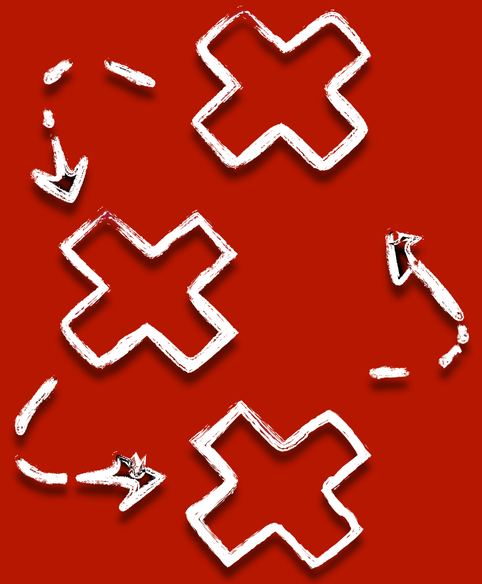


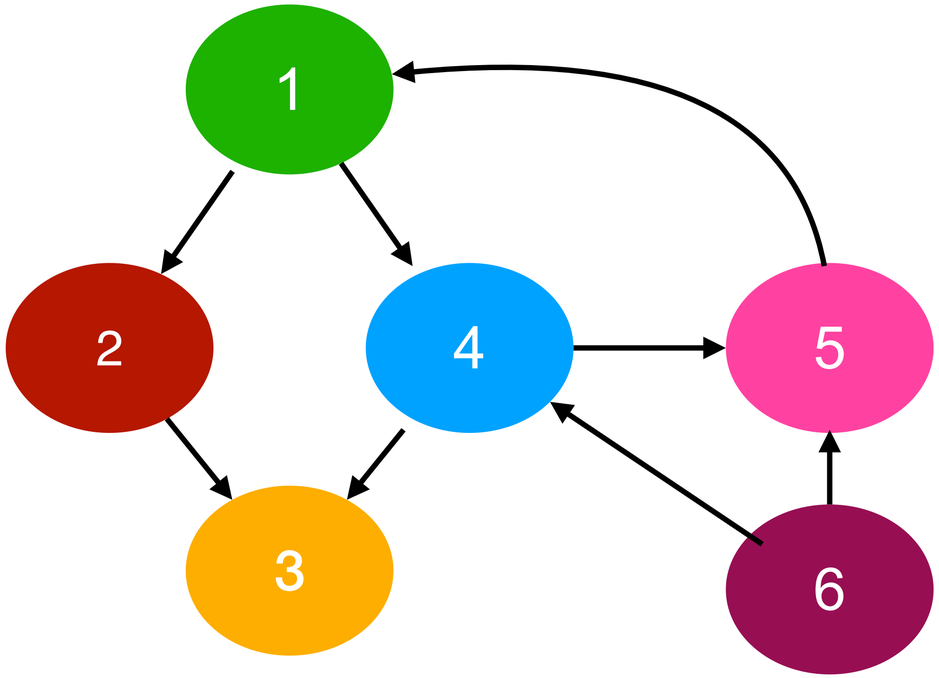
Causal Data Science

Lecture 4:0 Solutions to last lecture quizzes

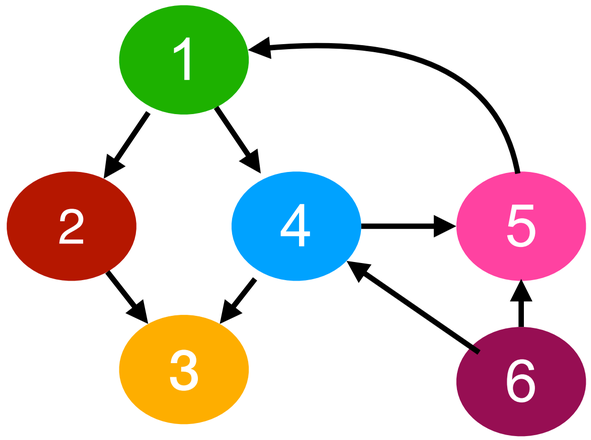
Lecturer: Sara Magliacane

UvA - Spring 2024

Exercise in Canvas: graph terminology



Exercise in Canvas: graph terminology



1 Multiple choice 0.5 points

What is the sequence of nodes (2,4,6)?

- ○ A directed path
- ○ A path, but not directed
- ◉ Not a path

2 Multiple choice 0.5 points

What is the sequence of nodes (6,5,1) ?

- ○ Not a path
- ◉ A directed path
- ○ A path but not directed

3 Multiple choice 0.5 points

What is the sequence of nodes (2,3,4,3)?

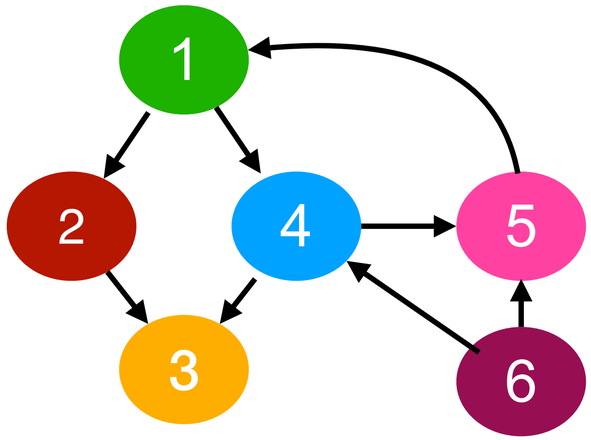
- ◉ Not a path
- ○ A directed path
- ○ A path, but not directed

4 Multiple choice 0.5 points

What is the sequence of node (1,4,6,5)?

- ◉ A path, but not directed
- ○ A directed path
- ○ Not a path

Exercise in Canvas: graph terminology

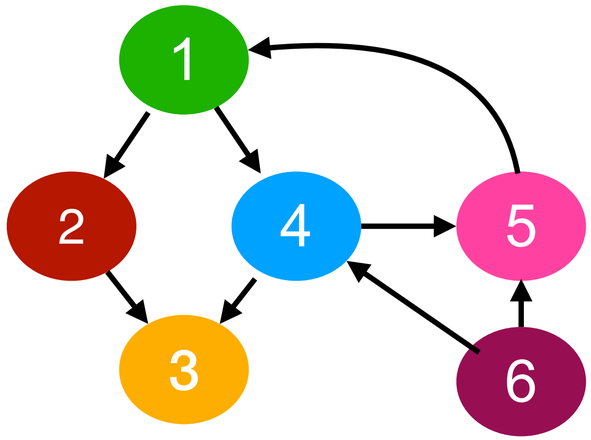


5 Matching 2 points

Match each sequence of edges with each type of cycle

1,4,3,1	Not a cycle (not a path)
1,4,5,1	Directed cycle
1,4,3,2,1	A cycle , but not a directed cycle
6,5,4	A path, but not a cycle

Exercise in Canvas: graph terminology



6 Multiple answer 0.5 points

Which nodes are the parents of node 4? (select all that apply)

- [x] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [x] 6

7 Multiple answer 0.5 points

Which nodes are the children of node 6? (select all that apply)

- [ ] 1
- [ ] 2
- [ ] 3
- [x] 4
- [x] 5
- [ ] 6

8 Multiple answer 0.5 points

Which nodes are the descendants of node 6? (select all that apply)

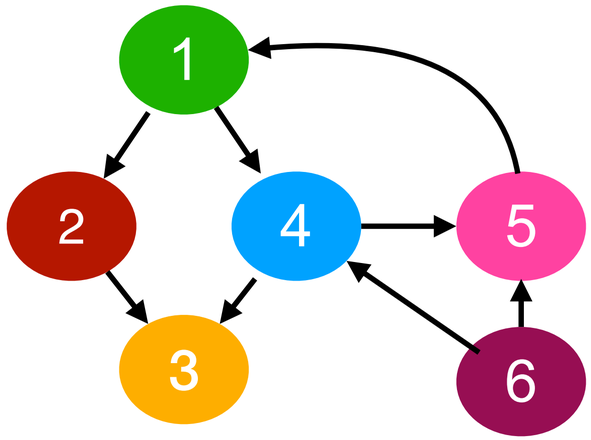
- [x] 1
- [x] 2
- [x] 3
- [x] 4
- [x] 5
- [x] 6

9 Multiple answer 0.5 points

Which nodes are the ancestors of node 2? (select all that apply)

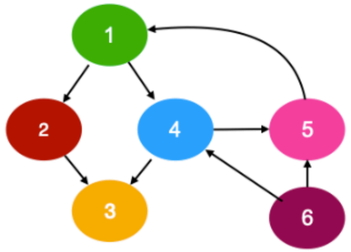
- [x] 1
- [x] 2
- [ ] 3
- [x] 4
- [x] 5
- [x] 6

Exercise in Canvas: graph terminology



10 Multiple choice 1 point

Which nodes are the descendants of nodes 3 and 4? **(select all that apply)**
HINT: in our definition nodes are their own descendants

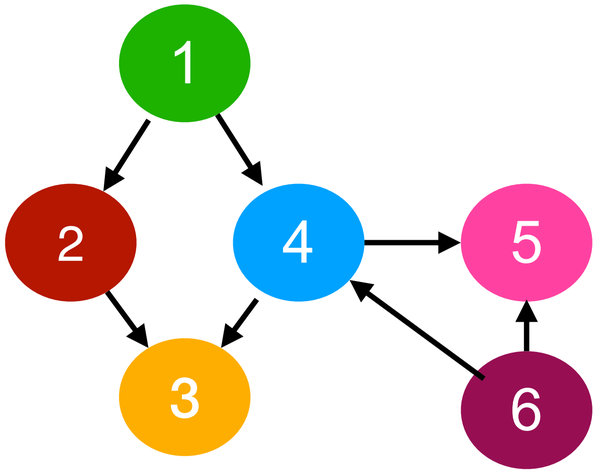


- [x] 1,2,3,4,5
- [ ] 3,4
- [ ] 1,2,3,4,5,6
- [ ] 3,4,5

Exercise 2 in Canvas: d-separation

- A **path** between **i and j** is **blocked by** $\mathbf{A} \subseteq \mathbf{V} \backslash \{i, j\}$ at least one condition holds, otherwise it is **active**
  - There is a *non-collider* on the path that is in $\mathbf{A}$**, or**
  - There is a *collider* k on the path, but $k \notin \mathbf{A}$ and $\mathrm{Desc}(k) \cap \mathbf{A} = \emptyset$
- Nodes **i and j** are **d-separated by** $\mathbf{A} \subseteq \mathbf{V} \backslash \{i, j\}$ if **all paths** between i, j are **blocked by** $\mathbf{A}$
  - We denote d-separation as $i \perp j \,|\, \mathbf{A}$
- Otherwise we say they are **d-connected,** $i \not\perp\!\!\!\perp j \,|\, \mathbf{A}$

Exercise 2 in Canvas: d-separation



1 Multiple choice 0.5 points Colliders

If 4 a collider in the graph?

- (●) Trick question
- ( ) Yes
- ( ) No

2 Multiple choice 0.5 points Colliders on a path

Is 4 a collider on the path 1, 4, 6, 5? What about on path 3, 4, 5?

- ( ) It's a collider on both
- ( ) It's not a collider on neither
- (●) Only on path 1,4,6,5
- ( ) Only on path 3,4,5

3 True or False 0.5 points Blocked paths

Path 1,4,5 between 1 and 5 is blocked by **A = {4}**

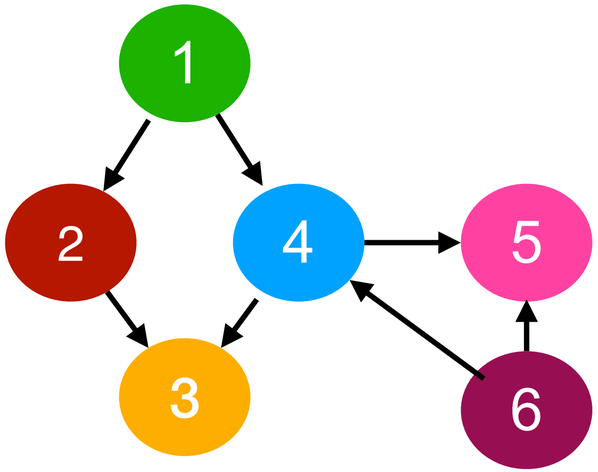
- (●) True
- ( ) False

4 True or False 0.5 points Blocked paths

Path 1,4,6 between 1 and 6 is blocked by **A={4}**

- ( ) True
- (●) False

Exercise 2 in Canvas: d-separation



5 True or False 0.5 points Blocked paths

Path 1,4,6 between 1 and 6 is blocked by **A={5}**

- ○ True
- ◉ False

6 Multiple choice 0.5 points D-separation

1 is d-separated from 6 when we consider **A** ...

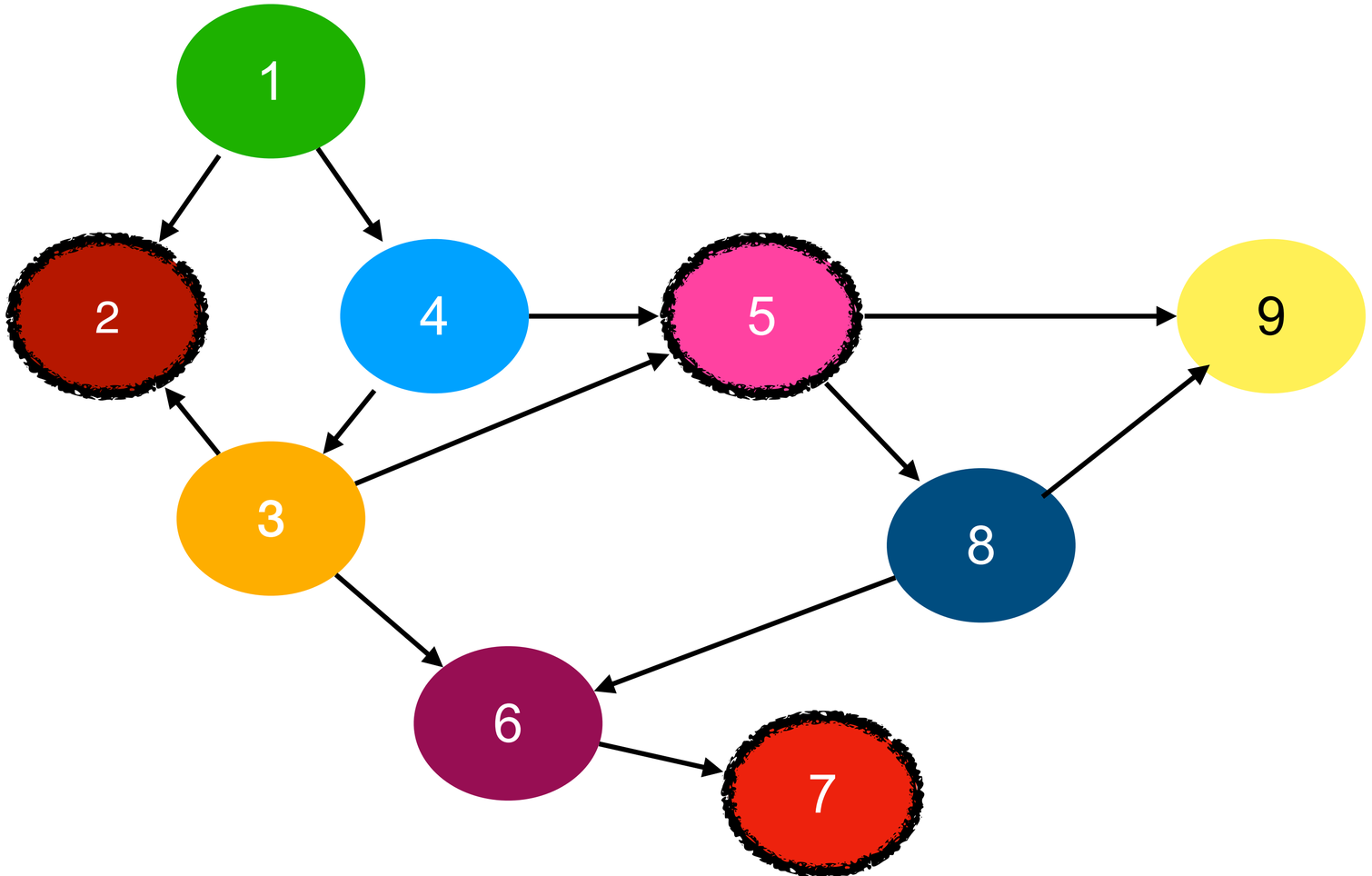
- ◉ **A** = {} (empty set)
- ○ **A** = {4}
- ○ **A** = {5}
- ○ **A** = {2,3}

7 Multiple choice 1 point

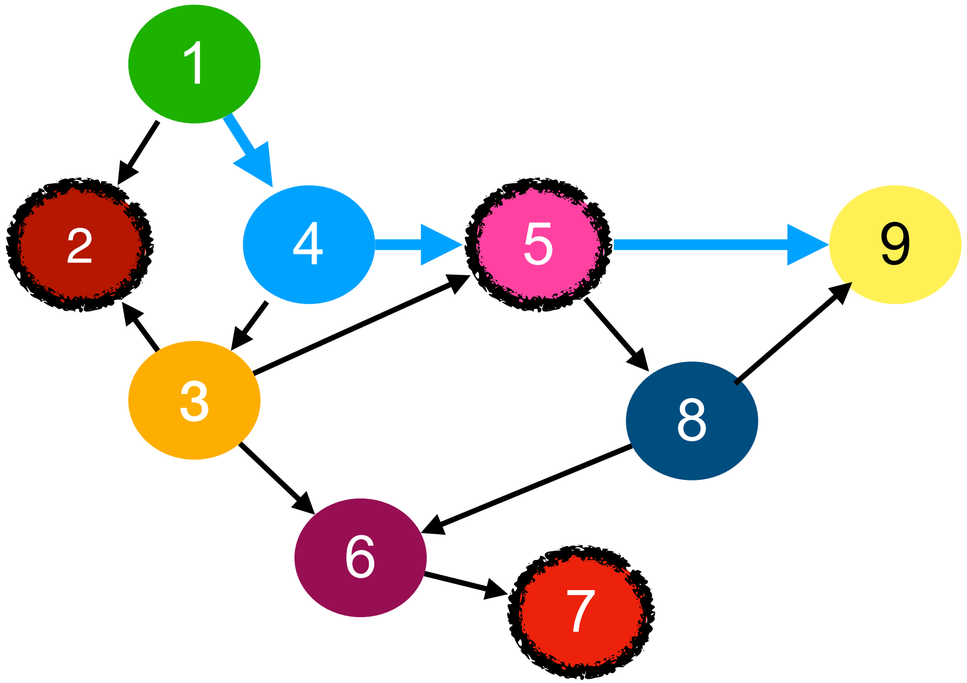
1 is d-separated from 3 when we consider **A**...

- ○ **A**={2}
- ○ **A**={4}
- ◉ **A**={2,4}
- ○ **A**= {}

Optional exercise in Canvas: d-separation 2



Optional exercise in Canvas: d-separation 2

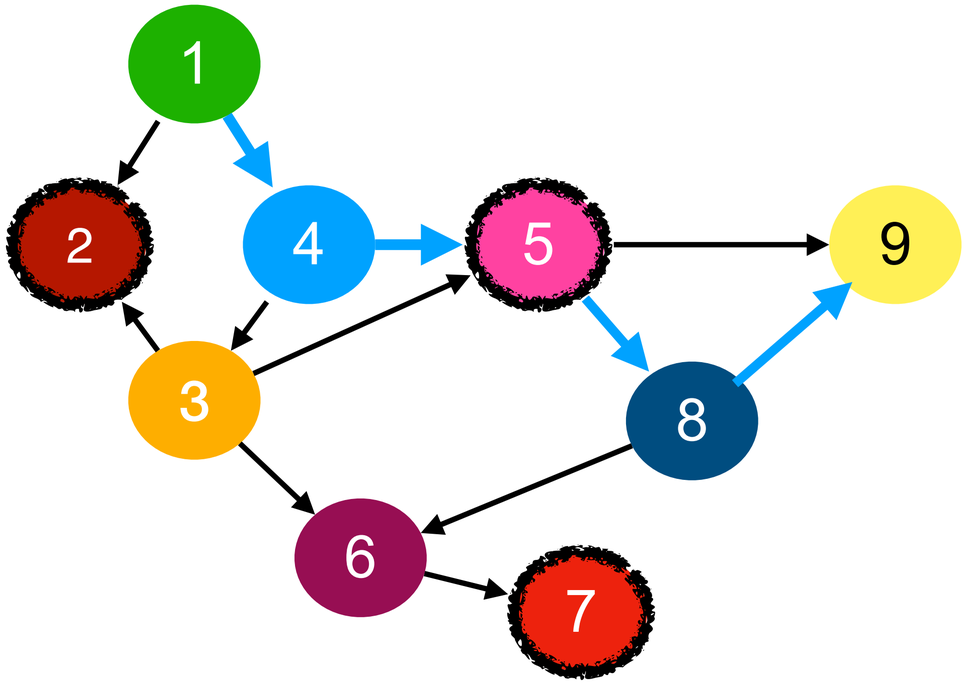


1 True or False 0 points

Is the path from 1 to 9 through 1,4,5,9 blocked when **A**= {2,5,7}?

- (●) True
- ( ) False

Optional exercise in Canvas: d-separation 2



1 True or False 0 points

Is the path from 1 to 9 through 1,4,5,9 blocked when **A**= {2,5,7}?

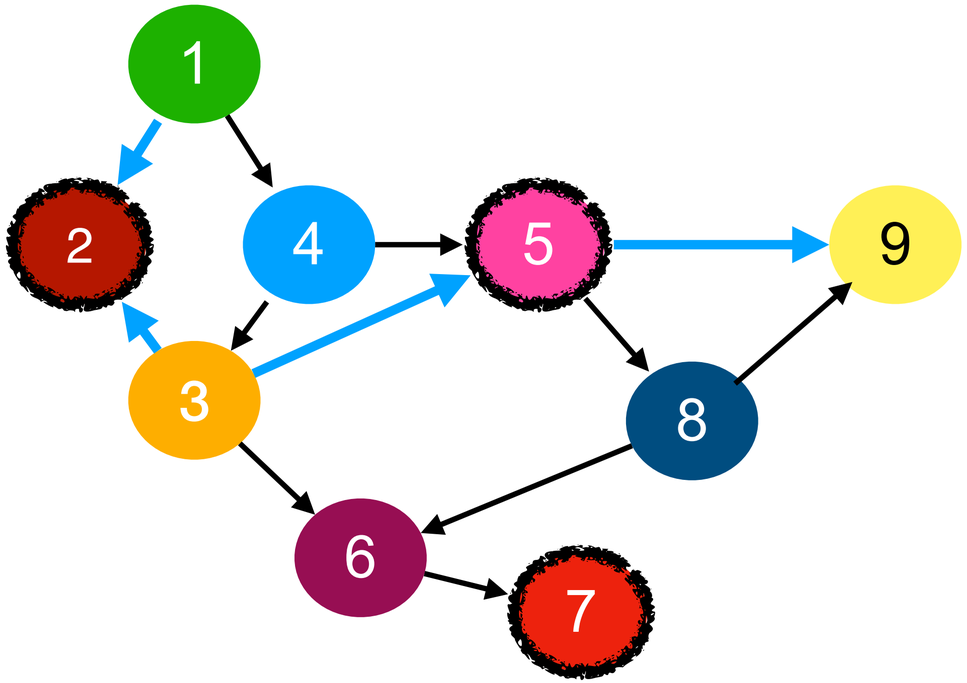
- (●) True
- ( ) False

2 True or False 0 points

Is the path from 1 to 9 through 1,4,5,8,9 blocked when **A**= {2,5,7}

- (●) True
- ( ) False

Optional exercise in Canvas: d-separation 2



1 True or False 0 points

Is the path from 1 to 9 through 1,4,5,9 blocked when **A**= {2,5,7}?

- (●) True
- ( ) False

2 True or False 0 points

Is the path from 1 to 9 through 1,4,5,8,9 blocked when **A**= {2,5,7}

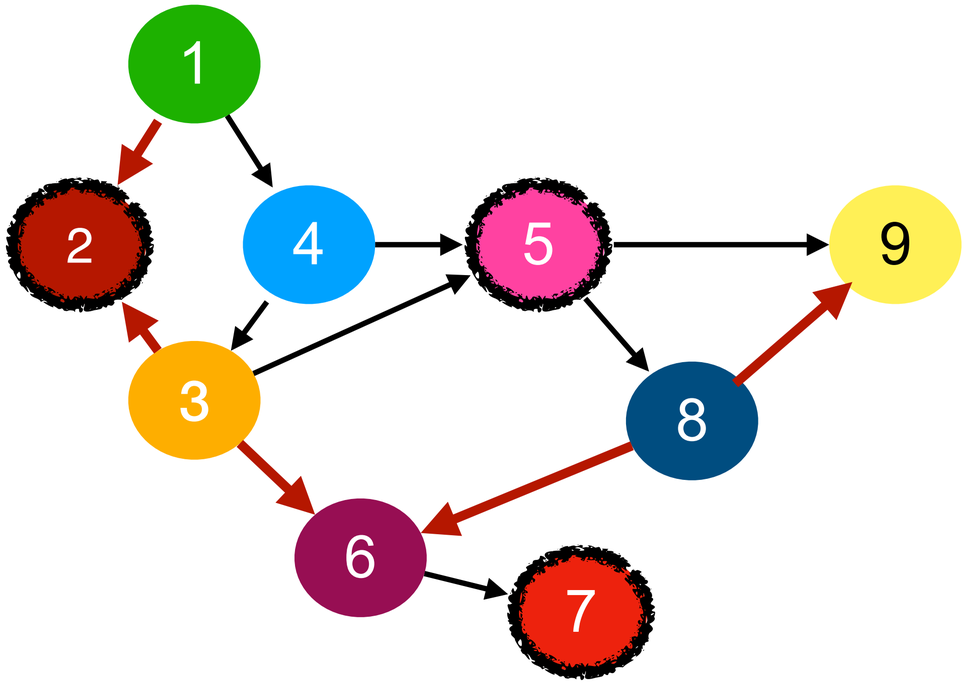
- (●) True
- ( ) False

3 True or False 0 points

Is the path from 1 to 9 through 1, 2, 3, 5, 9 blocked when A= {2,5,7}?

- (●) True
- ( ) False

Optional exercise in Canvas: d-separation 2



1 True or False 0 points

Is the path from 1 to 9 through 1,4,5,9 blocked when **A**= {2,5,7}?

- (●) True
- ( ) False

2 True or False 0 points

Is the path from 1 to 9 through 1,4,5,8,9 blocked when **A**= {2,5,7}

- (●) True
- ( ) False

3 True or False 0 points

Is the path from 1 to 9 through 1, 2, 3, 5, 9 blocked when A= {2,5,7}?

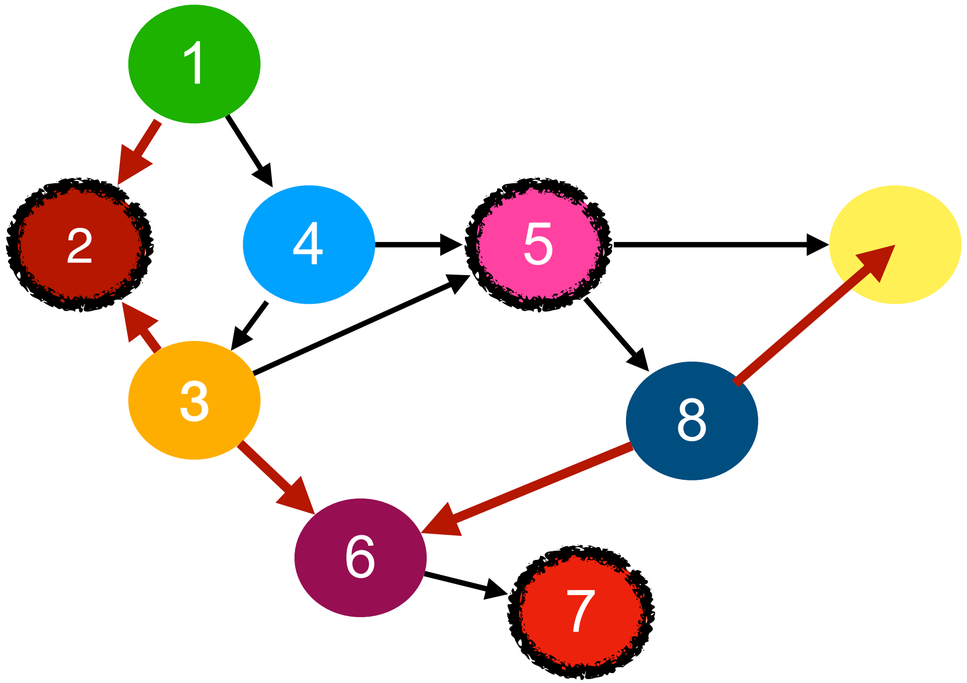
- (●) True
- ( ) False

4 True or False 0 points

Is the path from 1 to 9 through 1,2,3,6,8,9 blocked when **A**= {2,5,7}?

- ( ) True
- (●) False

Optional exercise in Canvas: d-separation 2



1 True or False 0 points

Is the path from 1 to 9 through 1,4,5,9 blocked when **A**= {2,5,7}?

- (●) True
- ( ) False

2 True or False 0 points

Is the path from 1 to 9 through 1,4,5,8,9 blocked when **A**= {2,5,7}

- (●) True
- ( ) False

3 True or False 0 points

Is the path from 1 to 9 through 1, 2, 3, 5, 9 blocked when A= {2,5,7}?

- (●) True
- ( ) False

4 True or False 0 points

Is the path from 1 to 9 through 1,2,3,6,8,9 blocked when **A**= {2,5,7}?

- ( ) True
- (●) False

5 True or False 0 points

1 is d-separated from 9, when **A**= {2,5,7}?

- ( ) True
- (●) False