

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

Author: Asst. Prof. Dr. UÄŸur CORUH

Contents

1	CE205 Data Structures	2
2	Week-6	2
2.0.1	Graph MST, Backtracking, Topological Sorting, Shortest Paths, Connectivity, Max Flow and Cycle Detection Algorithms.	2
2.0.2	Graph Isomorphism and canonization	2
2.0.3	Graph Cuts	2
2.0.4	Outline-1	2
2.0.5	Outline-2	2
2.0.6	Outline-3	2
2.0.7	Graph Topological Sorting	2
2.0.8	Graph MST	2
2.0.9	Graph Backtracking	3
2.0.10	Graph Shortest Paths	3
2.0.11	Graph Connectivity	3
2.0.12	Graph Max Flow	3
2.0.13	Graph Isomorphism	3
2.0.14	Graph Cuts	3
2.0.15	Graph canonization	3
2.0.16	Cycle Detection	4
2.0.17	Graph Coloring	4
2.0.18	Alpha-Beta Pruning	4
2.0.19	Hasse Diagrams	4
2.0.20	Petri Nets	4
2.0.21	Bipartite Graphs	4
2.0.22	Cycle Detection	4
2.0.23	Bayesian Network	4

List of Figures

List of Tables

1 CE205 Data Structures

2 Week-6

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

2.0.2 Graph Isomorphism and canonization

2.0.3 Graph Cuts

Download PDF¹, DOCX², SLIDE³, PPTX⁴

2.0.4 Outline-1

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

2.0.5 Outline-2

- Graph Shortest Paths
- Graph Connectivity - SCC
- Graph Max Flow
- Graph Isomorphism
- Graph canonization
- Graph Cuts
 - Min Cut
 - Max Cut

2.0.6 Outline-3

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

2.0.7 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/>

2.0.8 Graph MST

- CE100

¹[pandoc_ce205-week-6-graph-algorithms.en_doc.pdf](#)

²[pandoc_ce205-week-6-graph-algorithms.en_word.docx](#)

³[ce205-week-6-graph-algorithms.en_slide.pdf](#)

⁴[ce205-week-6-graph-algorithms.en_slide.pptx](#)

- <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/>

2.0.9 Graph Backtracking

- Tug of War
 - Geeks for Geeks
 - * <https://www.geeksforgeeks.org/tug-of-war/>
- n-Queen's Problem
 - Geeks for Geeks
 - * <https://www.geeksforgeeks.org/n-queen-problem-backtracking-3/?ref=lbp>
- 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%20ass>
- Euler & Hamiltonian Path
 - <https://www.geeksforgeeks.org/mathematics-euler-hamiltonian-paths/>

2.0.10 Graph Shortest 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>

2.0.11 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>

2.0.12 Graph Max Flow

- Geeks for Geeks
 - <https://www.geeksforgeeks.org/max-flow-problem-introduction/>

2.0.13 Graph Isomorphism

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

2.0.14 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](https://en.wikipedia.org/wiki/Cut_(graph_theory)#:~:text=In%20graph%20theory%2C%20a%20cut,said%20to)

2.0.15 Graph canonization

- Wikipedia
 - https://en.wikipedia.org/wiki/Graph_canonization

2.0.16 Cycle Detection

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

2.0.17 Graph Coloring

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

2.0.18 Alpha-Beta Pruning

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

2.0.19 Hasse Diagrams

- Geeks for Geeks
 - <https://www.geeksforgeeks.org/discrete-mathematics-hasse-diagrams/>

2.0.20 Petri Nets

- Wikipedia
 - https://en.wikipedia.org/wiki/Petri_net

2.0.21 Bipartite Graphs

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

2.0.22 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/>
- CE100
 - <https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-10/ce100-week-10-graphs/?h=bipartite#cycle-detection>

2.0.23 Bayesian Network

- <https://towardsdatascience.com/introduction-to-bayesian-networks-81031eed94e>

End – Of – Week – 6