CE205 Data Structures Week-6

Graph MST, Backtracking, Topological Sorting, Shortest Paths, Connectivity,Max Flow and Cycle Detection Algorithms. Graph Isomorphism and canonization,Graph Cuts

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# CE205 Data Structures

# Week-6

### Graph MST, Backtracking, Topological Sorting, Shortest Paths, Connectivity,Max Flow and Cycle Detection Algorithms.

### Graph Isomorphism and canonization

### Graph Cuts

Download [DOC](ce205-week-6-graph-algorithms.md_doc.pdf), [SLIDE](ce205-week-6-graph-algorithms.md_slide.pdf), [PPTX](ce205-week-6-graph-algorithms.md_slide.pptx)

### Outline-1

* Graph Topological Sorting
* Graph MST
* Graph Backtracking
  + Tug of War
  + n-Queen’s Problem
  + m Coloring Problem
  + Euler & Hamiltonian Path

### Outline-2

* Graph Sortest Paths
* Graph Connectivity - SCC
* Graph Max Flow
* Graph Isomorphism
* Graph canonization
* Graph Cuts
  + Min Cut
  + Max Cut

### Outline-3

* Alpha-Beta Pruning
* Hasse Diagrams
* Petri Nets
* Bipartite Graphs
* Cycle Detection
  + Brent’s Algorithm
  + Hare and Tortoise Algorithm
* Bayesian Network

### Graph Topological Sorting

* CE100
  + https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-10/ce100-week-10-graphs/?h=topolo#directed-acyclic-graphs-dag
* Geeks for Geeks
  + https://www.geeksforgeeks.org/topological-sorting/

### Graph MST

* CE100
  + https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-10/ce100-week-10-graphs/?h=mst#minimum-spanning-tree-mst
* Geeks for Geeks
  + https://www.geeksforgeeks.org/prims-minimum-spanning-tree-mst-greedy-algo-5/

### Graph Backtracking

* Tug of War
  + Geeks for Geeks
    - https://www.geeksforgeeks.org/tug-of-war/

### Graph Backtracking

* n-Queen’s Problem
  + Geeks for Geeks
    - https://www.geeksforgeeks.org/n-queen-problem-backtracking-3/?ref=lbp

### Graph Backtracking

* m Coloring Problem
  + Geeks for Geeks
    - https://www.geeksforgeeks.org/m-coloring-problem-backtracking-5/
  + Tutorials Point
    - https://www.tutorialspoint.com/M-Coloring-Problem#:~:text=The%20problem%20is%20to%20find,is%20assigned%20on%20which%20vertex.

### Graph Backtracking

* Euler & Hamiltonian Path
  + https://www.geeksforgeeks.org/mathematics-euler-hamiltonian-paths/

### Graph Sortest Paths

* Single-Source Shortest Paths (SSSP)
  + https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-11/ce100-week-11-shortestpath/
  + https://visualgo.net/en/sssp?slide=1

### Graph Connectivity

* Strongly Connected Components
  + https://ucoruh.github.io/ce100-algorithms-and-programming-II/tr/week-10/ce100-week-10-graphs/?h=scc#strongly-connected-components-scc

### Graph Max Flow

* Geeks for Geeks
  + https://www.geeksforgeeks.org/max-flow-problem-introduction/

### Graph Isomorphism

* https://www.sciencedirect.com/science/article/pii/S0747717113001193
* https://www3.cs.stonybrook.edu/~algorith/implement/nauty/implement.shtml
* https://github.com/Mith13/Graphs-isomorphism

### Graph Cuts

1. Min Cuts
2. Max Cuts

* Wikipedia
  + https://en.wikipedia.org/wiki/Cut\_(graph\_theory)#:~:text=In%20graph%20theory%2C%20a%20cut,said%20to%20cross%20the%20cut.

### Graph canonization

* Wikipedia
  + https://en.wikipedia.org/wiki/ Graph\_canonization

### Cycle Detection

* https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-10/ce100-week-10-graphs/#cycle-detection

### Graph Coloring

* https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-10/ce100-week-10-graphs/#graph-coloring

### Alpha-Beta Pruning

* Geeks for Geeks
  + https://www.geeksforgeeks.org/minimax-algorithm-in-game-theory-set-4-alpha-beta-pruning/

### Hasse Diagrams

* Geeks for Geeks
  + https://www.geeksforgeeks.org/discrete-mathematics-hasse-diagrams/

### Petri Nets

* Wikipedia
  + https://en.wikipedia.org/wiki/Petri\_net

### Bipartite Graphs

* CE100
  + https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-10/ce100-week-10-graphs/?h=bipartite#biparitite-checker
* Geeks for Geeks
  + https://www.geeksforgeeks.org/bipartite-graph/

### Cycle Detection

* Brent’s Algorithm
  + Geeks for Geeks
    - https://www.geeksforgeeks.org/brents-cycle-detection-algorithm/
* Hare and Tortoise Algorithm
  + Geeks for Geeks
    - https://www.geeksforgeeks.org/tag/tortoise-hare-approach/

### Cycle Detection

* CE100
  + https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-10/ce100-week-10-graphs/?h=bipartite#cycle-detection

### Bayesian Network

* https://towardsdatascience.com/introduction-to-bayesian-networks-81031eeed94e