The maximum independent set problem is a NP-hard problem in graph theory. The goal is to find an the largest independent set of vertices that is not a subset of any other independent set in a graph.
Review: Heuristic Approach (Min-degree-max-support Algorithm)

degree = number of neighbors to a vertex
support = sum of all neighbors' degree of a vertex

while (E>0){
    V_mindeg = {vertices with minimal degree}
    V_mindeg_maxsup = {vertices with maximal support in v_mindeg}
    v = select a vertex from {V_mindeg_maxsup} based on priority
    G = graph G with vertex v and all its neighbor removed
}
Graph

1. Represents the graph to be used.
2. Stores the adjacency list of the graph, the degrees of all the vertices and the Maximum Independent Set.
3. We chose an adjacency list, as the adjacency matrix stores the \((\text{number of vertexes})^2\) entries, which can exceed JVM’s maximum heap size for large vertex amounts.
Graph: Important methods

1. Method to find Degree of a vertex:

   ```java
   public void findDegrees(vertex v) {
       degree[v] = total number of neighbors to vertex v;
   }
   ```
2. Method to find Support of a vertex:

```java
public int findSupport(int v) {
    int support = 0;
    for (int n : neighbors[v]) {
        support += degree[n];
    }
    return support;
}
```
Graph: Important methods

3. Method to add a vertex to MIS:

public void addToMIS(MaxSupportVbl vbl) {
    addVertexToMIS(vertex v);
    For each neighbor n of vertex v {
        Remove n from vertex list;
        Remove all edges related to n from adjacency list;
    }
}
Sequential Program

1. MaximumIndSetSeq extends Task.

1. It reads in a CSV file with:
   a. Line 1 = <number of vertices>, <number of edges>
   b. Line 2:n = <number of edges> lines of: <vertex 1>,<vertex 2>
      where <vertex 1> and <vertex 2> form an edge.

1. Performs the sequential algorithm using methods Graph.class
Parallel Implementation
MaximumIndSet

while (E>0){
    Vmindeg = vertices with minimal degree
    In parallel:
    Vmindeg_maxsup = vertices with maximal support in vmin
    v = select a vertex from Vmindeg_maxsup based on priority
    G = graph G with vertex v and all its neighbor removed
}
THANK YOU

QUESTIONS?