Travelling Salesman Problem

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Agenda

- What is TSP ?
- Quick Refresher - Branch & Bound
- Sequential Algorithm
- Parallel Approach
- Demo

What is TSP?

- Given a complete weighted directed / undirected graph G = (V {1,...n}, E) and a cost matrix C, a tour is a circle in G which visits each vertex exactly once.

Image References:

http://makeagif.com/i/4-ew7H

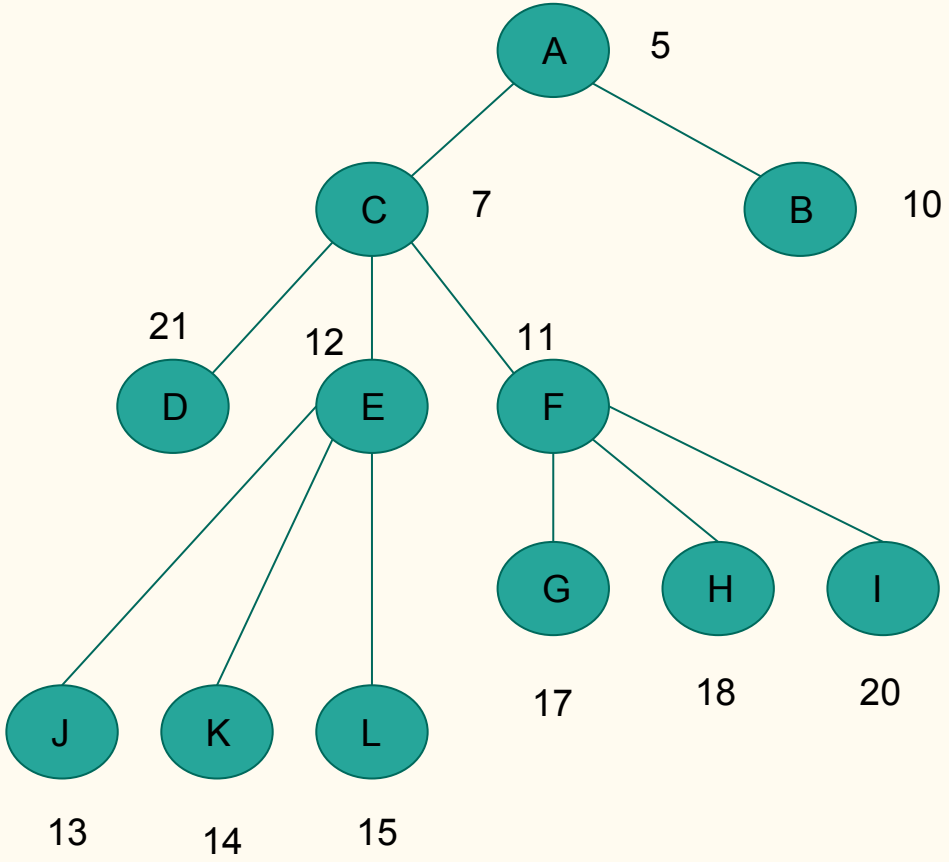
Branch & Bound Algorithm

Branch and Bound Algorithm

- **Select:** A node is selected based on a search criteria
- **Branch:** The selected node from above is subdivided into its child nodes
- **Bound:** Some of the nodes that are created are then pruned
- **Repeat the first 3 steps**

Sequential Algorithm

- Nodes are put on a queue
- Nodes are explored to find the TSP.
- If TSP is found, the path and the cost is found
- Nodes are bound using the TSP path found.



D	E	F	B	G

Pseudo Code:

For each node in **queue**:

child → **getchildren(**node)

if(child is leaf):

-Trace path to check for TSP

-Save the **path** and cost

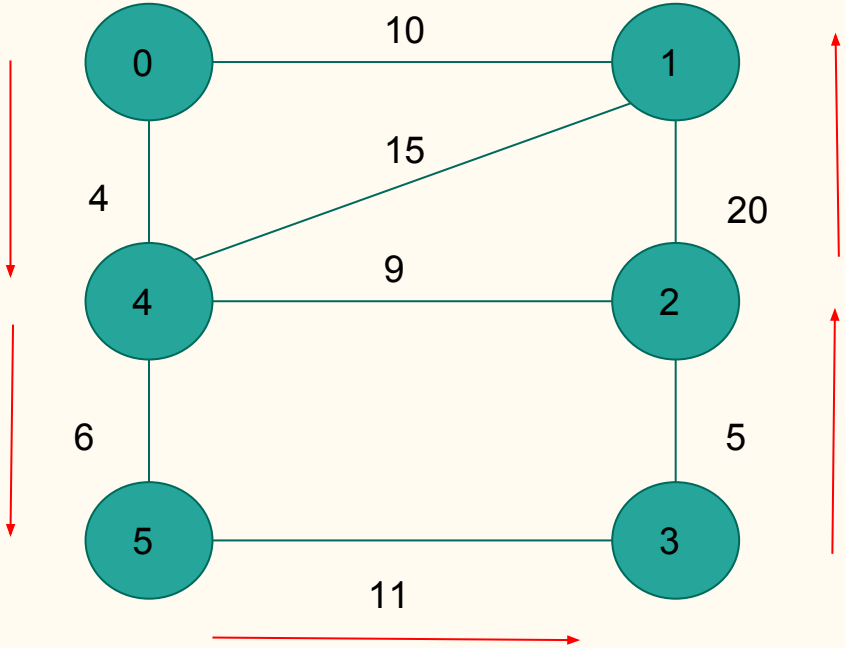
Else:

Update cost of child

Put the child on **queue** if cost is less than TSP cost

Parallel Algorithm

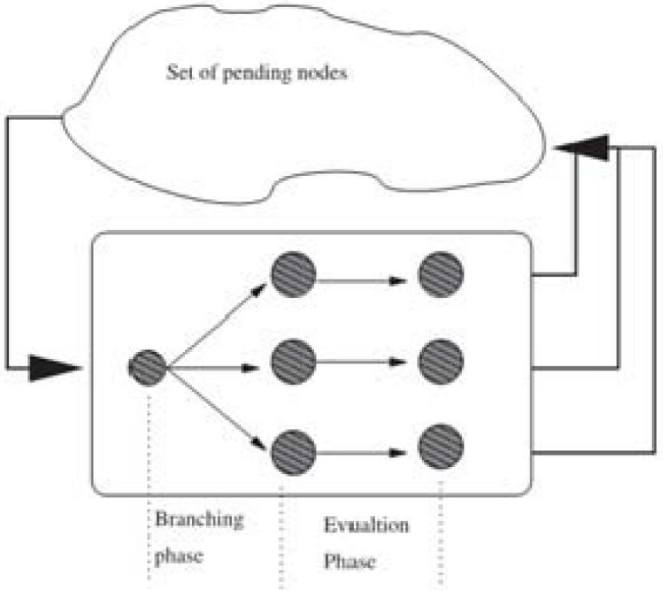
Graph:

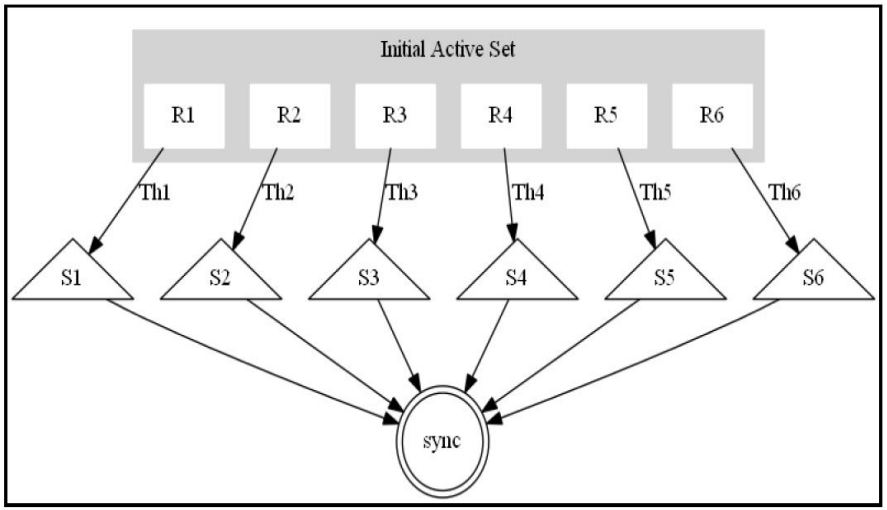


Two ways to parallelize:

- Node Based Strategy
- Tree Based Strategy ➡ Our Approach

Approach:

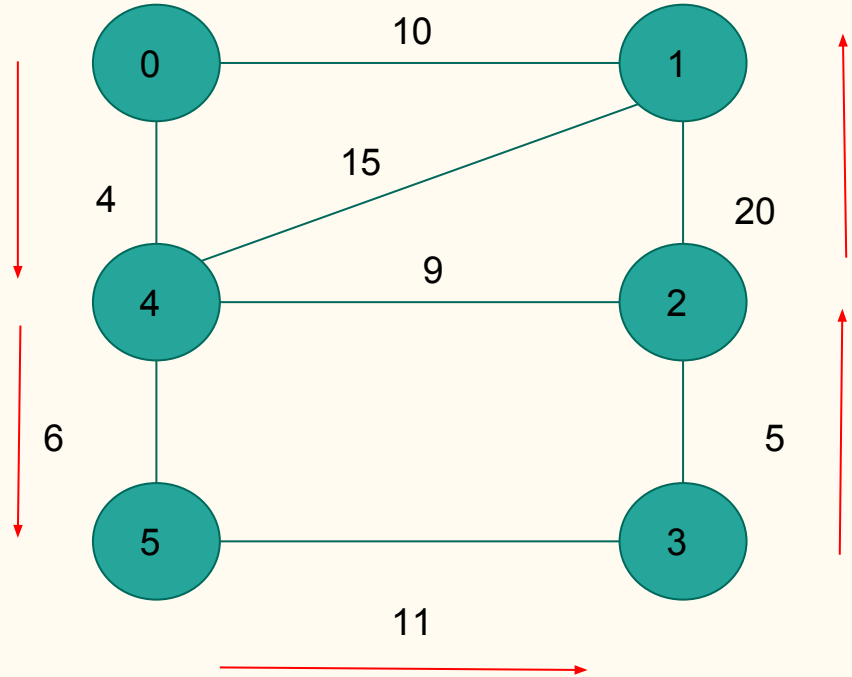




After the concurrent search, all threads will inform the amount of solutions found and the best one.

Image References: [1]

Demo



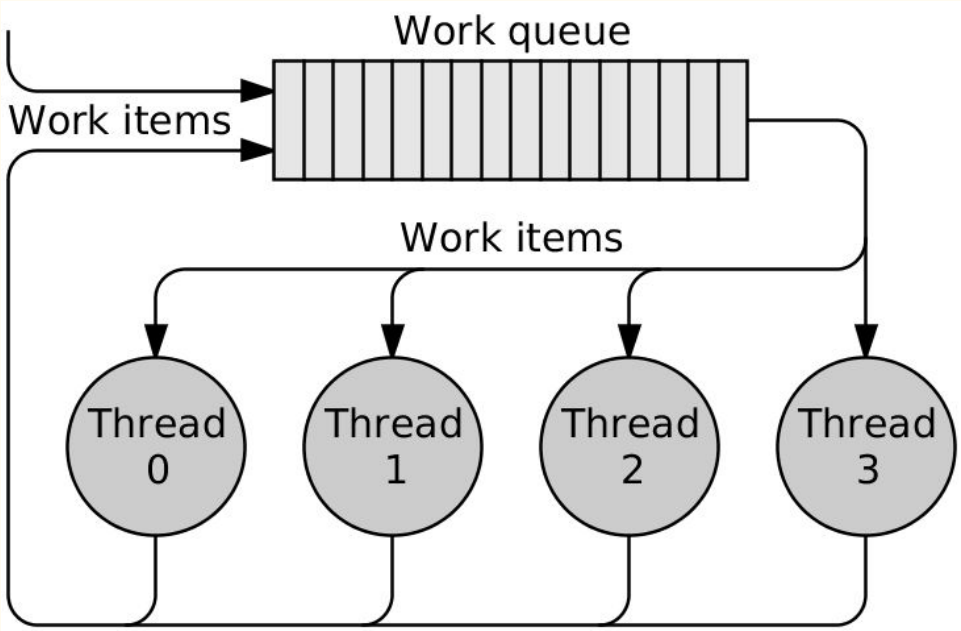


Image References:

Referenced from text book: https://www.cs.rit.edu/~ark/bcbd/

Pseudo Code for Parallel Implementation:

ParallelFor node in **queue**:

child → **getchildren(**node)

if(child is leaf):

-Trace path to check for TSP

-Save the **path** and cost

Else:

Update cost of child

Put the child on **queue** if cost is less than TSP cost

References

- [1] T. Carneiro, A. E. Muritiba, M. Negreiros and G. A. Lima de Campos, "A New Parallel Schema for Branch-and-Bound Algorithms Using GPGPU," Computer Architecture and High Performance Computing (SBAC-PAD), 2011 23rd International Symposium on, Vitoria, Espirito Santo, 2011, pp. 41-47.

Questions?