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The EOL problem, as stated, can be easily confused with the EOL augmented problem, which is actually PSPACE hard. Maybe it's a good idea to clarify that there can be more than one unbalanced node other than 0^n and the goal is to find any one of those?

COMMENTS FROM RYAN WILLIAMS

I just looked at your latest draft. You're defining the problem (on p.47) to have clauses of length at most 3 with exactly b occurrences per variable ... you even mention that a clause can have the same variable twice.

As the reduction below indicates, we can actually set $b = 3$ in that case, not just $b = 4$, and still get an NP complete problem.

For $b = 2$, we can apply the monotone literal rule and resolution to solve the problem in P.

HERE IS OLD email of ryan that has that reduction.

I'm struggling to understand why the following thing doesn't show that 3 variable occurrence version isn't also hard, it's a simple modification of the typical reduction from 3sat to 3sat with at most 3 occurrences per variable.

Let F be a 3CNF (at most 3 literals per clause).

Let M be an upper bound on the number of occurrences of any variable in F.

For each variable x we make 2M new variables, x_1, \dots, x_{2M} , and we relate them with the following clauses:

For all odd i , add $(\neg x_i \vee \neg x_{i+1})$,

For all even $i < 2M$, add $(x_i \vee x_{i+1})$.

For $i = 2M$, add $(x_{2M} \vee x_1)$.

This has the effect of creating a "cycle" of equivalent literals, where the odd variables are all equivalent to the *negations* of the even variables.

Now we can, for every variable occurrence of x in every clause, plug in one fresh copy of an odd or even variable x_i (depending on whether x appears positive or negative) to make every clause monotone. There are three occurrences total for each variable.

I'm not sure why this doesn't work ... even if you required clauses of length exactly 3, one can simply make another copy of one of the variables (thus bringing the total number of occurrences per variable to 4).

Is the issue that you wanted (for some reason) three *distinct* variables in each clause?

BASED ON Ryan's email Erik D asked

Why do we cover monoton 3SAT-4 instead of 3SAT-3

Do you in fact show Monoton 3SAT-E3 or ESAT-4 or ESAT-3 hard? That would be different. (But its doot to add the appropriate E's for Exact in this case- its very confusing when authors omit them.

COMMENTS FROM Harry Lewis.

1. You are kind to cite my trivial result about Horn sets. More interesting are the attached two papers, which I would not have mentioned except that you are SO exhaustive and these are more worth noting than the Horn set paper. One is in the spirit of Schaefer's dichotomy theorem, except that instead of assuming CNF, it works off what boolean operators are allowed, relying on an exhaustive but little known analysis by Post. The other pretty much exhausts what there is to say about the complexity of easily characterized decidable subclasses of the predicate calculus. The papers are [?] and [?].
2. Try to cut down on *Google SO AND SO* or *Look at Wikipedia*.

COMMENTS FROM BILL GASARCH

1. We have a projects env- use it. (check that we have it)
2. Repetition between PCP chapter and UGC Chapter?
3. Put in new pictures that Auguste got.
4. PPAD chapter- look into making some of the figures in LaTeX, either me or Auguste. Also try to find where some of them came from.
5. Those figures that have some words in them that Auguste redid- check those out.