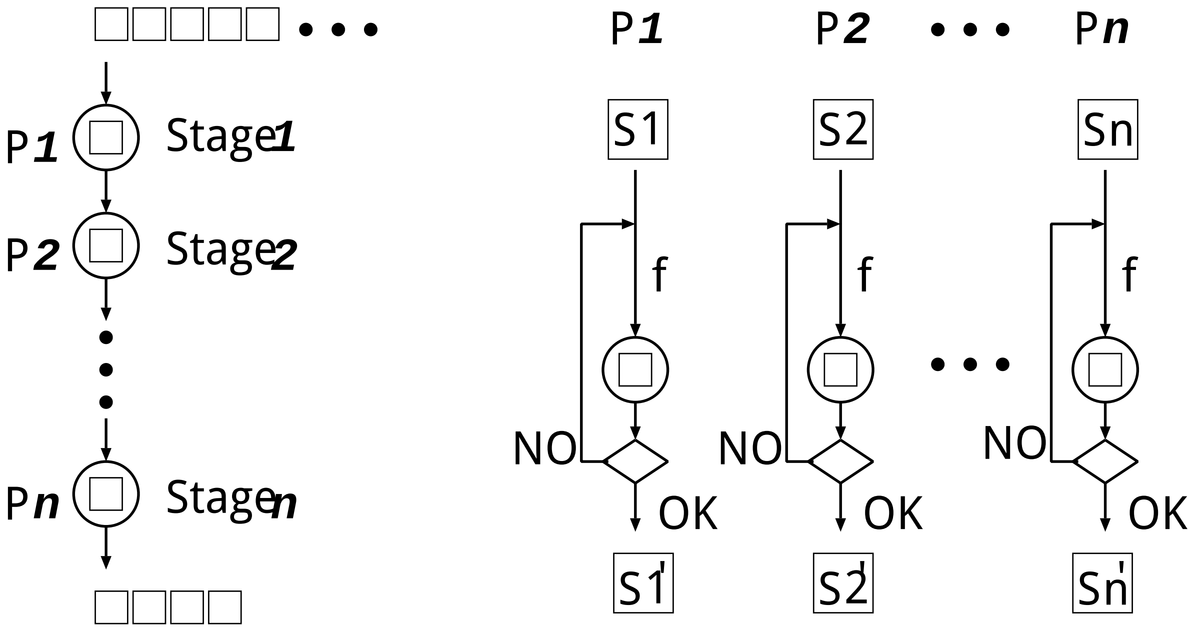
  M?$($il?LdBjKD$$$F!$$=$N7W;;$rJ#?t$N%9%F!<%8$KJ,1k!%F~NO%G!<%?O"$k%9%F!<%8>e$G7W;;$,9T$Jol$?$i<!$N%9%F!<%8$K0\$k!%$^$?!$$=3G7W;;$,9T$o$l<!$N%9%F!<%8$K0\$k!!&&$H=gHV$KN.lF$$$/!%$=$N3F%9%F!<%8$OJB9T$K<B9T5l$k!%

- 7+jJV7JQ49

  M?$($il?LdBjr"$k%*%V%8%'%/%H$KJ,1k!%3F%*%V%8%'%/%H$OJ#?t$N7+jJV7$N7W;;$KhjCM$,JQ49$5$l!$5aakCM$,F@$ilk!%$=$N7+jJV7$O%*%V%8%'%/%H$NCM$,$"$kM?$(il$?>r7o$rK~$?$9$^$GB3$1$ilk!%$^$?!$A0$N%9%F%C%W$G7W;;$5l?CM$O<+J,<+?H$^$?$OJL$N%W%m%;%9>e$G%i%s%@%`$K;H$olk!%



(a) プロセッサファーム　(b) 分割統治法



(c) プロセスネットワーク　(d) 繰り返し変換

?^1: JBNs%"%k%4%j%:%`$N0lHIE*J,N`

2.2.2 BACS(Basel Algorithm Classification Scheme)

BACS(Basel Algorithm Classification Scheme) $O%"%k%4%j%:%`$NJ,N`!$J#;(5r<g$K%" %k%4%j%:%`$N%H%]%m%8!<!$%W%m%;%99=B$!$%G!<%?$NJ,;6!$<B9T9=B$$J$I$N4QE@$+$iJBNs%W %m%0%i%`$rJ,N`!&I=8=9k[6]!%0J2<K=$NBeI=E*$JbNKD$$$F@bL@r9$k!%

- %G!<%?9=B$!J?%9%/J,3d!K

  %G!<%?9=B$$G$O3F%W%m%;%C%5$,7W;;KI,MWJ%G!<%? !J=!<%9%G!<%?!K$H7W;;7k2L%G!<%? !Jk2L%G!<%?!K$r<h$j>e2k!%%?%9%/J,3dGO!$$=$N%G!<%?$K$D$$$FJ,3dJ}K!$rL@$i$+$K9k!%$=$N%G!<%?$OJ,3dBP>]!$J,3dC10L!$J,3dJ}K!$N3F9`L\$K$D$$$F>\:Y9k!%J,3dBP>]$O3F%W%m%;%C%5$KJ,3d9k%G!<%?$r!$J,3dC10L$OC1FH$K7W;;G-$k:G>.$N7W;;C10L$r!$J,3dJ}K!O=$N%G!<%?$NA4BN$N%3%T!<$rA4%W%m%;%C%5$K?6$jJ,1k6&M-!$$"$k7h$^C?Bg$-$5$N%V%m%C%/$KJ,3d7F3F%W%m%;%C%5$K?6$jJ,1k%V%m%C%/!$$"$k0lDj$N<~4|$G=gHV$K3F%W%m%;%C%5$K?6$jJ,1k%5%$%/%j%C%/$N$$$:l+$r!$$=l>$l5-:\$9$k!%

- %H%]%m%8

  %W%m%;%9$r@8@.$7$?$j!$>C5n$7$?$j9k7ABV!JTo!<%+!<!$%D%j!<!$%Q%$%W!$%a%C%7%e!K$r<($9!J^2;2>H!K!%

- %$%s%?%i%/%7%g%s

  %$%s%?%i%/%7%g%s$O%G!<%?$N0l4S@-$rJ]D?aK!$%W%m%;%94V$NF14|H7$FMQ$$$k!J7%0%J%k!$%&%(%$%H!$%P%j%dF14|!$mutex!K!%

- %$%Y%s%H !JB9T9=B$!K

  JBNs%"%k%4%j%:%`$N<B9T9=B$$O$?$$$F$$!$7W;; !C!K$%$%s%?%i%/%7%g%s !U!K$%G!<%b%s%3!<%k !D!K$N#3$D$N%$%Y%s%H$N7+$jJV$79=B$$K4p$E$$$F$$$k!%

  $"$k%$%Y%s%HFb$G$NMM!9$J%W%m%;%9$N4X78$r6hJL9k3H$,$G$-$k!%

  - %H!<%?%k%$%Y%s%H

    A4%W%m%;%9$,$=$N%$%Y%s%H$K;22C$9$k;~!$$=lr%H!<%?%k%$%Y%s%H$H8F$S!$Nc$($P

    $$C^t$$

    $HI=$9!%

  - %Q!<%7%c%k%$%Y%s%H

    $"$k0lIt$N%W%m%;%9$,$=$N%$%Y%s%H$K;22C9k;~!$$=lr%Q!<%7%c%k%$%Y%s%H$H8F$S!$Nc$($P

    $$C^p$$

$HI=$9!%$^$?!$%Q!<%7%c%k%$%Y%s%H$K;22C$9$k%W%m%;%9%;%C%H$K$D$$$F4JC1$K=q$/3H$,$G$-$?$i!$P $K3g8L$GB0@-rIU12C$($k3H$,$G$-$k!%

  - Dj?t$NDj5A

    ;22C9k%W%m%;%9$N?t$,<(5l$k!%Nc$($P!$#18D$N%W%m%;%9$@1,7W;;$r9T$J$&>l9g!$$C^{p(1)}$ $HI=$9!%

  - ;XDj;R$NDj5A

    M?$($il?%H%]%m%8Fb$KB8:_$9$k%W%m%;%9$NCf$+$i$"$kFCJL$J%0%k!<%W$,7W;;$r9T$J$&>l9g!$Nc$($P!$ $C^{p(group)}$ $Ogroup $H$$$&;XDj;R$r;}$C$?%W%m%;%9$N$_$,$=$N%$%Y%s%H$K;22CG-$k!%

- 7W;;%$%Y%s%H

  J#?t$N%W%m%;%9$N4V$G7W;;$N%$%Y%s%H$r6hJL9k$?$a$K2<IU$-J8;z$,IU$1il$k!%Nc$($P!$%^%9%?!<$N7W;;%$%Y%s%H$O

$$C_m$$

  %o!<%+!<$N7W;;%$%Y%s%H$O

$$C_w$$

  $HI=$9!%

- %$%s%?%i%/%7%g%s

  F14|!$Aj8_GS=|!$%G!<%?E>AwJI%W%m%;%94V$NAj8_:nMQ$,9TJolk%$%Y%s%H$G!Nc($P

$$I_{barrier} \qquad , \qquad I_{mutex}$$

  $HI=$9!%

- %G!<%b%s%3!<%k%$%Y%s%H

  %W%m%;%9$N@8@.!$=|5n$r9T$J$&%$%Y%s%H!%

D_c : %W%m%;%9@8@.

D_d : %W%m%;%9>C5n

  %W%m%;%9@8@.$N;~!$@8@.5l$k%W%m%;%9?t$H<oN`$r<1JL$9k?aN%Q%i%a!<%?$,MW5a$5lk!%Nc$($P

$$D_c(2, Label)$$

  $HI=$9!%

- 8GDj2s$N7+$jJV7r9TJ&%k!<%W

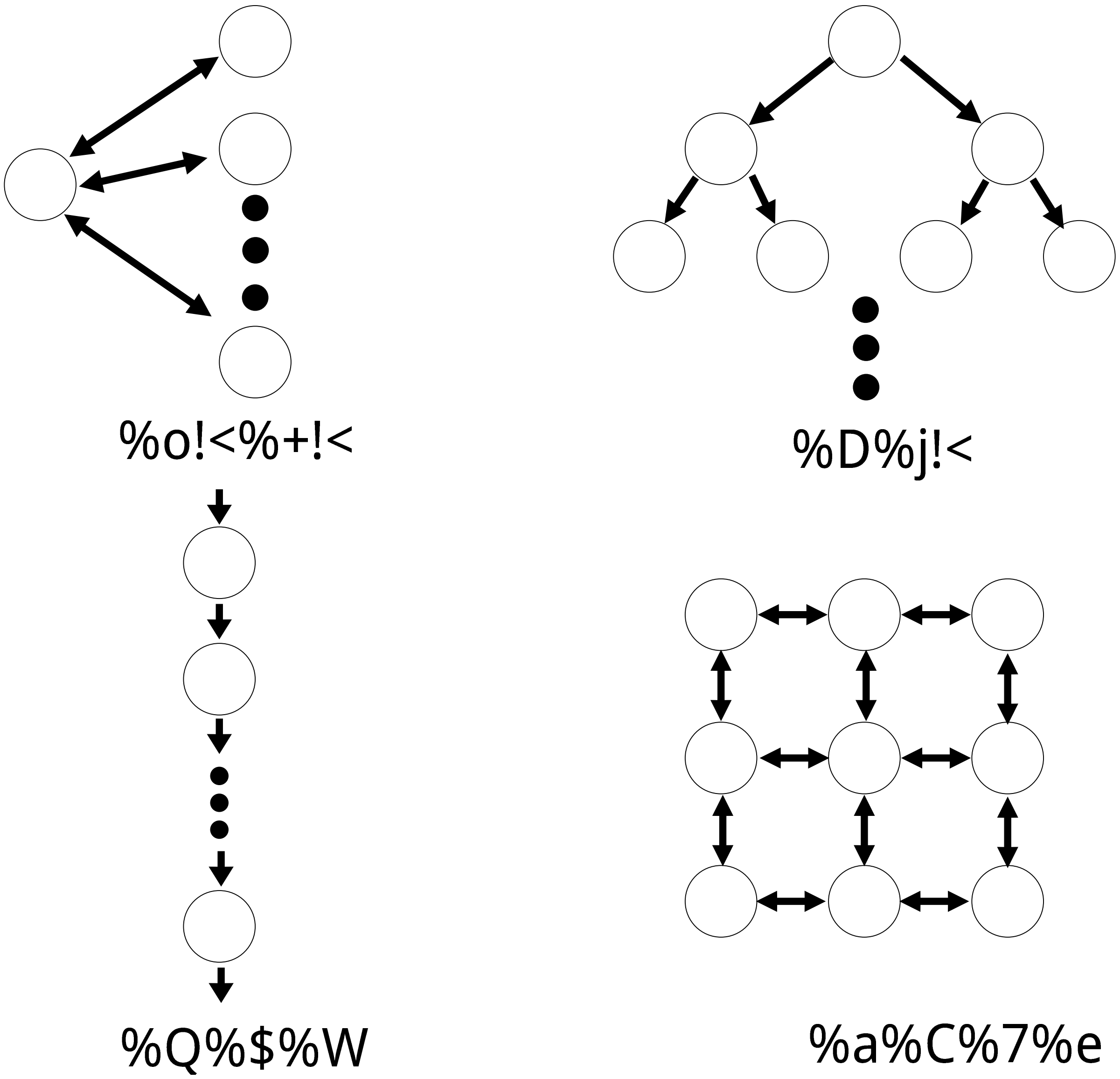
  7+jJV7$N2s?t$O<B9T0JA0$KJ,$+CF$$$k!%FOR-Loop J8$KAjEv$9$k!%

$FIX($%$%Y%s%H, !!&&&$)$

- >r7oKh$k%k!<%W

  7+jJV7$N2s?t$O<B9T;~$N>uBV$Khj7hDj5l$k!%WHILE-Loop J8$KAjEv9k!%

  COND(%$%Y%s%H, !!%&%&)



?^2: %H%]%m%8

2.3 JBNs<B9T9=B$

2>A[6&M-%a%b%j7?JBNs%^%7%sKSR-1 $K0MB8$7$?JBNs<B9T9=B$$K$D$$$F=RYk!%KSR-1 $O 7W;;%9%F!<%8$HJkJ#?t$N%W%m%;%C%5$rJBNs$K<B9T$9k3HKhj!$JBNs=hM}$,<B8=G-$k!%6&M-%a%b%jJBNs%W%m%0%i%_%s%0GO!$6&M-JQ?t$NAj8_GS=|$r<B8=$9k?aK!$%m%C%/!&%"%s%m%C%/$rM[$K;XDj$7!$3F%W%m%;%C%54V$N>pJs<x<u$r9T$&!%KSR-1 KO3F%W%m%;%C%5$K%9%l%C%I$,$=$l$>$lMQ0U5lF*$j!$3F%9%l%C%I4VGO%G!<%?$N6&M-$,G-!$6&M-%a%b%j$Khj%G!<%?DL?.$,2DG=$G$"$k!%3lKh$j%9%l%C%I4V$NF14|!$Aj8_GS=|$,MF0W$K<B8=$G$-$k!%JBNs%W%m%0%i%`$OF14|!$%?%9%/J,3dJIKhCF, $$$m$$$m$JF0E*?6$kIq$$$r9k!%KSR-1 >eGNJBNs<B9TKO$$$m$$$m$J%$%Y%s%H$,$"$k!%JBNs7W;;$r9T$&%9%F!<%8$HJk%9%l%C%I$N<+F0E*!$$"$k$$$O?t!&?%$%_%s%0$,J,$+$C$F$$$k;~$N@EE*$J@8@.!&C5n$d!$%9%l%C%I4V$N;2>H%G!<%?0MB8@-$r9MN8$7$F%G!<%?$N0l4S@-J];}$N$?$a$NF14|!&Aj8_GS=|$d!%3F7W;;%9%F!<%84V$G%G!<%?$N<u$1EO$7r9k?aN;2>H%G!<%?DL?.%Q%?!<%s$d!$3F%9%l%C%I$K7W;;BP>]$HJk%G!<%?$r?6$jJ,1k$?$a$N%?%9%/J,3d$JI,$"$k!%0J2<$KJBNs%"%k%4%j%:%`Kh$N<B9T9=B$$K$D$$$F@bL@9k!%

1. J,3dE}<#K!

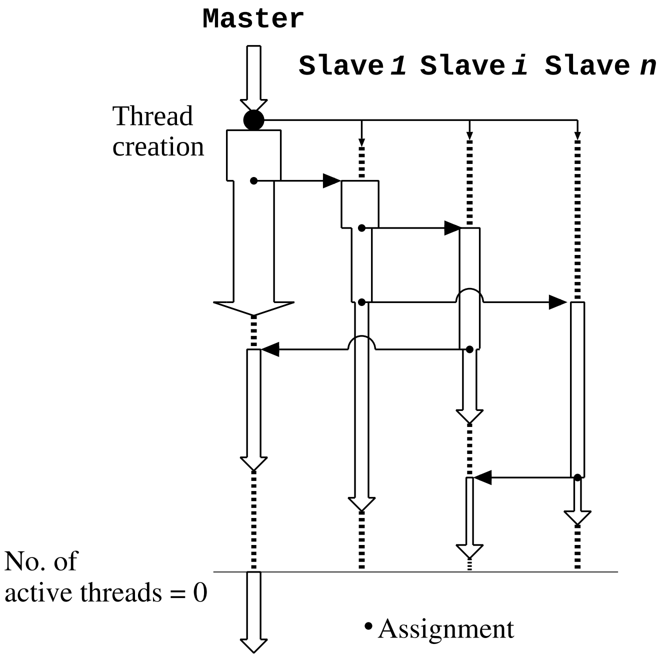
   J,3dE}<#K!$O%?%9%/J,3d$r7+jJV7$F$$$-!$7k2L$r2s<}9k3H$G2r$rF@$k%"%k%4%j%:%`$G$"$k!%?^3(a) $KJ,3dE}<#K!$NJBNs<B9T9=B$$r<($9!%%9%l%C%I$O%?%9%/$rJ,3d$7!$l DNJ,3d%?%9%/r=N^$^3N%9%l%C%I<+?H$,<u$1;}$A!$B>$NJ,3d%?%9%/$O%"%$%I%k%9%l%C%IKEO9$,!$%"%$%I%k%9%l%C%I$,8!:wG-J+C?>l9g$O!$B>$NJ,3d%?%9%/$b3N%9%l%C%I<+?H$,<u$1;}D3HKJk!%$=$7F3$N%?%9%/J,3d$rM?$($il?>r7o$,@.N)$9k^$G7+jJV7!$:G=*E*$KF@$il?7k2Lr=l>lN%9%l%C%I$+$i2s<}$7!$7k9g9k!%3F%9%l%C%I$O<u$1<hC?%?%9%/$N7W;;$,=*oCFb>CLG$;$:$K!$%"%$%I%k%9%l%C%IHJCFJ,3d%?%9%/rBTA!$A4FN%9%l%C%I$,%"%$%I%k%9%l%C%IHJC?;~E@$GJBNs7W;;$,=*N;$7!$%9%l%C%I$r>C5n9k!%

2. %W%m%;%C%5%U%!!<%`

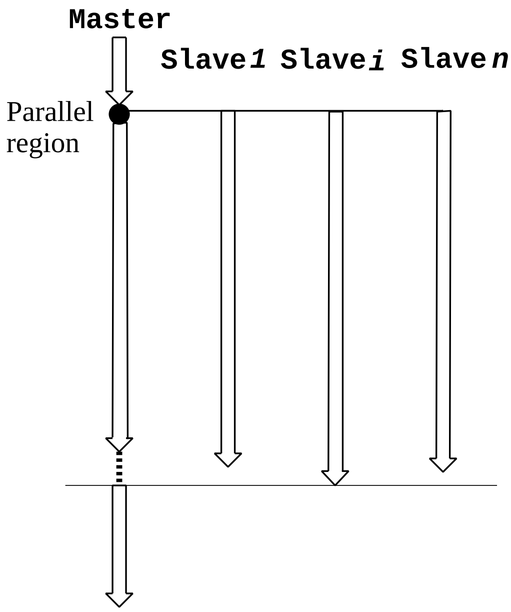
   %W%m%;%C%5%U%!!<%`$OJ,3d%?%9%/$r$=$l$>$l$N%9%l%C%I$GFHN)$K7W;;$7!$7W;;7k2L$r$^$H$a$k$3$H$G2r$rF@$k%"%k%4%j%:%`G"$k!%?^3(b) $K%W%m%;%C%5%U%!!<%`$NJBNs<B9T9=B$$r<($9!%%^%9%?!<$,%?%9%/$rJ,3d$7!$$=l>lN%9%l%C%I$K?6$jJ,1k!%3F%9%l%C%I$OB>$N%9%l%C%IHO40A4$KFHN)$7$F7W;;$7!$7k2L$r%^%9%?!<KJV9!%%^%9%?!<$,$=l>lN%9%l%C%I$+$i2s<}7?7W;;7k2Lr^Ha!$:G=*E*$J7k2L$rF@$k!%%?%9%/J,3d$O1 2s$@$19T$$!$$=l>lN%9%l%C%IO=$N1 D@1NJ,3d%?%9%/$G7W;;9k!%

3. %W%m%;%9%M%C%H%o!<%/

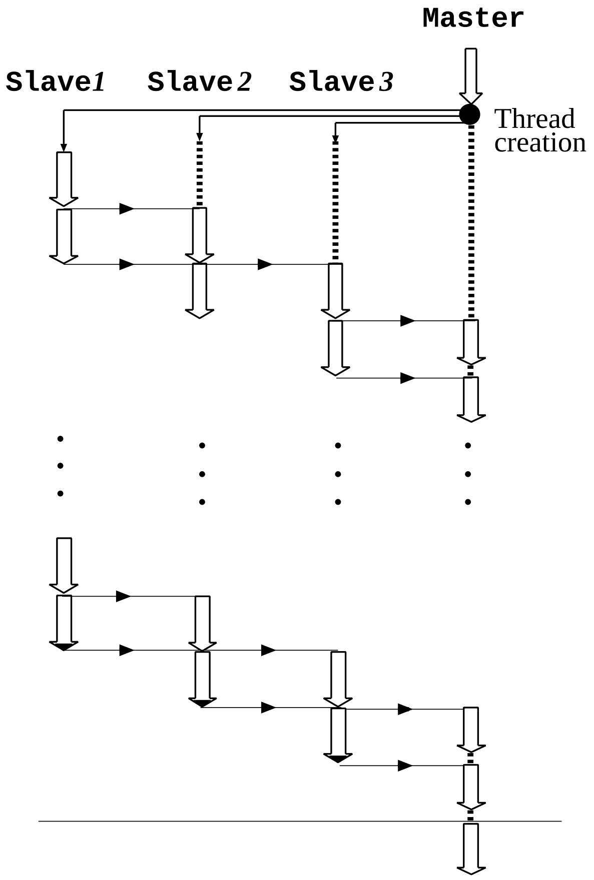
   %W%m%;%9%M%C%H%o!<%/$O7W;;%9%F!<%8$rJ#?t$KJ,$1!$J#?t$N%G!<%?$r3F7W;;%9%F!<%8$KN.$l:n6H$Nh&$KN.$9$3$H$G2r$rF@$k%"%k%4%j%:%`$G$"$k!%?^3(c) $K%W%m%;%9%M%C%H%o!<%/$NJBNs<B9T9=B$$r<($9!%%9%l%C%I$O>e0L%9%l%C%I$+$i%?%9%/$r<u$1<h$j!$$=$N%?%9%/$r4p$K7W;;$9$k!%$=7F2<0L%9%l%C%I$K%?%9%/$rEO$9$3HG2<0L%9%l%C%I$O7W;;$r3+;O$7!$$=$N%9%l%C%I<+?H$O>e0L%9%l%C%I$+$i$N<!$N%?%9%/rBTD!%3Nh&$J%Q%$%W%i%$%s=hM}$r$=$l$>$l$N%9%l%C%I$,F14|$r<h$jJ,$iJBNs$K7W;;$7!$$"$k>r7o$,@.N)9k$^$G7+jJV5lF7k2L$rF@$k!%


Master
Slave 1
Slave i
Slave n
Thread creation
No. of active threads = 0
• Assignment

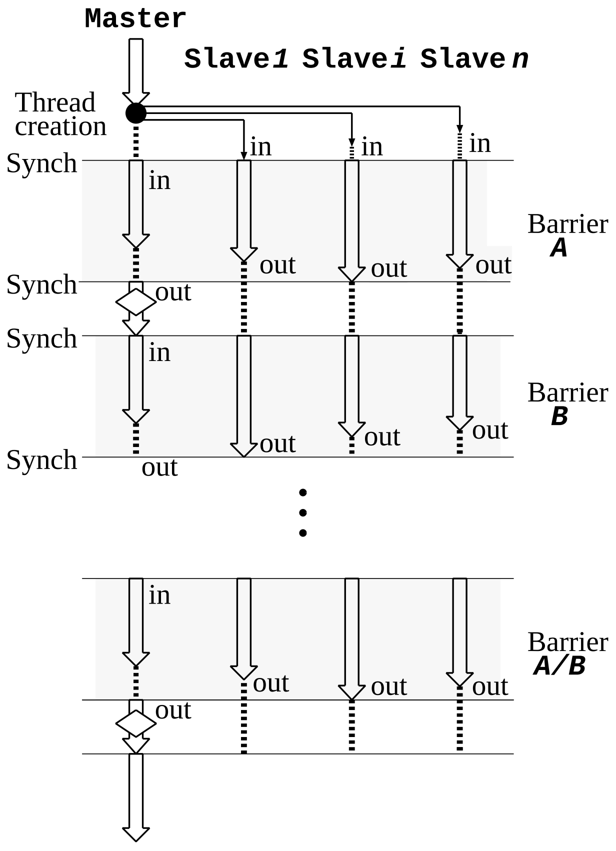
(a) °‹‡ ¯ …£¸¡


Master
Slave 1
Slave i
Slave n
Parallel region

(b) ¥ ¥ ¥»¥ˆ¥ ¥ ¥¡¡…¥


Master
Slave 1
Slave 2
Slave 3
Thread creation

(c) ¥ ¥ ¥»¥„¥˝¥ˆ¥˙¥ ¡…¥ﬂ


Master
Slave 1
Slave i
Slave n
Thread creation
in
in
in
Synch
in
Barrier
A
out
out
out
Synch
out
Synch
in
Barrier
B
out
out
out
Synch
out
in
Barrier
A/B
out
out
out
out

(d) •«⁄Œ˚ ⁄•˚ ·„

4. 7+jJV7JQ49

7+jJV7JQ49O=1>1N%9%1%C%I$,%?%9%/$rJQ49$7!$%^%9%?!<$,JQ497k2L$rI>2A$9
$kN.$1$r>r7o$,@.N)9k$^$G7+jJV7$F2r$rF@$k%"%k%4%j%:%`$G$"$k!%?^3(d) $K7+
jJV7JQ49$NJBNs<B9T9=B$$r<($9!%3F%9%1%C%I$OF14|$r<h$C$FF1;~$K$=$1$>$1$NJ,3d
%?%9%/$r7W;;$7$FJQ49$r9T$&!%%^%9%?!<$O$=$1$>$1$N%9%1%C%I$NJQ497k2L$rI>2A$7!$
>r7o$,@.N)$9$1$P$=$3$GJBNs7W;;$,=*N;HJk,!$@.N)$7J1$1$P>r7o$,K~$?$5$1$k
$^$GJQ49$r7+$jJV$9!%B>$N%9%1%C%IhjAa$/JQ49$,=*N;7?%9%1%C%I$,:FEYJQ49$,;O
$^$i$J$$$h$&$K!$2 DN%P%j%"$rMQ$$$FF14|$r<h$k!%

JBNs%W%m%0%i%`$N<g$J%$%Y%s%H$H7F!$%9%1%C%I@8@.!$%9%1%C%I4V!$$"$k$$$O%G!<%?4V
$NF14|$,$"$k!%F14|KOJ#?t$N%9%1%C%I4V$GF14|$r<h$k%P%j%"!$;2>H%G!<%?4V$GF14|$r<h
$k%_%e!<%F%C%/%9!$2 DN%9%1%C%I4V$GF14|$r<h$k%7%0%J%k!&&%'%$%H$,$"$k!%

%9%1%C%I@8@.KO%W%m%0%i%`Cf$G<+F0E*$K%9%1%C%I$r@8@.$9$kF0E*$J@8@.$N%Q%i%1%k%j!<
%8%g%s!$%W%m%0%i%`$G;XDj7?%?%$%_%s%0$G<jF0$G%9%1%C%I$r@8@.9k@EE*$J@8@.$N%9%1%C
%I%i%$%V%i%j$,$"$k!%%Q%i%1%k%j!<%8%g%s$O3F%9%1%C%I4V$GF14|$r<h$C$FF1;~$K%9%1%C%I
$r@8@.$7$FJBNs7W;;3+;O$N=`Hwr9$k!%%9%1%C%I%i%$%V%i%j$OJ,3d%?%9%/$,EO$5$1$F;O$a
$F%9%1%C%I$r@8@.7F7W;;3+;O$N=`Hw$r$7!$C4Ev9k7W;;$,=*$o1P%9%1%C%I$r>C5n$7$F
<!$NJ,3d%?%9%/$,Mhk^GBTD>l9g$K;HMQ$5$1$k!%%9%1%C%I%i%$%V%i%j$O3Nh&$JN.$1
$r%f!<%6$,%W%m%0%i%`Cf$GM[$K%W%m%0%i%_%s%0$9$k3H$G<B8=$7!$<g$KJ,3dE}<#K!$GMQ$$
i1$k!%

%^%9%?!<$,%A%'%C%/%$%s$N;X<($r=P7F!$3F%9%1%C%I$,F14|$r<h$C$FF1;~$K<B9T$r3+;O
$7!$A4%9%1%C%I$,%A%'%C%/%"%&%H$9kNrBTC$F3F%9%1%C%I$N7W;;7k2L$r%^%9%?!<$,;2>H
9k!%3N%a%+%K%:%`$r7+$jJV$79T$$$?$$>l9g$K%P%j%"$,MQ$$$i1k!%$^$?%P%j%"$O%^%9
%?!<$,%A%'%C%/%$%s7F$$$k;~$O!$%9%1!<%VKBP9$k%A%'%C%/%$%s$N5v2D$OB3$/$N$G!$%P%j
%"$,1<dN`$7$+$J$1$1$P!$%^%9%?!<hjAa$/%A%'%C%/%"%&%H$7$?%9%1!<%V$O$9$0$K:F%A%'%C
%/%$%s$r7F7^$&$N$G!$F14|$,@.N)$7J/Jk!%hC$F2 <dN`$N%P%j%"A/B $rMQ0U$9$k
3H$G!$%P%j%"A $r%A%'%C%/%"%&%H$7$?%9%1!<%V$O%^%9%?!<$,%P%j%"B $N%A%'%C%/%$%s5v
2D$r=P$9$^$GBTD3HKJk!%

%_%e!<%F%C%/%9$O6&M-JQ?t$r;2>H9k;~!$J#?t$N%9%1%C%I$,F1;~$K%G!<%?NFI_=q$-$r
7F!$%G!<%?$N014S@-rJx9NrKI0?aK;HMQ9kF14|G"$k!%%9%1%C%I$O%m%C%/r7
F+$i6&M-JQ?t$NFI$_=P$7/=q$-9~$_$r9T$$!$=*$o1P%"%s%m%C%/$r9T$&!%$"$k%9%1%C%I$,
%m%C%/Cf$O!$B>$N%9%1%C%I$O6&M-JQ?tNFI_=P$7/=q$-9~$_$,G-J/Jj!$6&M-JQ?t$r;2
>H9k>l9g$O%m%C%/Cf$N%9%1%C%I$,%"%s%m%C%/$9k^GBTD3HKJ$k!%

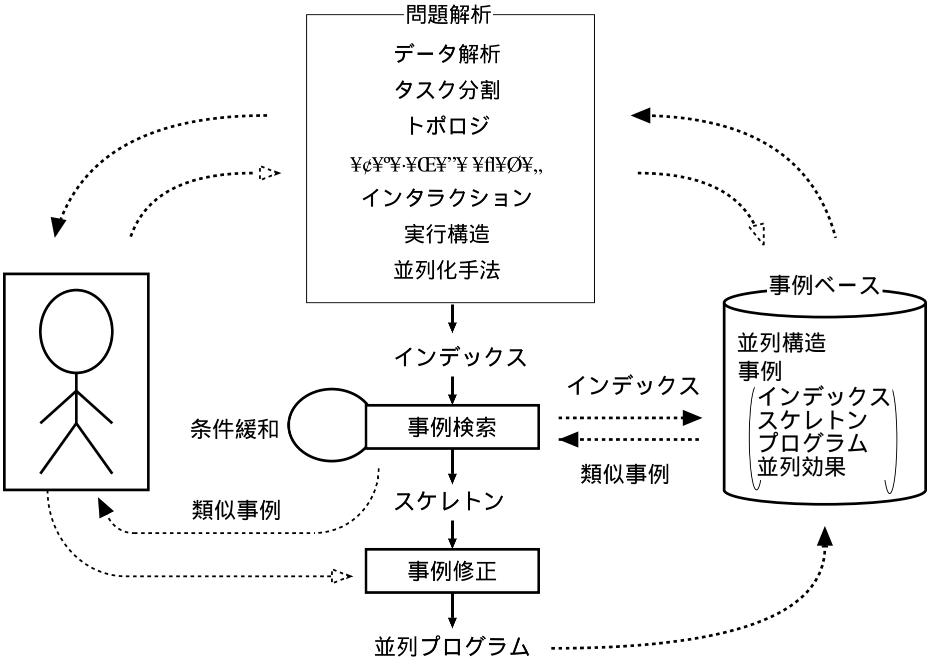
%7%0%J%k!&&%'%$%H$O6&M-JQ?t$rMQ$$$F!$2 DN%9%1%C%I4V$@1GF14|$r<hk?aK;H
MQ9k!%2 DN%9%1%C%I$O8_$$$KF14|$r<h$kAj<j$rG'<1$7F*$j!$$=1>1N%9%1%C%I$N
4X78$,L@3N$KDj5A$5$1$k!%$=1>1N%9%1%C%I$G%S%8!</%"%$%I%k$r<($96&M-JQ?t$rMQ0U$9
$k!%7W;;$r=*N;7?%9%1%C%I$,Aj<j$N%9%1%C%I$N>uBV$r6&M-JQ?t$+$iFI$_<h$j!$%S%8!<$G
$"$1$P<+J,$r%"%$%I%k$K7FAj<j$N%9%1%C%I$,7W;;$r=*N;$9kNrBTA!$%"%$%I%kG"$1
$PAj<j$r%S%8!<K7$F:F$S<+J,$HAj<j$N%9%1%C%I$,7W;;$r;Oak!%

3 ;vNc%Y!<%9JBNs%W%m%0%i%_%s%0%7%9%F%`

3.1 %7%9%F%`35MW

?^4$K%7%9%F%`9=@.$r<($9!%;vNc%Y!<%9$NCf$N0l$D$N;vNc$K$O!$LdBj$NDj5A!$%$%s%G%C%/%9!&%9%1%l%H%s!&W%m%0%i%`!&JBNs8z2L$N3F9`L\$K$D$$$F5-:\$5$l$F$$$k!%$=$N%$%s%G%C%/%9$K$O1~MQ!$;EMM!$%"%k%4%j%:%`!$=*N;>r7o!$%G!<%?9=B$!$%?%9%/J,3d!$%H%]%m%8!$%$%s%?%i%/%7%g%s!$JBNs2=<jK!!$<B9T9=B$$N#1#09`L\$K$D$$$F5-:\$5$l$F$$$k!%$3$N3F9`L\$K$D$$$F$N>\:Y$O8e$K=R$Y$k!%%9%1%l%H%s$OJBNs%W%m%0%i%`$N9|3J$D$^$j!$$=$NJBNs%W%m%0%i%`Cf$G;H$olk%G!<%?9=B$!$%?%9%/J,3d!$F14|!$Aj8_GS=|!$%9%1%C%I$J$I0lO"$NbN$,5-:\$5lF$$$k!%

$^$:!$%f!<%6!<$O$"$kM?$($il?LdBjKD$$$F!$%$%s%G%C%/%9$N3F9`L\$K1h$C$F2r@O$r9T$$$J$,$i!$%$%s%G%C%/%9$r:n@.$9$k!%%7%9%F%`$O$=$N%$%s%G%C%/%9$rMQ$$$F;vNc%Y!<%9NCf+$i:G$bN`;w$7$?;vNc$r8!:w$9$k!%8!:w$5$l$?;vNc$N%9%1%l%H%s$K$=$NLdBj$KI,MW$JJQ?t$d7W;;ItJ,$J$I$NFyIU$1!?=$@5$r$7!$JBNs%W%m%0%i%`$r40@.$5$;$k!%40A4$K%^%C%A$9$k;vNc$,8!:w5l$J$$>l9gGb!$>r7o$r4KOB$7!$:G$bN`;w$7$?;vNc$,8!:w$5$l$k$h$&$K$7!$LdBj$K9g$o$J$$ItJ,$O<jF0$GItJ,E*$K=$@5$7!$JBNs%W%m%0%i%`$r40@.5;$k!%$3Nh$&$K7FG-$?JBNs%W%m%0%i%`$b$^$?!$;vNc$H7F;vNc%Y!<%9$KC_@Q$5lk!%



?^4: JBNs%W%m%0%i%_%s%0;Y1g%7%9%F%`

3.2 ;vNc%Y!<%9$N9=C[

;vNc$O!$LdBj$NDj5A!$%$%s%G%C%/%9!&%9%1%l%H%s!&%W%m%0%i%`!&JBNs8z2L$N3F9`L\$K$D$$$F5-:\$5lF$$$k!%$=$7$F!$$=$N%$%s%G%C%/%9KO1~MQ!$;EMM!$%"%k%4%j%:%`!$=*N;>r7o!$%G!<%?9=B$!$%?%9%/J,3d!$%H%]%m%8!$%$%s%?%i%/%7%g%s!$JBNs2=<jK!!$<B9T9=B$$N#1#09`L\$K$D$$$F5-:\$5lF$$$k!%%9%1%l%H%s$OJBNs%W%m%0%i%`$N9|3J$D$^$j!$$=$NJBNs%W%m%0%i%`Cf$G;Hol$k6&M-JQ?t!$JQ?t$N0lIt!$%9%l%C%I4X78!$7W;;$d7k2L$N2s<}>l=j$J$I0lO"$NbN$,5-:\$5lF$$$k!%

$3$3$G!$;vNc$N0lHIE*I=8=$r<($9!%

1. LdBj$NDj5A

   LdBj$N@bL@

2. %$%s%G%C%/%9

1~MQ	?tCM7W;;!$%G!<%?=hM}!$5-9f=hM}!$%S%8%M%9%G!<%?=hM}
;EMM	LdBj$NDj5A
%G!<%?9=B$	%=!<%9%G!<%?: 7W;;KI,MWJ%G!<%? 7k2L%G!<%? : 7W;;7k2L%G!<%?
%?%9%/J,3d	%=!<%9%G!<%?: J,3dBP>]!$J,3dC10L!$J,;6J}K! 7k2L%G!<%? : J,3dBP>]!$J,3dC10L!$J,;6J}K!
=*N;>r7o	>r7o<0
%H%]%m%8	%o!<%+!<!$%D%j!<!$%Q%$%W!$%a%C%7%e
%"%k%4%j%:%`	%W%m%;%C%5%U%!!<%`!$J,3dE}<#K!!$%W%m%;%9%M%C%H%o!<%/!$7+$jJV$7JQ4 9
<B9T9=B$	BACS
JBNs2=<jK!	%Q%i%l%k%j!<%8%g%s!$%Q%i%l%k%;%/%7%g%s!$%9%l%C%I%i%$%V%i%j
%$%s%?%i%/%7%g%s	%7%0%J%k!&%&%(%$%H!$%P%j%dF14 |!$mutex

3. %9%1%l%H%s

   JBNs%W%m%0%i%`$N9|3J!%G!<%?9=B$!$%?%9%/J,3d!$F14|!$Aj8_GS=|!$%9%l%C%I!K

4. %W%m%0%i%`

   %W%m%0%i%`$NK\BN

5. JBNs8z2L

   B.EY8~>e$r<($9%0%i%U$H%3%a%s%H

4 N`;w;vNc$rMQ$$$?JBNs%W%m%0%i%_%s%0

4.1 %S%8%M%k0E9f

1. LdB jD j5A[2]

0E9f2=O, G0U$N>pJs$r, $"$k5,B'$K=>$C$F, A4$/JL$N>pJs$KJQ49$7, B><T$KFbMFrCNilJ$$$h$&$K9k5;=QG"$k. %S%8%M%k0E9f !Vigenere cipher!KO=$N<jK!$N#1DG, C;$$%-!<%o!<%I$r7+$jJV$7MQ$$$F, 3F%9%F%C%W4H$K!"8 0$N1Q;z$NHV9f$HJ?J8$N1Q;z$NHV9f$NOB !#2#7$rK!H9$k!K$r0E9fJ8$N1Q;z$NHV9fH9$k."ATTACK AT DAWN" $H$$$&J8$r, %-!<%o!<%I$rABC H7$F0E9f2=$9kH, <!Nh$&$KJk.

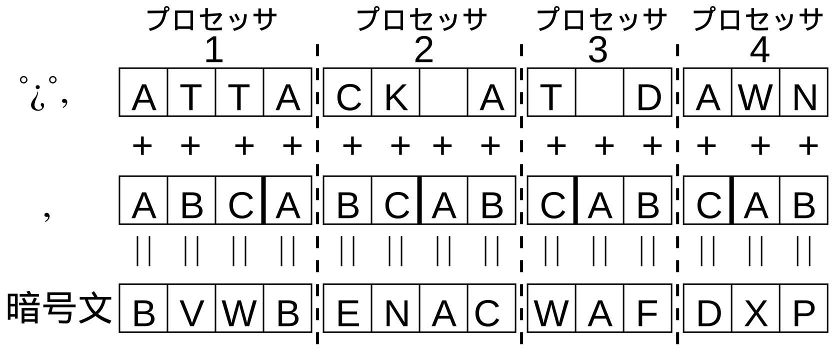
J?J8 :ATTACK AT DAWN

80 :ABCABCABCABCAB

0E9fJ8 :BVWBENACWAFDXP

2. JBNs2=

%S%8%M%k0E9fGO, 0E9f2=9kJ8;zNs$N3FJ8;z$4HK, %-!<%o!<%I$NBP1~$9$kJ8;z$rMQ$$$F, FHN)$K=hM}$9kN$G, J,3dBP>]$O%=!<%9%G!<%?G"$kJ?J8 !$JbHNJ8!KH7, 3FJ8;z$N0E9f2=$KMW9k7W;;NL$O, INJ8;z$bF1$8JN$G, %V%m%C%/$KhkJ,3drE,MQ9$k. ?^5$K%S%8%M%k0E9f$N%?%9%/J,3d$r<($9. $^$?, %-!<%o!<%I$r7+$jJV7EMQ$$$kH-, %?%9%/4V$K%-!<%o!<%I$,$^$?$,$k3H$,$"kN$G, 3F%9%l%C%I$G$O0E9f2=$N=hM}$r;O$a$kA0$K, $=$N%9%l%C%I$G%-!<%o!<%I$N2?J8;zL\$+$i;HMQ$9k+$r7W;;$9kI,MW,$"$k. ?^5$N>l9g$G$O, #1BfL\$O%-!<%o!<%IABC $N#1J8;zL\$NA $+$i, #2BfL\$O#2J8;zL\$NB $+$i, #3BfL\$O#3J8;zL\$NC $+$i, #4BfL\$O#3J8;zL\$NC $+$i;HMQ9k3HKJkN$G, 3N3H$r3F%9%l%C%I$O, 0E9f2==hM}$r;OakA0$K7W;;7F$*$+J1lPJi$J$$.



?^5: %S%8%M%k0E9f$NJBNs2= !%W%m%;%C%5!#4Bf!K

3. %$%s%G%C%/%9

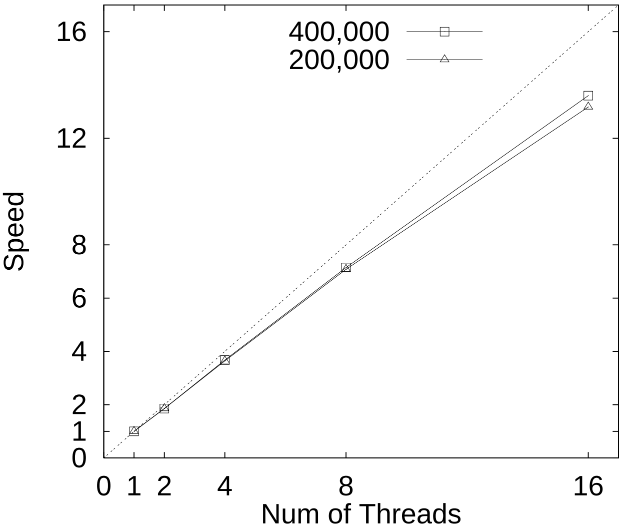
%S%8%M%k0E9f$N%$%s%G%C%/%9$rI=1$K<($9.

I=1: %S%8%M%k0E9f$N%$%s%G%C%/%9(KMP K!$+$i=$@5)

	1~MQ	0E9f2=
	;EMM	TEXT $r%S%8%M%k0E9f$G0E9f2=9k!#0E9fKey $OTEXT A4BN $G6&DL$G!"%9%1%C%I?t$GJ,3d$7$?%5%VTEXT $r0E9f2=$9$k:]!" Key $N2?J8;zL\$+$i;HMQ$7;OaJ$1$1$P$$$1$J$$$+9MN8$9$k
"$	%G!<%?9=B$	%=!<%9%G!<%?: J8;z7?1<!85G[Ns TEXT J8;z7?1<!85G[Ns Key 7k2L%G!<%? : J8;z7?1<!85G[Ns TEXT
"$	%?%9%/J,3d	%=!<%9%G!<%?: TEXT, %V%m%C%/, %V%m%C%/ 7k2L%G!<%? : TEXT, %V%m%C%/, %V%m%C%/
!{	=*N;>r7o	J7
!{	%H%]%m%8	%^%9%?!<!u%o!<%+!<
!{	%"%k%4%j%:%`	%W%m%;%C%5$U%!!<%`
!{	<B9T9=B$	C^t
!{	JBNs2=<jK!	%Q%i%1%k%j!<8%g%s
!{	%$%s%?%i%/%7%g%s	J7

4. JBNs8z2L

#4#0K|J8;z$H#3#0K|J8;z$N%F%-%9%H$r%-!<%o!<%I ABC $G0E9f2=$7$?. ?^6$K%S%8%M%k0E9f$NJBNs8z2L$r<($9. %W%m%;%C%5$,#1#6BfNH$-, A0<T$GLs#1#3. #6G\, 8e<T$GLs #1#3. #2G\$NB.EY8~>e$,F@$il?.



?^6: %S%8%M%k0E9f$NJBNs8z2L

5. ;vNc=$@5

KMP K!$N;vNc$rbH$K, %S%8%M%k0E9f$NJBNs%W%m%0%i%`$r:n@.$7$?$H$-, ;vNc$+$i$I $NItJ,$r:FMxMQ$7, $I$NItJ,$r=$@5$7$?$+$J$I$r, 0J2<$NJBNs%W%m%0%i%`$N:8C<$K5-9frIU1$?$bNG, 0J2<$K<($9 !\0J1lIt>JN,!K :8C<$N5-9f$OI=2$KBP1~$7, 6uGr9T$OC`<!%W%m%0%i%`$+iNMxMQ, S C1FHGO%9%1%l%H%s$+$i$NMxMQ$G$"$k.

I=2: ;vNc=$@5$N5-9f

	%9%1%C%I(T)	F14|(S)	%?%9%/J,3d(D)
:FMxMQ(S)	ST	SS	SD
=$@5(M)	MT	MS	MD
?75,(N)	NT	NS	ND

```
!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2
S:#include<stdio.h>
S:#include<string.h>
S:#include <ksr/numarg.h>
S:#include <ksr/ksr_timers.h>
S:#define NUMCHAR 400001

ST:int THREADs ,myteam;
S:int text[NUMCHAR];
ST:int NumText;
  int angou;
  char *Key;
S:void work(void);

  main(int argc, char *argv[])
  { FILE   *in_fp,*out_fp;
    int i;
S:  double  as , us;
    char temp[10];

ST:  printf("num of THREADs = ");
ST:  scanf("%d",&THREADs);

  if ( ( in_fp = fopen( argv[1], "r" ) ) == NULL )
   { printf("file not found\n" );  exit(1); }
  strcpy(temp,argv[1]);
  if (argc == 3){ strcat(temp, "An"); angou = 1;}
  else{ strcat(temp, "De"); angou = -1; }
  out_fp = fopen(temp, "w");

  Key = argv[2];
ST: NumText = 0;
ST: while (( text[NumText] = fgetc(in_fp)) != EOF ) NumText++;
ST: text[NumText] = '\0';
```

```
  fclose(in_fp);

ST:  myteam = pr_create_team(THREADs);
S:  as = all_seconds();
S:  us = user_seconds();
SS:  pr_pcall(myteam, work, copyargs(THREADs));
S:  printf("CPU time = %f\n",user_seconds()-us);
S:  printf("Elapsed time = %f\n",all_seconds()-as);

     for(i = 0; i < NumText; i++)
      {fprintf(out_fp, "%c", text[i]);}
     fclose(out_fp);
}
S:void work(void)
 {
MD:  int THREADno,i,k, offset, tmp, start,shift;

SD:  THREADno = pr_mid();
SD:  offset = NumText / THREADs;
SD:  tmp    = NumText % THREADs;
MD:  if (THREADno <  tmp) start = THREADno * (offset+1);
MD:  else start = (THREADno-tmp) * offset+ tmp * (offset+1);
ND:    shift = start % strlen(Key);
MD:  if (THREADno < tmp ) offset++;

ND:  k = shift;
  for (i = start; i < start + offset; i++){
      if (Key[k] == ’\0’) k = 0;
      if (angou == 1)
        {text[i] = text[i] + angou * (Key[k] - ’a’ + 1);}
      else if (angou == -1)
        {text[i] = text[i] + angou * (Key[k] - ’a’ + 1);}
      k++;
  }
}
```

4.2 %i%s%l%s%0%9O5=L

1. LdBjDj5A[2]

O5=LHO%U%!%$%k$N%5%$%:$r>.5/$7, 5-21NNO$hJI$r@aLs$9$k5;=Q$G, $=$N5;=QKh$k%W%m%0%i%`$H7F, UNIX $Ngzip $dWindows $Nlha JI$,$"$k. %i%s%l%s%0%9O5=L(run-length encoding) ONc($P, AAAABBBAAAAAACCCCCCCBBBBB $H$$$&J8;zNs$,$"C?H-, 3NJ8;zNs$r A4B3A6C7B5 $H$$$&h&$K, J8;z$H$=$NJ8;z$NO"B3$9$k?t$H$NAH9g$;KCV-49$($kJ}K!G"$k. 7+$7, 3NJ}K!GONc$($P ABC $H$$$&J8;zNs$O,A #1B #1C #1$HJC$F>iD9$KJkNG, #1J8;zNH$-$O=hM}7J$$$3HK9k.

2. JBNs2=

%i%s%l%s%0%9O5=LGO, %=!<%9%G!<%?$N%F%-%9%H$rJ,3d7F$b, J,3d$7$?3F%F%-%9%H$r%=!<%9%G!<%?H7$FO5=L=hM}$r9TC?8e, #1DN%F%-%9%HK^HalP, 7k2L$OF1$8KJ$k. $=$N$?$a, JBNs2=9kKO%=!<%9%G!<%?$r%W%m%;%C%5Bf?t$G3dC?J,$@$1, 3F%W%m%;%C%5$K=hM}$5$;$lPh$$. 3F%W%m%;%C%5$OF HN)$K=hM}9kNG, 9b$$JBNs8z2L$,M=A[$5lk.

3. %$%s%G%C%/%9

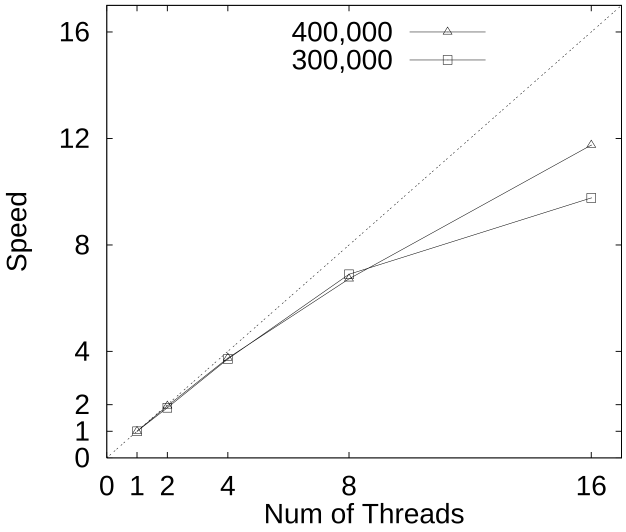
%i%s%l%s%0%9O5=L$N%$%s%G%C%/%9$rI=3$K<($9.

I=3: %i%s%l%s%0%9O5=L$N%$%s%G%C%/%9(KMP K!$+$i=$@5)

	1~MQ	O5=L
	;EMM	1Q;zN_$NTEXT $r%i%s%l%s%0%9$GO5=L9k. F1$81Q;z$,O"B3$7$?H-, $=$N1Q;z$HO"B3$7$??t$NAH9g$;$GI=8=$7D>$9$3$H$GO5=L$9$k.
"$	%G!<%?9=B$	%=!<%9%G!<%?: J8;z7?1<!85G[Ns TEXT 7k2L%G!<%? : J8;z7?1<!85G[Ns TEXT
"$	%?%9%/J,3d	%=!<%9%G!<%?: TEXT, %V%m%C%/, %V%m%C%/ 7k2L%G!<%? : TEXT, %V%m%C%/, %V%m%C%/
!{	=*N;>r7o	J7
!{	%H%]%m%8	%^%9%?!<!u%o!<%+!<
!{	%"%k%4%j%:%`	%W%m%;%C%5%U%!!<%`
!{	<B9T9=B$	C^t
!{	JBNs2=<jK!	%Q%i%l%k%j!<%8%g%s
!{	%$%s%?%i%/%7%g%s	J7

4. JBNs8z2L

#4#0K|J8;z$H#3#0K|J8;z$N%F%-%9%H$r%i%s%l%s%0%905=L$7$?. ?^7$K%i%s%l%s%0%905=L$NJBNs8z2L$r<($9. %W%m%;%C%5$,#1#6BfNH$-, A0<T$GLs#1#1. #7G\, 8e<T$GLs#9. #8G\$NB.EY8~>e$,F@$il?.



?^7: %i%s%l%s%0%905=L$NJBNs8z2L

5. ;vNc=$@5

KMP K!$N;vNc$rbH$K, %i%s%l%s%0%905=L$NJBNs%W%m%0%i%`$r:n@.$7$?$H$-, ;vNc$+$i$I$NItJ,$r:FMxMQ$7, $I$NItJ,$r=$@5$7$?$+$J$I$r, JBNs%W%m%0%i%`$N:8C<$K5-9frIU1$?$bNG0J2<$K<($9 !J0lIt>JN,!K

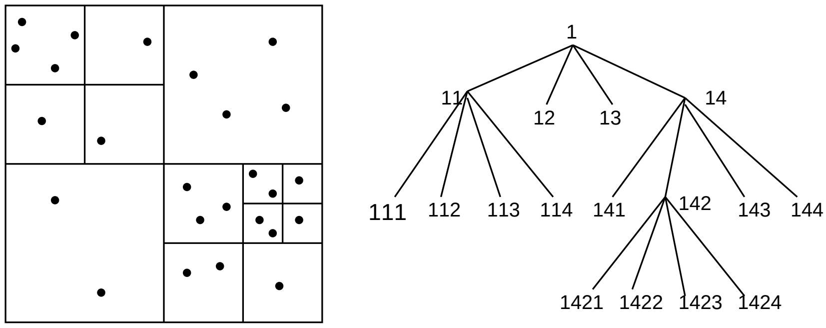
```
!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2
S:#include <stdio.h>
S:#include <ksr/numarg.h>
S:#include <ksr/ksr_timers.h>
S:#define NUMCHAR 400001
S:char indata[NUMCHAR];
N:char outdata[NUMCHAR];
N:int outsize[16];
ST:int NumText,THREADs ,myteam;
S:void work(void);

main(int argc, char *argv[])
{  FILE *infile,*outfile;
N: int no,start,tmp,offset,i;

***************%3%^%s%I%i%$%s0z?t%A%'%C%/*********
**********FI$_9~$_!"=q$-9~$_%U%!%$%k$N%*!<%W%s****

ST: printf("num of THREADs = ");
ST: scanf("%d",&THREADs);
```

```
ST:  NumText = 0;
ST:  while (( indata[NumText] = fgetc(infile)) != EOF ) NumText++;
ST:  indata[NumText] = '\0';
  fclose(infile);
ST: myteam = pr_create_team(THREADs);

****************;~4V7WB,3+;O**********************
SS: pr_pcall(myteam, work, copyargs(THREADs));
****************;~4V7WB,=*N;!"7P2a;~4V$NI=<(*******

N: offset = NumText / THREADs;
N: tmp    = NumText % THREADs;
N: for(no=0;no<16;no++){
N:  if (no <  tmp) start = no * (offset+1);
N:  else start = (no-tmp) * offset+ tmp * (offset+1);
N:   for(i=start;i<start+outsize[no];i++)
N:     fprintf(outfile,"%c",outdata[i]);}
  fclose(outfile);
}
void work(void)
{ SD: int THREADno, offset, tmp, start,i,j,k;
  N: char temp;
     int count;
SD: THREADno = pr_mid();
SD: offset = NumText / THREADs;
SD: tmp    = NumText % THREADs;
MD:  if (THREADno <  tmp) start = THREADno * (offset+1);
MD:  else start = (THREADno-tmp) * offset+ tmp * (offset+1);
SD: if (THREADno < tmp ) offset++;

count=1; j=start; temp=indata[start];
for (i=start+1; i<=start+1+offset; i++)
      {**************** 05=IK\BN--->JN, *****************}
   outdata[j]='\0';
N: outsize[THREADno]=j;
}
```

4.3 C_@QK!

1. LdBjDj5A[4]

#1Kg$N2hA|$NCf$KB?$/$NE@$,B8:_7F$$$kH-, $=$1iNE@$N:BI8CM$H, E@$N;}$DIU B0>pJsHr5-21$9$kJ}K!G"$k. E@$N?t$,B?$$$H, $"$kE@H=$NIUB0>pJs$r<h$j=P$9 $?$aK+$+$k;~4V$,I,A3E*$KD9$/$J$k. $=$3$GE@$N?t$,B?$$$H$-, ?^8$N(a) K"kh $&$K, #12hLL$r#4J,3d$7, $=$1$>$1$NItJ,2hLIFb$NE@r^Ha$F5-21$9$k. $3$1$r7+$j JV$79T$$, 3FItJ,2hLIFb$NE@$N?t$,, 5v$5$1$?CM0JFbKJ1P=*N;9k. $=$7$F?^8$N (b) K"kh$&$K, 3F%N!<%I$+$i#4K\$N;^$r=P$9%H%j!<$rJ,3d$5$1$?2hLL$KBP1~$7$F :n@.$7, E@$N%G!<%?$r4IM}9k.



(a)領域の4分割　(b)データの蓄積

?^8: C_@QK!

2. JBNs2=

2hLL$NE@$N?t$rD4$Y$F, 5vMFCM$h$jB?$1$1$P, 2hLL$r#4J,3d$9$k. %"%$%I%k%9%1%C%I$r 8+$D1F, J,3d$5$1$?2hLL$r3F%9%1%C%I$K3d$jEvFk. %"%$%I%k%9%1%C%I$,8+D+iJ $$$H$-$O, A4%9%1%C%I$,7W;;Cf$JNG, $$$:1+$N%9%1%C%I$,6u$/$^GBTD. $3$1ir 7+jJV7, J,3d$5$1$?3F2hLIFb$NE@$N?t$,5vMFCM0J2<G"1P, =hM}$O40N;$9$k. 3F%9 %1%C%I$KEO$9%G!<%?$O, $=$N%9%1%C%I$,C4Ev$9$kItJ,NN0h !;JM3Q7A!K$N:8>e$H1&2<$N E@NX,Y$:BI8H=$NItJ,NN0h$NA4NN0hCfGN0LCV !%JH%j!<GN3,AX!KG"$k.

3. %$%s%G%C%/%9

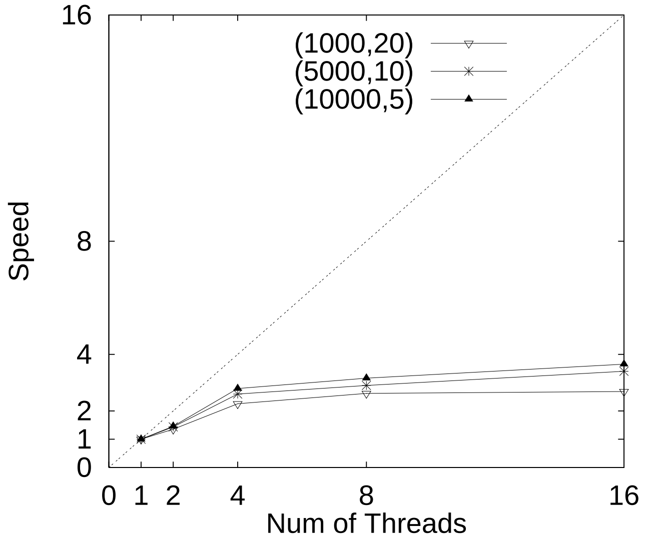
C_@QK!$N%$%s%G%C%/%9$rI=4$K<($9.

I=4: C_@QK!$N%$%s%G%C%/%9(%/%$%C%/%=!<%H$+$i=$@5

	1~MQ	C_@QK!
	;EMM	#1DNNN0h$KB?$/$NE@$,;6:_7F$$$kH9$k. $=$NH-, $=$NNN0h$r#4J,3d$7, J,3d7?NN0hFb$NE@$r$^$HaF5-21$9$k. 3FNN0hFb$NE@$N?t$,, 5vMFHO0O$N?tKJk^$G7+$jJV$9.
	%G!<%?9=B$	%=!<%9%G!<%?: @0?t#2<!85G[Ns data @0?t7?pmax 7k2L%G!<%? : @0?t7?pos, count
	%?%9%/J,3d	%=!<%9%G!<%?: data, %V%m%C%/, %V%m%C%/ pmax, , %3%T!< 7k2L%G!<%? : J7
	=*N;>r7o	J,3d5l$?NN0h$NE@$N?t!c!apmax
!{	%H%]%m%8	%H%j!<
!{	%"%k%4%j%:%`	J,3dE}<#K!
!{	<B9T9=B$	$Cond\{I^{p(i)}_{waitNew_task}, Cond(C^{p(i)}, I^{p(i)}_{searchIdle_thread})\}$
!{	JBNs2=<jK!	%Q%i%l%k%j!<%8%g%s
!{	%$%s%?%i%/%7%g%s	%_%e!<%F%C%/%9

4. JBNs8z2L

2hLL$N%5%$%:$r#2#0#0#0x #2#0#0#0$H$7, 2hLIFb$NE@$NAm?t, J,3d2hLIFb$NE@$N5vMF?t$r !J#1#0#0#0, #2#0!K, !J#5#0#0#0, #1#0!K, !J#1#0#0#0#0, #5!K$N#3AH$G<B83$r9T$C$?. ?^9$KC_@QK!$NJBNs8z2L$r<($9. %W%m%;%C%5$,#1#6BfNH$-, =g$KLs#2.#7G\, Ls#3.#4G\, Ls#3.#7G\$NB.EY8~>e$,F@$il?.



?^9: C_@QK!$NJBNs8z2L

5. ;vNc=$@5

%/%$%C%/%=!<%H$N;vNcrbHK, C_@QK!$NJBNs%W%m%0%i%`$r:n@.$7$?$H$-, ;vNc$+$i $I$NItJ,$r:FMxMQ$7, $I$NItJ,$r=$@5$7$?$+$J$I$r, 0J2<$NJBNs%W%m%0%i%`$N:8C<$K 5-9f$rIU1?bN$G, 0J2<$K<($9 !0JlIt>JN,!K

```
!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2!2
S:#include <stdio.h>
ST:#include <pthread.h>
S:#include <ksr/numarg.h>
S:#include <ksr/ksr_timers.h>
#define MSIZE 3000

SS:pthread_mutex_t mu;
int data[MSIZE][MSIZE], pmax;
ST:int ActiveThreads, THREADs,*box;
MD:int L[16][2],R[16][2],Pos[16];
N:void divide(int ,int ,int, int, int, int);
N:void thread_divide();

void main(void)
{S:  double as, us;
ST:  int i, team;
     int n,mSIZE=MSIZE;

ST: printf("num of threads\n");
ST: scanf("%d",&THREADs);
  printf("E@$NAm?t?");  scanf("%d",&n);
  printf("#1$D$NNN0h$NE@$N?t?"); scanf("%d",&pmax);
  srand();
  for(i=0; i<n; i++){ data[rand()%mSIZE][rand()%mSIZE]=1;}

ST:  box    = (int *)malloc(sizeof(int)* THREADs);
SS:  pthread_mutex_init(&mu,pthread_mutexattr_default);
ST:  for(i=1; i<1+THREADs; i++) box[i]=0;

MD:  L[0][0]=0; L[0][1]=0; R[0][0]=mSIZE; R[0][1]=mSIZE;
MD:  Pos[0]=0
ST:  ActiveThreads=1;
ST:  box[0]=1;

S:  as = all_seconds();
S:  us = user_seconds();
ST:  team = pr_create_team(THREADs);
SS:  pr_pcall(team, thread_divide, copyargs(THREADs));
S:  printf(" CPU time = %f \n",user_seconds()-us);
S:  printf(" Elapsed time = %f \n",all_seconds()-as);
}
void thread_divide()
```

```
{MD:int  no,flag, i,j,Lx,Ly,Rx,Ry,pos;
SD: no = pr_mid();
SD: while(1)
    {
  SD: flag=0;                            /* box $NCM$,1$J$i 7W;;$r9T$G$F$$$k */
  ST:  while((ActiveThreads!=0) && (flag==0)) flag = box[no];
  ST:  if(ActiveThreads==0)  break;
  MD:  Lx=L[no][0];Ly=L[no][1];Rx=R[no][0];Ry=R[no][1];
  MD:  pos=Pos[no];
      divide(Lx,Ly, Rx,Ry ,pos);
  SS: pthread_mutex_lock(&mu);
  ST: ActiveThreads--;
  ST: box[no]=0;
  SS: pthread_mutex_unlock(&mu);
    }
}
void divide(int Lx,int Ly, int Rx, int Ry, int pos)
{ int count=0;
  int i,j;
  int tmppos;
SD:int nextno;
  tmppos=pos*10;

  for(j=Ly; j< Ry; j++){
    for(i=Lx; i< Rx; i++){if (data[i][j]==1) count++;}}
  printf("in%d count=%d\n",pos,count);
  if (count >pmax){
SD:  nextno=0;
SS:  pthread_mutex_lock(&mu);
-----------------$3$3$+$i------------------------------------
ST:  if( ActiveThreads < THREADs ) {
ST:     ActiveThreads++;
ST:     while( ( nextno < THREADs ) && ( box[nextno]==1 ) ) nextno++;
MD:     L[nextno][0]=Lx;L[nextno][1]=Ly;               ------(1)
MD:     R[nextno][0]=(Rx+Lx)/2;R[nextno][1]=(Ry+Ly)/2; ------(2)
MD:     Pos[nextno]=tmppos+1;                          ------(3)
ST:     box[nextno]=1;
SS:     pthread_mutex_unlock(&mu);}
-------$3$3$^$G(1)(2)(3) $NFbMF$@$1$,JQ$o$C$F#42s7+$jJV$7------
 }
}
```

5 ;vNc$N:FMxMQEY$NI>2A

1. %S%8%M%k0E9f

%S%8%M%k0E9f$NJBNs2=$O, JBNs%"%k%4%j%:%`$,%W%m%;%C%5%U%!!<%`KJk3H,M=A[5l$?$N$G, %W%m%;%C%5%U%!!<%`$GJBNs2=$5$l$F$$$k KMP K!$N;vNc$r$b$H$K:n@.$9 $k$3$H$K$7$?. KMP K!$NJBNs%W%m%0%i%`$G, $=$l8GM-$NItJ,$O:FMxMQG-$J$$$,, JB Ns=hM}$K4X$9$kItJ,$O$[$\$=N^$^:FMxMQ$G$-$?. 7+$7, %?%9%/J,3d$NJ}K!$O, 0lHL E*$K3FLdBj4H$K8D@-$NGkH3mG, 3N%S%8%M%k0E9f$NJBNs2=$N>l9g$O, KMP K! $H0[$J$k%?%9%/J,3d$KJC$?. 3N%S%8%M%k0E9f$N%?%9%/J,3d$NJ}K!$O, KMP K!N= lH$O0[$JkN$G, ?7$?$J%W%m%;%C%5%U%!!<%`$N;vNc$H$7$F, Lr$KN)$D$H;W$&. $^$?, KMP K!$H%S%8%M%k0E9f$NJBNs%W%m%0%i%`$r%9%l%C%I, F14 |, %?%9%/J,3d, C`<!%W%m%0 %i%`KD$$$F, :FMxMQ7?9T?t, =$@5$7$?9T?t, ?75,$K:n@.7?9T?t$rD4$Y, ;vNc$N:F MxMQEY$rI>2A7?. $=$N7k2L$rI=5$N>eCJ$K<($9. I=$+$i%9%l%C%I$O#89T, F14 |$O#19T $"$j, N>J}Hb:FMxMQ5l$F$$$k3H$,$o$+$k. %W%m%;%C%5%U%!!<%`$G$O, :G=i$K$^$H $a$FI,MW$J?t$@$1%9%l%C%I$r@8@.$7, 3F%W%m%;%C%5$K0l@F$K=hM}$r;O$a$5$;$k$?$a$K #1EY$@$1F14 |$r<h$k$+$i$G$"$k. $3$l$O$[$\Dj7?$N$b$N$J$N$G, :FMxMQ$5$l$k2DG=@- $,9b$$. C`<!%W%m%0%i%`$N0E9f2==hM}It$O$[$HsIJQ99J7$K:FMxMQ$G$-$?. $^$?, Hf 3SE*%?%9%/J,3d$G=$@5$9$k8D=j$,B?$+C?.

2. %i%s%l%s%0%905=L

3l$b%S%8%M%k0E9f$NH-$HF1MM$K, JBNs%"%k%4%j%:%`$,%W%m%;%C%5%U%!!<%`KJ$k 3H$,M=A[$5l?NG, KMP K!$N;vNcrbHK:n@.$9k3HK7?. I=5$NCfCJ$K%i %s%l%s%0%905=LGN;vNc$N:FMxMQEY$r<($9. %9%l%C%I@8@., F14 |$NItJ,$O;vNc$+i= N^^MxMQ7$?. $^$?, %?%9%/J,3dGN=$@5$NNL$O@h$N%S%8%M%k0E9f$N>l9g$H$"$^$j JQ$oiJ$$$,, C`<!%W%m%0%i%`$NC10L7W;;$O, %i%s%l%0%905=L$N?75,:n@.$,B?$$$3$H $K5$IU$/. 05=L$G$O, %=!<%9%G!<%?$N%5%$%:$H7k2L%G!<%?$N%5%$%:$,0[$J$j, 7k2L%G!< %?$r#1<!85G[Ns$K3JG<$9kh$&$K7F$$$kNG, JBNs=hM}$G%W%m%;%C%5$4HK05=L$9 kH7k2L$r@5$7$/2s<}$9k?aK$O, 3F%W%m%;%C%5$G05=L7?%G!<%?$N%5%$%:$bI,MW KJ$k. $=$3$G, 3N%5%$%:$r5aakJI$N=hM}<j=g$,A}$($k. 3l$,, C10L7W;;$rA} d7$F$$$kM}M3$G, 05=L%W%m%0%i%`$NJBNs2=$NFCD'$G$"$k. $h$jJ#;($J05=L%"%k%4%j %:%`$KJk$H, 3N7k2L%G!<%?$N07$$J}$,Hs>o$KFq7/Jk$H;W$olk.

3. C_@QK!

;vNc$N%/%$%C%/%=!<%H$r=$@5$7$FC_@QK!$NJBNs%W%m%0%i%`$r:n@.$7$?. C_@QK!$O:F5" %"%k%4%j%:%`$JNG, N`;w;vNcH7$F%/%$%C%/%=!<%H$rA*$s$@. I=5$N2<CJ$KC_@QK!$G $N;vNc$N:FMxMQEY$r<($9. A4BNE*$J9=B$$O$[$\F1$8$@C?NG, %9%l%C%I@8@.O=$N $^$^:FMxMQ, F14 |O=lr<h$k2s?t$OA}$($?$,, A}$($?J,$b;vNcr=N^$^:FMxMQ$G $-$?. %?%9%/J,3d$O, $=$N$^$^:FMxMQG-$?$bN,B?$/, $^$?=$@5$7$?$bNb, C1$K%9 %l%C%I$KEO$9%G!<%?$r%/%$%C%/%=!<%H$N%G!<%?$+$iC_@QK!$N%G!<%?$KJQ99$9$k$@$1$G h+C?. 7W;;ItJI$N<g$JItJ,$OC`<!%W%m%0%i%`$+$i=$@5$;$:$K:FMxMQG-$?.

4. 9M;!

%9%l%C%I@8@.$OJBNs2=<jK!$,%Q%i%l%k%j!<%8%g%sG"lP, :G=iKI,MWJJ,r^Ha $F@8@.$9kNG=N^$^:FMxMQ$G$-$k. F14|$O%W%m%;%C%5%U%!!<%`$N>l9g$O, :G=i$K #12sI,MW$J$@$1$J$N$G, =$@5$NI,MW$,$J$/, J,3dE}<#K!$N>l9g$b;vNc$H$*$*$`$M;wDL$C $F$$$l$P, :G>.8B$N=$@5$G:Q$`. %?%9%/J,3d$O, JBNs%W%m%0%i%`$N:GbFq7$$$H3m$G $"$j, F1$8$KJk3H$O>/$J$$. C`<!%W%m%0%i%`$NC10L7W;;$O%?%9%/J,3d$K4XO"$7$F, =$@5$7$?$j?75,$K:n@.7?j9kI,MW,GF$/$k. 0J>eN3H+iG$-$k$@$1=$@5$d ?75,:n@.r7J/Fh$$$h$&$K9kKO, 5i$KB?$/$N;vNc$,I,MW$@$H;Wol$k.

I=5: ;vNc$N:FMxMQEY!9T?t!K

		%9%l%l%H%s			C`<!%W%m%0%i%`
		%9%l%C%I(T)	F14|(S)	%?%9%/J,3d(D)	
0E	:FMxMQ(S)	8	1	4	33
	=$@5(M)	0	0	5	0
9f	?75,(N)	0	0	2	1
05	:FMxMQ(S)	8	1	5	28
	=$@5(M)	0	0	4	0
=L	?75,(N)	0	0	0	14
C_	:FMxMQ(S)	30	9	3	22
	=$@5(M)	0	0	18	0
@Q	?75,(N)	0	0	0	0

6 $*$ojK

JBNs%W%m%0%i%`$r:n@.$9$k$H$-!$%f!<%6$O3F%W%m%;%C%54V$G$NF14|!mutex!$%P%j%d$J$I!K!$%?%9%/J,3d!$Aj8_GS=|$d%9%l%C%I$J$I!$JBNs%W%m%0%i%`KBP7$F=OCN$7$F$$$kI,MW$,$"$j!$$"$^$jJBNs%W%m%0%i%_%s%0$N7P83$N$J$$%f!<%6KO,JBNs%W%m%0%i%`$r:n@.$9$k$N$OHs>o$KFq$7$$!%<B:]$KJBNs%W%m%0%i%`$r:n@.$7F_$F,$=N3Hr6/$/46$8$?.K\O@J8$G=RY?JBNs%W%m%0%i%`O9YF,2a5n$K8&5f<<$N@hGZJ}$,:n@.$7$?;vNc$rbH$K:n@.$7$?$,,$=$lGbdO$jJBNs%W%m%0%i%_%s%0$OFq7+C?.$H$$$&Nb,F14|,%9%l%C%IKD$$$F$O,;vNc$+i=N^$^:FMxMQ$G$-$?$j,>/$7$N=$@5$G:Q$s$@$jG"C?$,,%?%9%/J,3d$K$D$$$F$O,$"$^$j:FMxMQOG$-$:,?75,$G:n@.$9k+,B?$/$N=$@5$,I,MWHJk+G"C?.7+$7,%W%m%0%i%`$N;EMM$,$?$$$X$s;wDL$C$F$$$kh&$J>l9g$O,%?%9%/J,3d$N;EJ}$b;wDLCF$$$k>l9g$,B?$$$h$&$JNG,;vNc$,A}$(lP,%?%9%/J,3d$NItJ,$b;vNc$+$i:FMxMQG-k3HbB?$/$JkNGO$J$$$+$H;W$&.

:#8e$N2]Bj$O%f!<%6$,%$%s%G%C%/%9$N3F9`L\$K$D$$$F2r@O7?;~!$$=$N%$%s%G%C%/%9$,8!:w$5lk$/$i$$B?$/$N0[JC$?7A<0$N;vNc$r:n@.$9k3HG$"$k!%

<U<-

K\8&5f$N5!2q$rM?$($F2<5j!$F|:"!$5.=E$J8f;XF3$rD:$-$^7?;3:j>!9065<x$K?4$h$j?<$/46<U$N0U$rI=7^$9!%

$^$?!$K\8&5f$K$"$?$j!$?t!9$N=u8@$rD:$-$^7?0BF#>40l;a!JBS$K$$$m$$$mJLLG5.=E$J8f0U8+$dNe$^$7$rD:$-$^$7$?K\8&5f<<$N3'MM$K?4$h$j46<UCW$7$^$9!%

$=$7$F KSR-#1$r;HMQ5;$FD:$$$F$$$k%-%c%N%s!&9!<%Q!<%3%s%T%e!<%F%#%s%0 S.I. 3t<02q<R$K46<UCW$7$^$9!%

;29MJ88%

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