Bielefeld University
Faculty of Technology

Algorithms in Comparative Genomics, Winter 2018/19

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Exercises

Exercise 03, 08.11.2018

1. In computing $srd(\pi)$, the offset for additional reversals needed to orient unoriented components can be calculated by determining the *minimum* cost of a *cover* of the component tree T_π. The cost $t(C)$ of a cover C is the sum of costs of all paths, whereby a short path has cost 1 and a long path has cost 2.

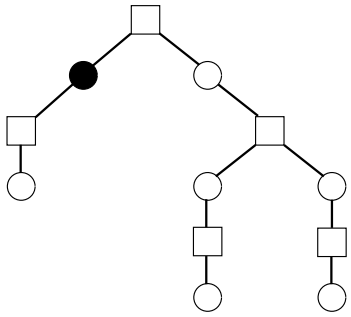
   Consider permutation

   $$\pi^6 = (\ 1\ 3\ {-8}\ 7\ {-6}\ 4\ 5\ 9\ 11\ {-13}\ 10\ {-12}\ 14\ {-2}\ 15\ 17\ 22\ 18\ 20\ 19\ 21\ 23\ 28\ 24\ 26\ 25\ 27\ 29\ 16\ ),$$

   (a) use the Java program `InversionVisualization` provided on the course website to draw $BG(\pi^6)$. The file containing π^6 can also be downloaded from the website. Using $BG(\pi^6)$, construct the component tree T_{π^6};

   (b) find an optimal tree cover (i.e. a cover with minimum cost) for T_{π^6}.

2. Consider the following component tree T:

   Find a permutation π whose component tree is T.

3. Sort the permutation $\pi^7 = (2\ \ {-5}\ 3\ \ {-1}\ 4)$. Indicate all intermediate steps by drawing the overlap graph $OV(\cdot)$ and include the reversal scores as annotation to each vertex. Indicate your choice of a safe reversal by marking the corresponding vertex in $OV(\cdot)$.

4. The score s of a vertex-induced reversal in the overlap graph is defined as the number of oriented vertices in the resulting permutation.

   Given some permutation π, let v be a vertex of $OV(\pi)$, T be the total number of oriented vertices in the overlap graph and $U(v)$, $O(v)$ the number of unoriented, respectively oriented vertices adjacent to v. Prove that the score of $\rho(v)$ can be computed by the following formula:

   $$s(\rho(v)) = T + U(v) - O(v) - 1\,.$$

Discussion of solutions in tutorial on 15.11.2018