A \((k, s)\)-SAT instance is a propositional formula in CNF, such that all clauses are of size \(k\) and each variable occurs at most \(s\) times (positively or negatively). It turns out that, for every \(k\), there is a threshold \(f(k)\), such that for every \(s \leq f(k)\), all \((k, s)\)-SAT instances are trivially satisfiable, while for \(s > f(k) + 1\), the \((k, s)\)-SAT problem is NP complete. Unfortunately, the exact values of the function \(f(k)\) are known for small values of \(k\) only.

The first contribution of the thesis is a computer program that finds upper bounds for \(f(k)\) by searching for an unsatisfiable \((k, s)\)-SAT of certain structure. The algorithm is based upon known theoretical results. The actual implementation seems to be quite sophisticated, and there is a very good discussion on the design of the program and the results produced. Overall, this is a solid experimental result that builds upon and requires deep understanding of some theoretical results.

The second contribution is a new lower bound on the size of an \((k, s)\)-SAT enforcer, a satisfiable \((k, s)\)-SAT instance, which forces the value of a designated variable to be true. The proof, although not long and difficult, is a very neat probabilistic argument. It led to finding an optimal \((3, 4)\) enforcer, which in turn led to an improved inapproximability result for MAX-\((3, 4)\)-SAT.

To summarise, the thesis is a very nice mixture of theory and experimentation, and is very well written. In my opinion, it is equivalent to a good research publication. The author has clearly demonstrated his ability not only to understand and produce theoretical results but also to do advanced computer programming. Based on all this, I would strongly recommend that the thesis be awarded the highest grade.