# Project Proposal

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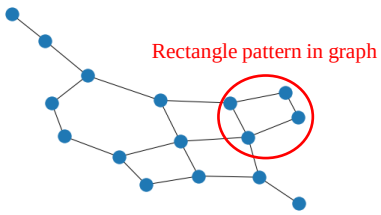
## 1. Title

# Finding total # of rectangle(grid) pattern in graphs

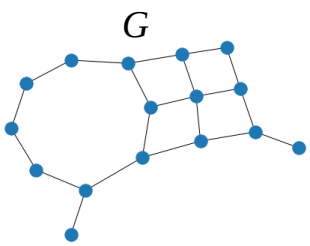
## 2. Problem description




In graphs, there are some geometric patterns inside that reveals its own graph property. For example, Finding triangles in graph is well known metric for graph to measure its clustering pattern.

However, there is no research for finding rectangle pattern inside. This measurement is useful for measuring how much the graph is like 'grid-pattern'.

## 3. Brief sketch of how to solve



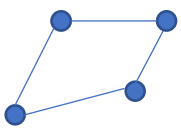

Let *A* be a adjacency matrix of graph *G*.

Then the $diagonal\ element\ of\ A^4$ implies the total # of connection set which pattern is like { a -> b-> c-> a }. But the diagonal element contains overlapping cases, so we should devide it by the total case of overlapping.

When using this fourth multiplication of adjacency matrix we could use divide and conquer algorithm – ***Strassen's formula***.
By doing so, we can reduce time complexity of matrix multiplication about $\approx O(n^3)\ to \approx O(n^{2.8})$.

In this big data driven society, there are many tasks that handle huge size of graphs. So this reduction of time complexity will have great effect.

However, ***Strassen's formula*** is not a good strategy for small size matrix. So we can also plot from what extend it might be effective to use the algorithm.



Rectangle in graph

$A$

[[0. 1. 1. 0.]
[1. 0. 0. 1.]
[1. 0. 0. 1.]
[0. 1. 1. 0.]]

$\Rightarrow \cdots \Rightarrow$

$A^4$

[[8. 0. 0. 8.]
[0. 8. 8. 0.]
[0. 8. 8. 0.]
[8. 0. 0. 8.]]

*diagonal element*