CSC 2420 Fall 2023, Assignment 2 Due date: Friday, November 3 at 11 AM,)

It is certainly preferable for you to solve the questions without consulting a published source. However, if you are using a published source then you must specify the source and you should try to improve upon the presentation of the result or at least express the result in your own words.

If you would like to discuss any questions with someone else that is fine BUT at the end of any collaboration you must spend at least one hour playing video games or watching a Blue Jays game or maybe even start reading a good novel before writing anything down.

If you do not know how to answer a question, state "I do not know how to answer this (sub) question" and you will receive 20% (e.g. 2 of 10 points) for doing so. You can receive partial credit for any reasonable attempt to answer a question BUT no credit for arguments that make no sense.

In class or on Piazza, I can clarify any questions you may have about this assignment or any material in the course. Do not spend too much time on any question.

1. In the analysis for the non-oblivious local search algorithm for the Max-2-Sat problem, we stated that at a local maximum for the potential function $\frac{3}{2}W(S_1) + 2W(S_2)$, the following equation holds (assuming without loss of generality the τ sets all variables to true).

$$-\frac{1}{2}P_{2,j} - \frac{3}{2}P_{1,j} + \frac{1}{2}N_{1,j} + \frac{3}{2}N_{0,j} \le 0$$

Explain why this inequality holds at a local maximum.

- 2. Show that the intersection graph induced by the k-set packing problem is a k + 1 claw-free graph. The intersection graph is the graph where the vertices are the sets $\{S_i\}$ and an edge (S_1, S_2) exists if $S_1 \cap S_2 \neq \emptyset$.
- 3. Consider an edge weighted graph G = (V, E, w). Explain why the weighted max cut function is a submodular function. That is given a partition (S, T) of the vertices of a graph V, the function

$$f(S) = \sum_{\{(u,v)|u \in S, v \in T, (u,v) \in E\}} w(u,v)$$

4. Perhaps one more question to follow.

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