CSDS 455: Homework 21

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Problem 1

I have consulted https://core.ac.uk/download/pdf/81147875.pdf *and couple of papers which cited this paper. However, I don't quite get the whole picture of the proof and can't jump right into these lemmas as I don't know how are they contributing to the proof.*

Say the algorithm finding r-vertex-disjoint-path in G takes $O(X)$ time where X is a polynomial of $V(G)$. Denotes vertices in G as $v_1, v_2, \ldots, v_j, v_k, \ldots, v_n$, we design a data structure that if v_j and v_k ever jointed together by edge contraction, we have the new vertex to be v_{jk} – where the original label j, k is till remembered by the new vertex made by contraction.

If H with $u_1, u_2, ..., u_k$ for $k \leq n$ is a minor of G. W.L.O.G. We know that the vertex-disjoint-path from u_a to u_b must be a subset of the r-vertex-disjoint-path in G from v_a to v_b: as for if a path P_H in H from u_a to u_b is $< u_a, u_1, u_{23}, u_5, u_b$, we must have path P_G in G like $< v_a, v_1, v_2, v_3, v_4, v_5, u_b$ where every vetrex in P_H is "covered" in a corresponding P_H.

So we may simply calculate the r_G-vertex-disjoint-path in G between every two verticies, which will take $\binom{n}{2}O(X_G)$ which is a polynomial of n. Similarily, we calculate the same r_H-vertex-disjoint-path in H which takes $\binom{k}{2}O(X_H)$. Then we try to figure if every path in r_H has a corresponding path in r_G. If so, H is a minor G; and otherwise it is not.