Show the proposed algorithm has the claimed running time by making all the computer verification explicit

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ABSTRACT
This project will focus on the #2SAT area and will design a complete computer validation of that thesis for a specific thesis. Since papers in this field rarely explain the reasoning process in detail, it is even more difficult to share codes that reproduce it. That's why it's essential to produce a complete computer verification. This project will replicate the recursive logic in the thesis by simulating the workflow of an oracle machine through computer code, thus verifying the correctness of the thesis results.

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous; See http://acm.org/about/class/1998/ for the full list of ACM classifiers. This section is required.

Author Keywords
#SAT; #2SAT; graph theory; complexity theory

INTRODUCTION
First, the project will design a computer validation process of Magnus Wahlström's work in 2004.[3] This project will focus on the #2-SAT area of the algorithm domain, which will be covered in detail later in this introduction.

Most algorithm designs are algorithm designs for decision problems. For example, to find a solution that makes a Boolean formula satisfying. By finding a satisfying answer to a Boolean expression, we mean that given an arbitrary Boolean expression, such as $A \vee B$, one of the solutions that can make its result to be true if A is true, and B is true. This is the SAT question in the algorithmic field. SAT is the first issue that was demonstrated to be NP-complete.[1] As we all know, P-class is a fundamental complexity class that is verifiable by a deterministic Turing machine. However, NP is a generalization of P, which the lesson of choice problems decidable by a non-deterministic Turing machine that runs in polynomial time. A decisive question that is NP-complete means that it is complete for NP, which means that any question that is NP can be reduced to it in polynomial time.

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Let us go back to the SAT problem. Going further, we will not only be content to find out if we can satisfy a particular Boolean expression, but we are trying to find out exactly how many solutions can satisfy that expression. This is the #SAT question, brought up by Valiant in 1979.[4] Valiant, meanwhile, raised the issue that this is a #P-complete.

To find the final solution to a complete Boolean expression, we split out each of the propositional variables. Each propositional variable can contain either true or false. We define a literal to denote both a propositional variable x and its negation ¬x. A disjunction of literals is defined as a clause. And a conjunctive nurmal form, short for CNF, is a conjunction of clauses.

So we can represent some special case SAT questions, such as if each clause contains at most 2 literals, then we call this formula a 2-SAT formula. A more general representation is that if each clause contains at most no more than k literals in a hypothetical CNF, then we call it a kSAT formula (k>0). The #2-SAT question of concern for this project can then be expressed as: how many possible solutions are there to make the formula satisfy a maximum of 2 liters per clause in any given proposed formula. Take for example the following.

$$(x_0 \vee x_1) \wedge (x_1 \vee x_2) \wedge (x_2 \vee x_3) \wedge (x_4)$$

Since we cannot give specific conclusions for all Boolean expressions, and indeed it is impossible, in this research area, we usually design a computational model to calculate the time complexity O of this model method. The time complexity usually describes the running time of an algorithm in a worst-case scenario. Computational models get different results in many branches, and we usually verify the worst time complexity to determine the time complexity of this algorithm.

In this project, the #2SAT algorithm is explored from the initial upper bound of $O(2^n)$, as proposed by Dubois, Zhang, Littman, and Dahllöf[2] et al. The scheme is continuously optimized to propose $O(1.3247^n)$, until this paper we forced uses the computer-verified work of Magnus Wahlström, who accelerated the algorithmic model of #2SAT to $O(1.2561^n)$ in 2004[3].

However, research in this field is purely theoretical, and the literature and papers are full of mathematical expressions and model reasoning. Papers in this field do not usually provide a specific computer code reproduction process for the given model, a process that is often hidden in the deductions of formulas, and it is difficult for later readers to rely solely on this paper to reproduce the full process of deductions. Moreover, as the theoretical research progresses, the inability to replicate the work of previously distinguished practitioners will have a very significant impact on subsequent research.

So an experimental replication of the reasoning process in this area of research will be very necessary. This is not only an experimental corroboration of the important theories of previous distinguished contributors but also an important reference for future continuing researchers in the field.

The project will be conducted based on the reading and validation of the thesis, which involves the validation of the different branches of Wahlström's work. (See Gantt chart). The initial design will be organized into a brief thesis validation report in the form of an algorithmic code design ensemble and proof draft, followed by specific code writing and validation.

As for the software required, python and related computing packages will be selected for this project because of the simplicity and ease of writing python. Due to the special nature of this project, the project does not require the operational efficiency of a complete project, only the verification of results, and therefore python has the advantage over c and java. The latest version of 3.8.2 will be chosen because the project will provide as much as possible a reasonable interpretation of previous outstanding work for future researchers in the field, so choosing the latest version of python will avoid creating a gap for future readers. As for the hardware part, since this project is a reproduction of a theoretical research example, there are no special hardware equipment requirements, just a computer that can run python.

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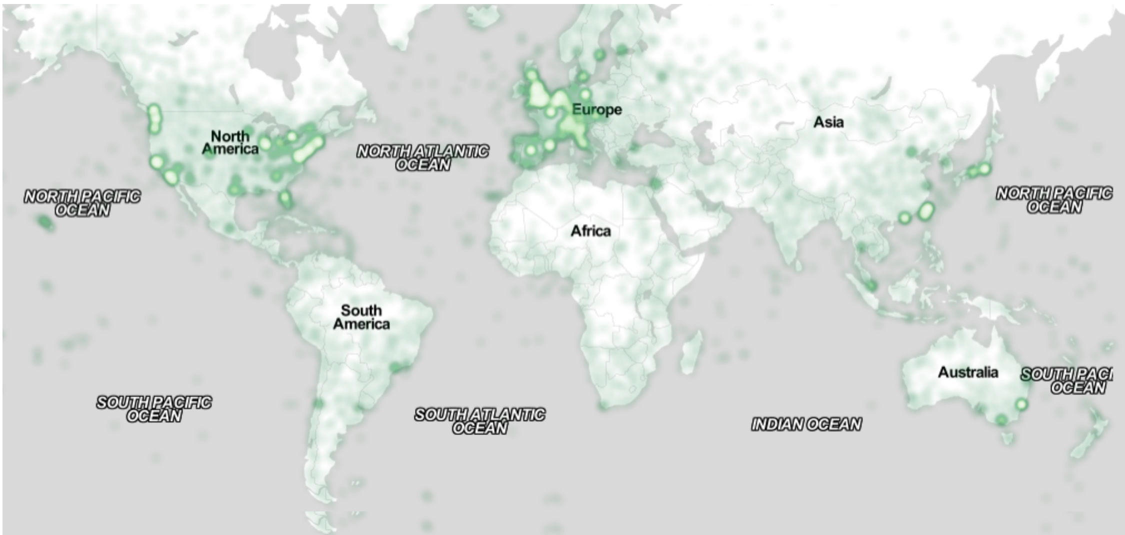

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