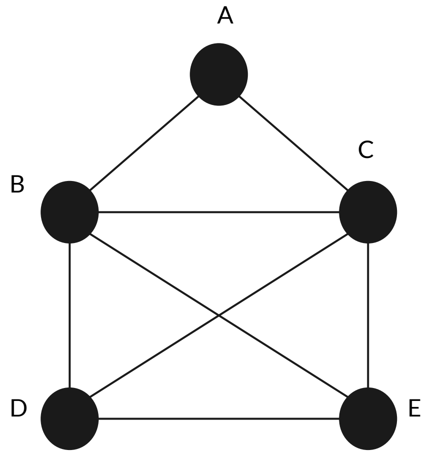
CIS 263 Introduction to Data Structures and Algorithms

Graph Coloring

Graph coloring

Given a Graph, we have color its nodes in a way that no two adjacent nodes have the same color (i.e. each edge ends at different color vertices)



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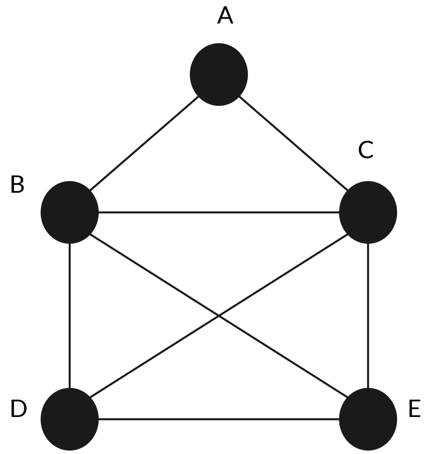
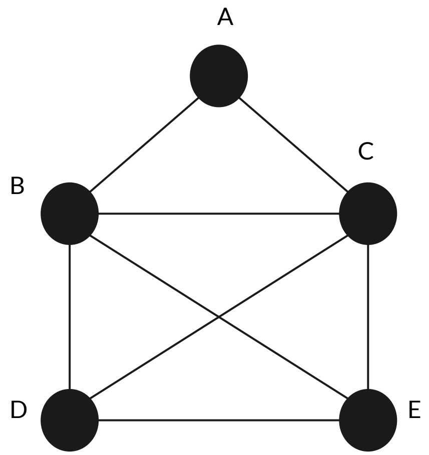
Traversal seq	A	B	C	D	E



Graph coloring

Greedy Algorithm



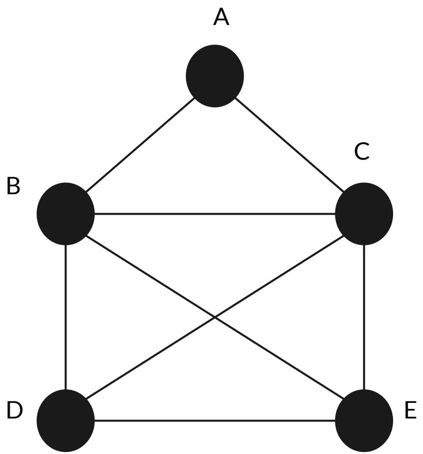
Traversal seq

A	B	C	D	E

Graph coloring

Greedy Algorithm

- Ordered list of colors



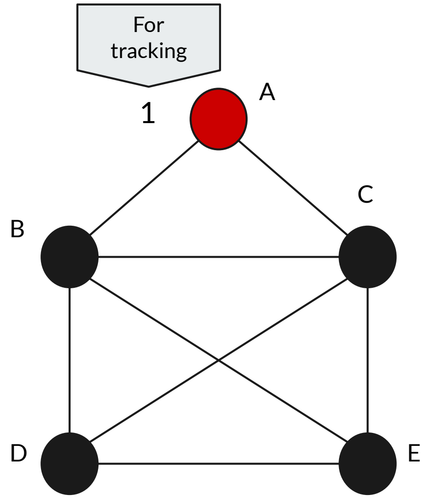
Traversal seq	A	B	C	D	E

🔴	🟢	🔵	🟣	🟠
1	2	3	4	5

Graph coloring

Greedy Algorithm

- Ordered list of colors
- **Starting node: color with the initial index**



Traversal seq

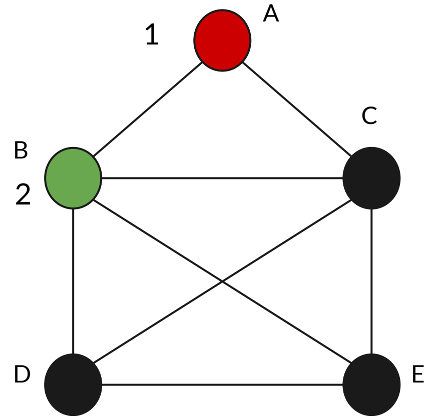
✗	B	C	D	E

🔴	🟢	🔵	🟣	🟠
1	2	3	4	5

Graph coloring

Greedy Algorithm

- Ordered list of colors
- Starting node: color with the initial index
- **Go to the next neighbour, color it**
  - **with the minimum available index (non replaceable) exclusive to the already labeled (colored) neighbor's indices**
  - **Iterate**



Traversal seq	☒	☒	C	D	E

🟥	🟩	🟦	🟪	🟧
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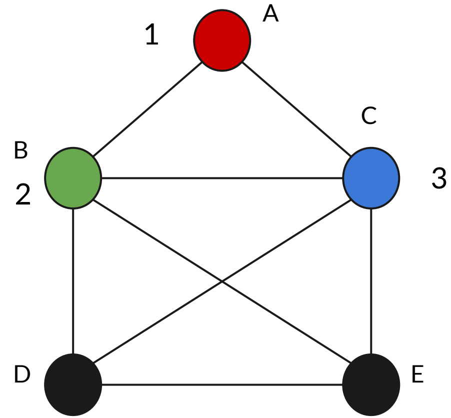

Traversal seq

✗	✗	✗	D	E

🔴	🟢	🔵	🟣	🟠
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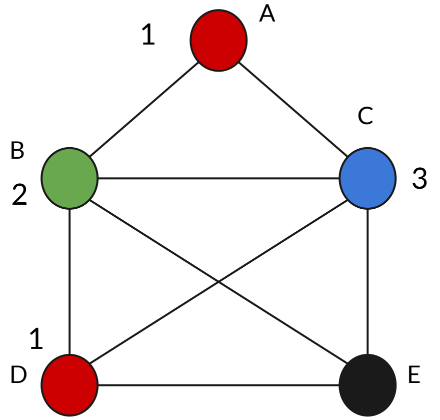
Pay attention here ..



Traversal seq

☒	☒	☒	☒	E

🔴	🟢	🔵	🟣	🟠
1	2	3	4	5

Graph coloring

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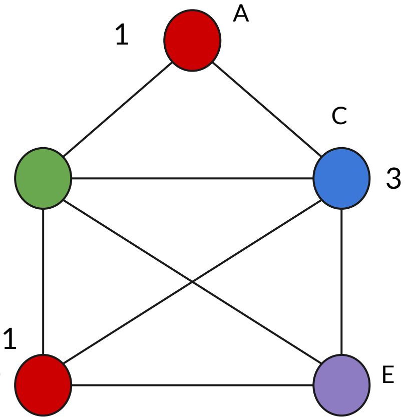

Traversal seq

☒	☒	☒	☒	☒

🟥	🟩	🟦	🟪	☒
1	2	3	4	5

Graph coloring

Greedy Algorithm

- Ordered list of colors
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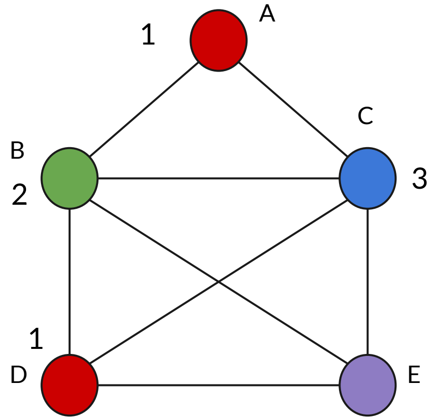
  - Iterate
- **Solution: 4 colours (chromatic number) graph**

Pay attention here ..



Traversal seq

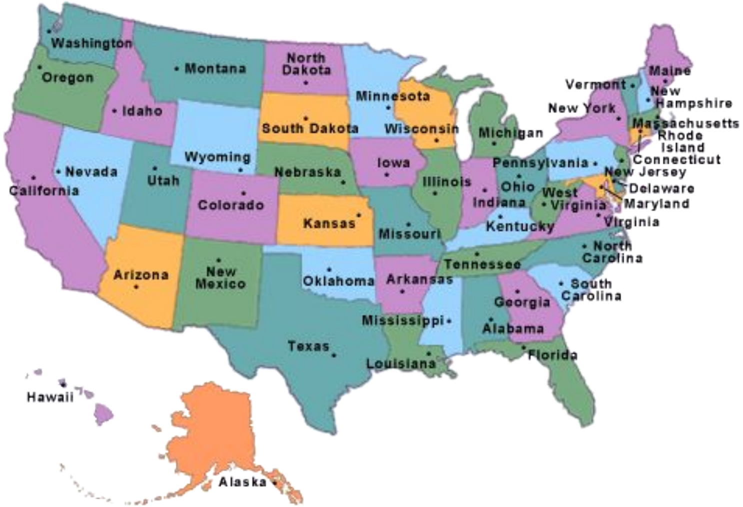
☒	☒	☒	☒	☒

🔴	🟢	🔵	🟣	☒
1	2	3	4	5

Revisit one more ..

Graph coloring applications

- No two states have the same color
  - Whiteboarding
- Old days printing



Summary

- **Given a Graph**, we used a **Greedy Algorithm** to perform graph coloring.