Review of: "SAT is as hard as solving Homogeneous Diophantine Equation of Degree Two"

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Potential competing interests: No potential competing interests to declare.

The topic of the article is interesting and, to this reviewer's knowledge, new. Formally, the article is well ordered. The below notes (related to the paper until the “Proof of Theorem 2”) may be worth addressing to further improve the work:

- On the first page (see the pdf form), it seems there is no difference between “a language is NP-hard” and “a language is an element of NP”. The two different expressions for the same meaning is a bit confusing here…
- Maybe “satisfying truth assignment” instead of “truth assignment” should be applied in the first QUESTION (in Definition 1) and the sentence “…in 3CNF has a satisfying truth assignment such that…” on page 2. If not, the problem should be explained/clarified more.
- A bit below on the same page, it should be clarified more what it means here, in the present context, “reducing the equation modulo p”. Even p is not yet defined.
- In Definition 3 (QUESTION), it is surprising if only strings of lengt n may come into consideration as possible solutions (for example, the length of x2 or u2 must be n binary characters), where n is just the number of unknowns in the equation as well… It is not clear why they are just the same. (Maybe {0, 1}* should be the set of the possible solutions, not {0, 1}^n…)
- On page 3, it seems that the same ci denotes two different things: a clause and a single variable/literal within a clause. It is confusing. Furthermore, the exact relation between ci (as a clause) and the variables ai, bi, ci should be clarified more.
- On the same page, it seems not clear that “…the clause ci has exactly at least one true literal and at least one false literal if and only if di has exactly one unsatisfied clause.” For if, say, a=1 (true literal), ai=1 (true literal), b=1 (true literal), bi=1 (true literal), c=0 (false literal), ci=1 (false literal) then there are at least two false (unsatisfied) clauses in di: (a xor ai) and (b xor bi)…
- On the same proof, the meaning of (fi, 5m) might be explained more (there are 6 clauses in d1, d2, …, dm)…
- Last sentence in the same proof: It seems that it is not enough to check if there are exactly K satisfied clauses in the formula if in each di, there should be exactly 5 ones. It might be explained a bit more.
- The proofs of the theorems might be more detailed in order to make them more easily understandable.