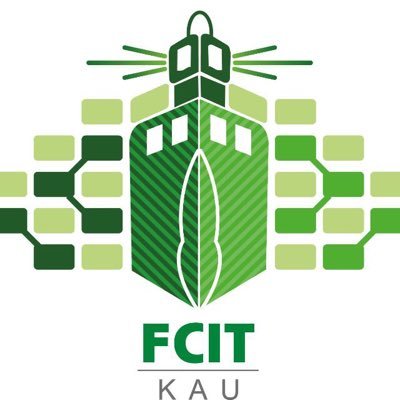
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King Abdul-Aziz University  
Department of Computer Science  
Faculty of Computing and Information Technology  
CPCS-324-Algorithms and data structure II, Spring 2nd Term 2020

Bonus Assignment

Submission date: 18/3/2020

Compare Kruskal’s algorithm to Prim’s algorithm

Instructor: Dr. Arwa Noorwali

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1. **How are they different?**

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| Kruskal’s algorithm | Prim’s algorithm |
| It starts to build the Minimum Spanning Tree from the vertex carrying minimum weight in the graph. | It starts to build the Minimum Spanning Tree from any vertex in the graph. |
| Need to sort all the edges in non-decreasing order of their weight. | No need to sort the edges. |
| Edge based | Vertex based |
| It traverses one node only once. | It traverses one node more than one time to get the minimum distance. |
| Gives disconnected components (can generate more than one tree) | Gives connected component (1 tree) |
| it can work on disconnected components | it works only on connected graph. |
| Need to check if edges acyclic or not, in each iteration | No need to check if there are cyclic. |
| Time complexity is O (E log E) | Time complexity is O (E log V) |

1. **How are they similar?**

- Both are methods for solving problem.

- Both are greedy algorithm to Find the minimum spanning tree (MST)

1. **What similarities and differences seem significant?** 
   * Prim’s algorithm in general is done by choosing the nearest vertex, while Kruskal’s algorithm selects the next smallest-weight edge.
   * Prim's requires a Priority Queue, so the efficiency of this algorithm is : O(|E|log|V|) ,while Kruskal’s requires a good sorting algorithm to sort edges and Union-Find Disjoint Sets to preventing cycle , so the efficiency of this algorithm is : O(|E| log |E|).
   * Kruskal’s algorithm is more efficient on sparse graph ,while Prims algorithm is more efficient on dense graphs.
   * They may produce the same MST if the tree was unique .
2. **What interpretation or conclusion is suggested by the significant similarities and differences?**

Both Prim’s and Kruskal’s algorithm finds the Minimum Spanning Tree. The most important idea of Kruskal’s algorithm to Prim’s is efficiency in their field. So, Choose the Kruskal algorithm is found to run faster in sparse graphs. Whereas, Prim's algorithm is found to run faster in dense graphs with more number of edges than vertices.

**5. Write your conclusions in your own words**

After we analyze the structure of Kruskal’s algorithm and Prim’s algorithm we found that they both have an easy logic to find the MST but with different implementation. So to decide which is the right algorithm to choose in order to apply MST we will concern most with number of edges, if its low we tend to apply Kruskal algorithm since every edge is considered only once then either it’s selected or rejected otherwise Prim algorithm will be better to apply.