Let $G = \langle S \rangle$ be a group, and let $\Gamma$ be its Cayley graph. Computing the diameter of $\Gamma$ is a computationally hard problem which comes up in several contexts. Thus, it is useful to be able to compute bounds on the diameter of Cayley graphs. In Ganesan the case where $S$ is a minimal set of transpositions which generate $G$ is examined, and an algorithm to find an upper bound on the diameter of $\Gamma$ without examining each permutation is exhibited. Expanding on this work, we give several new algorithms to compute upper bounds on the diameter of $\Gamma$, without examining individual elements of $G$. Some of the algorithms we give are computationally more efficient than Ganesan’s; one is computationally similar but produces much tighter bounds in many cases. (Received September 19, 2012)