CSDS 455: Homework 24

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I have consulted Yige Sun for this assignment.

Problem 1

Using the idea of "ribbons", modify CLIQUE example to determine the existance of 6-cliques instead of 4-cliques, and modify the TRIANGLE example to count the number of 5-cliques instead of triangles.

`6-CLIQUE` and `5-CLIQUE` with utilization of ribbons can be expressed as:

$$\texttt{6-CLIQUE}(A_R, B_R) = \frac{1}{2^{15}} \sum_{\text{R: graph on } V(A_r \cup B_r)} \Pi_{\{l_1,l_2\}\in E(R)} \chi\{l_1, l_2\}$$

$$\texttt{5-CLIQUE}(A_R, B_R) = \frac{1}{2^{10}} \sum_{w_1 \in [n] \setminus V(A_r \cup B_r)} \cdot \sum_{\text{R: graph on } V(A_r \cup B_r \cup C_R)} \Pi_{\{l_1,l_2\}\in E(R)} \chi\{l_1, l_2\}$$

Problem 2

Is there a parity issue with this technique? Can we count the number of 6-cliques and determine the existance of 5-cliques? Show how you can adjust the algorithms for these problems or show why a straightforward modification will not work.

I don't quite get this question, if we can count the number of 6-cliques we can surely determine the exsitance of 5-cliques, as any 6-clique contains a 5-clique. But in the case of no 6-clique, there is still the possibility of having 5-clique. In such case we may remove a vertex x from one side of the ribben and run the `n-CLIQUE` algorithm to count if there's a `(n-1)-CLIQUE`.

Problem 3

Given your solutions above, define what the "ribbon" and "shape" would be for the solutions.

- Ribbon in `6-CLIQUE` in **Problem 1** **2** is two sets of verticies of equal size (3).

- Shape in `5-CLIQUE` in **Problem 1** is two sets of verticies of equal size (2) and another vertex from $[n]$.

Problem 4

Describe (general terms) the purpose of the "constraint graph" in section 3. What is it supposed to represent?

I haven't got this far yet but from a superficial scan it seems it a multi-graph representation of multiple graph matrices "gluting" together. Specifically it makes edge if there is an edge between two verticies from different partition of the ribben.