1142-20-243   **Ignat Soroko*** (`ignatsoroko@lsu.edu`), Louisiana State University, 303 Lockett Hall, Baton Rouge, LA 70803. *On intersections and joins in free groups.*

The famous Hanna Neumann Theorem stipulates that for the ranks of arbitrary subgroups H and K of a nonabelian free group we have: $\operatorname{rank} H \cap K - 1 \leq (\operatorname{rank} H - 1)(\operatorname{rank} K - 1)$. It is an interesting open question to quantify this bound with respect to the rank of $H \vee K$, the subgroup generated by H and K. We describe a set of realizable values $(\operatorname{rank} H \vee K, \operatorname{rank} H \cap K)$ for arbitrary H, K, and conjecture that this locus is complete. Using graph-theoretic techniques introduced by Dicks, we show that the region

$$\operatorname{rank} H \vee K \geq \operatorname{rank} H + \operatorname{rank} K - 3 \quad \& \quad \operatorname{rank} H \cap K \geq 4$$

consists of non-realizable values, thus resolving the remaining open case of R. Guzman's conjecture in the affirmative and obtaining applications to 3-dimensional topology. (Received September 04, 2018)

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