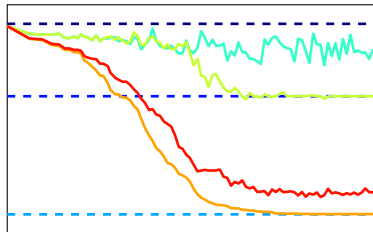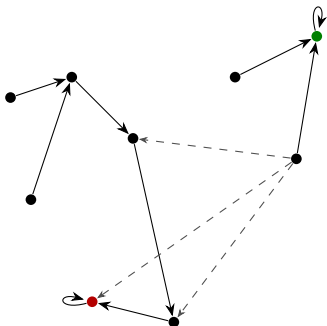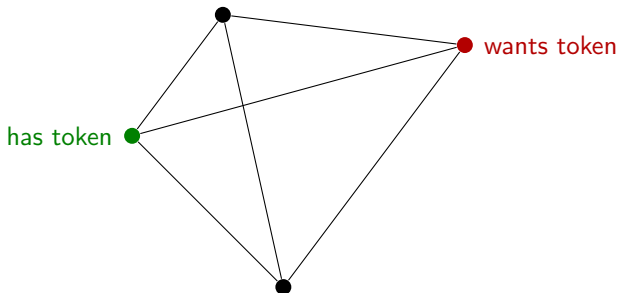# Arvy Heuristics for Distributed Mutual Exclusion



Silvan Mosberger
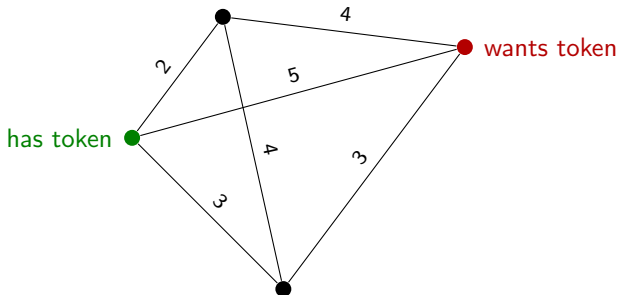*Advised by Pankaj Khanchandani and András Papp*

# Distributed Mutual Exclusion

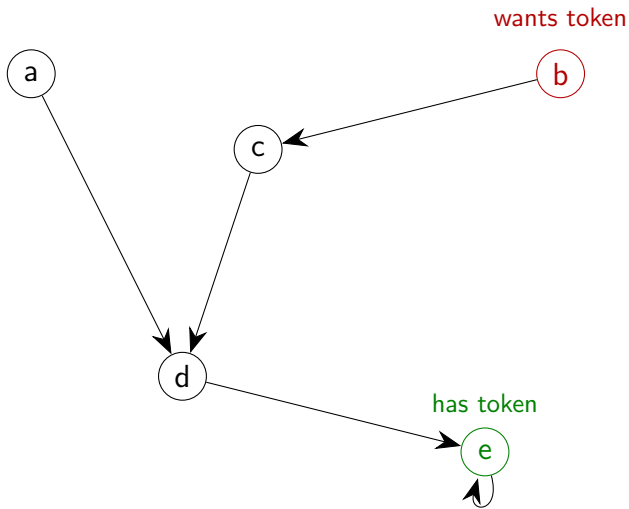Single shared resource in network of nodes wanting exclusive access to it
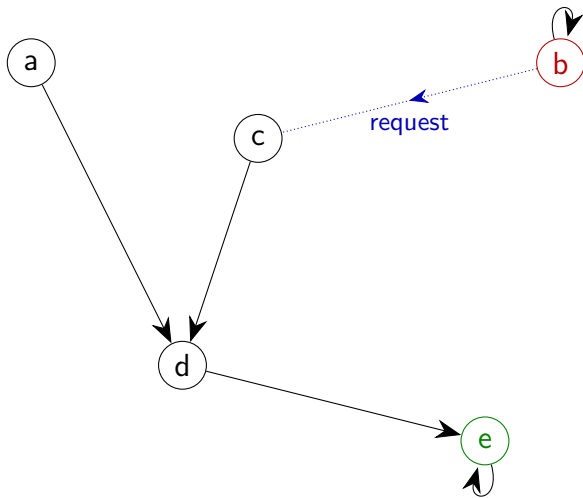
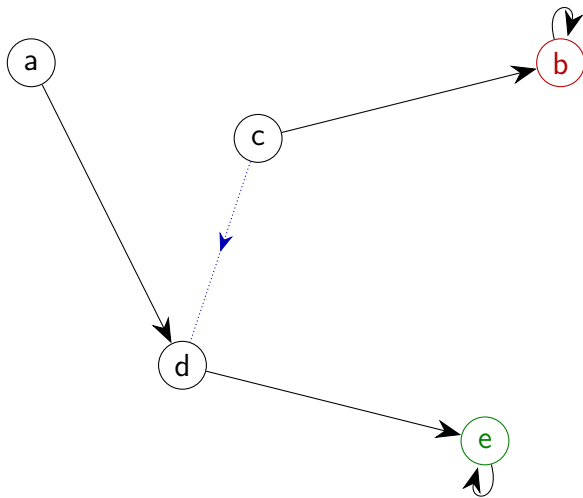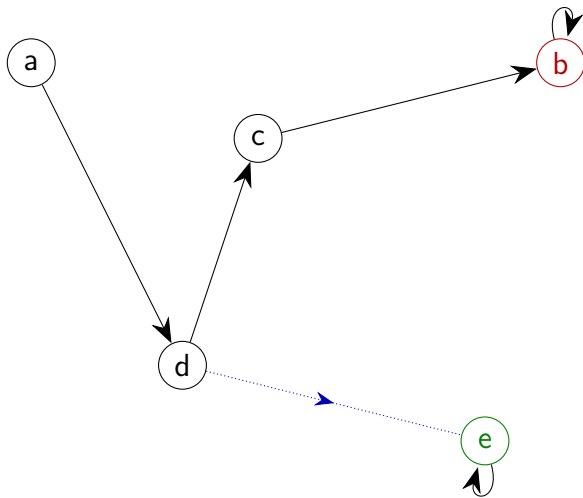# Distributed Mutual Exclusion

Single shared resource in network of nodes wanting exclusive
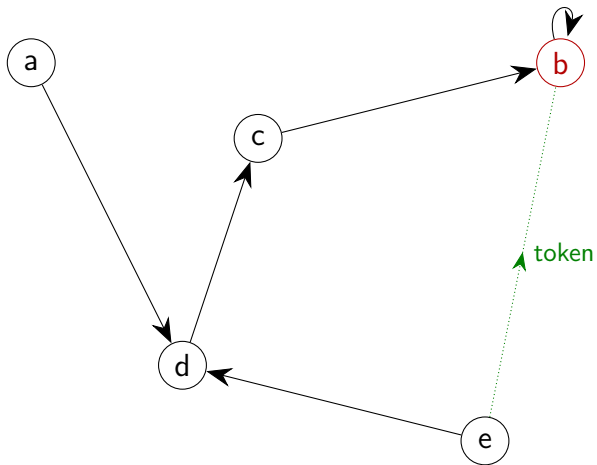access to it
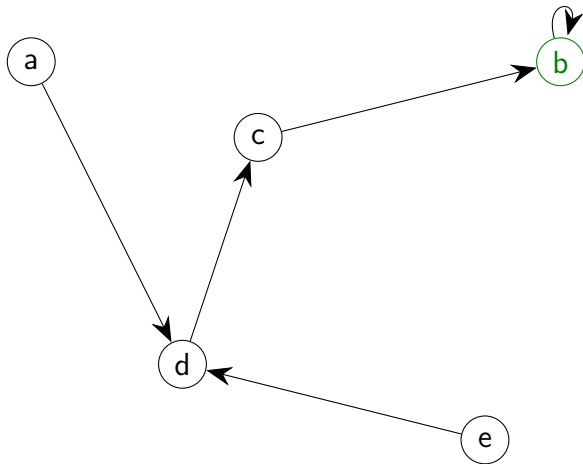
# Arrow

# Arrow

# Arrow
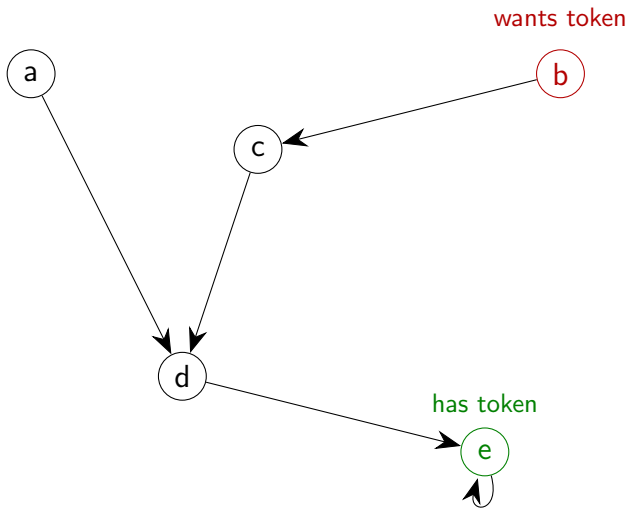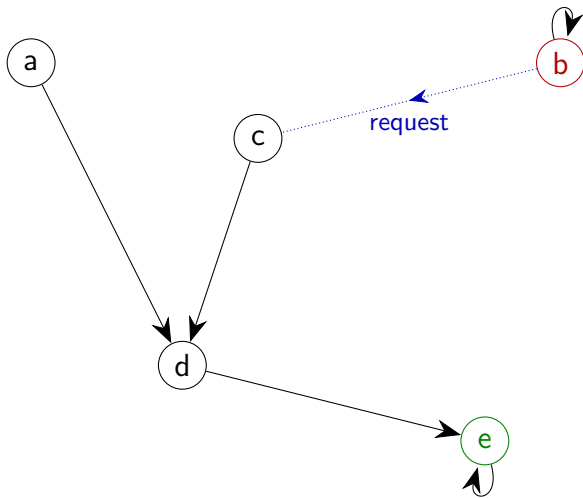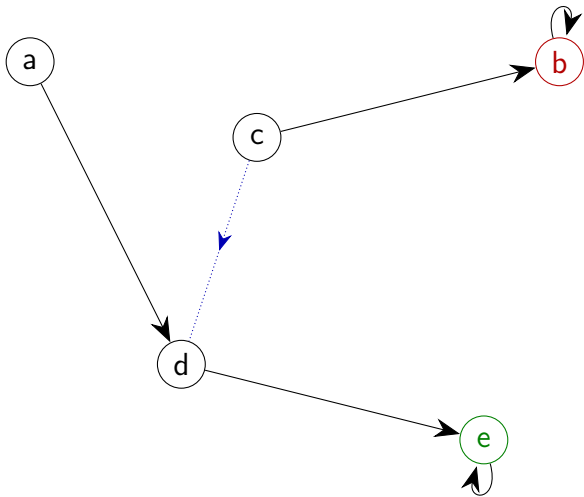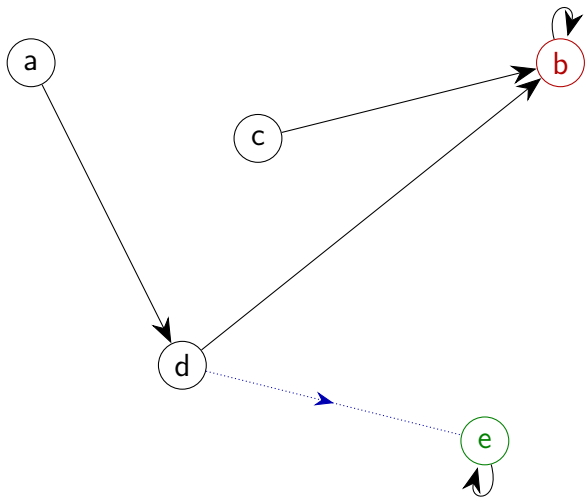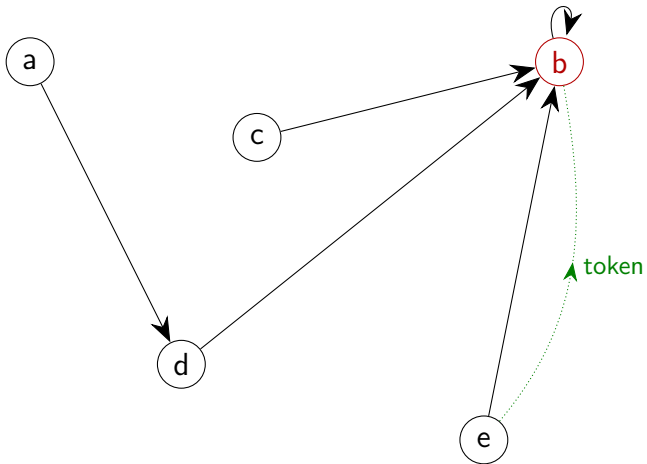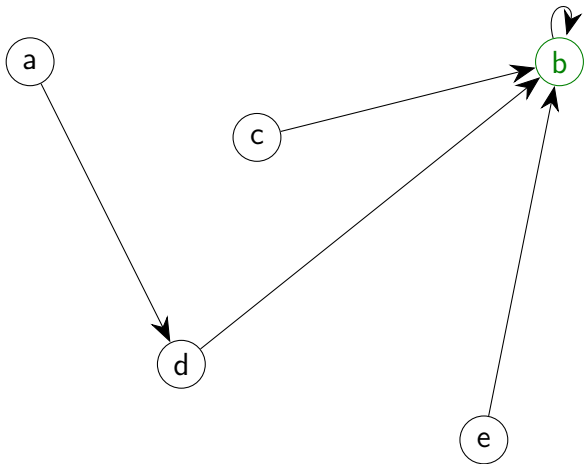
# Arrow

# Arrow

# Arrow

# Ivy

# Ivy

# Ivy

# Ivy

# Ivy

# Ivy

# General Arvy

# General Arvy

# General Arvy



parent candidate

# General Arvy

# General Arvy

# General Arvy
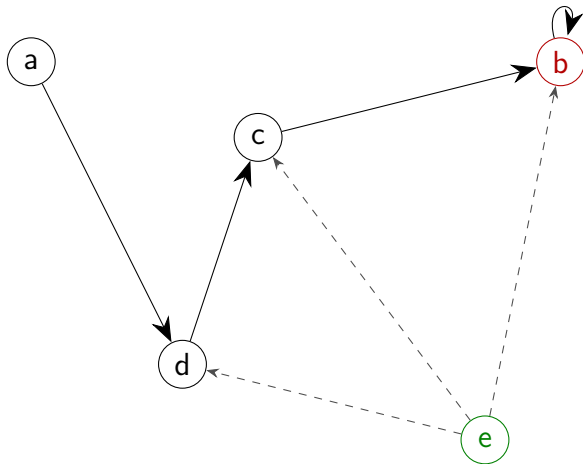
# General Arvy
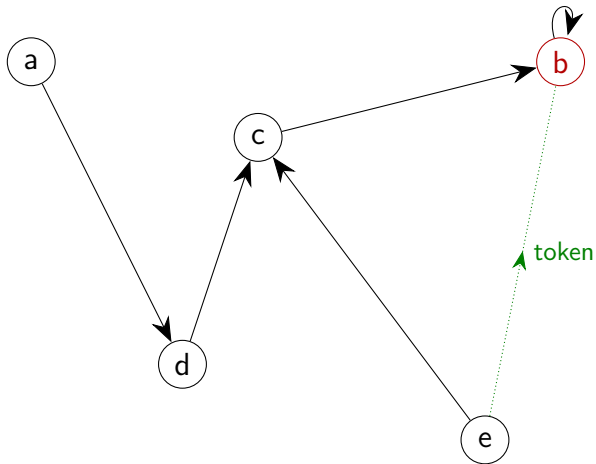
# General Arvy

# General Arvy

# Edge Distance Minimizer
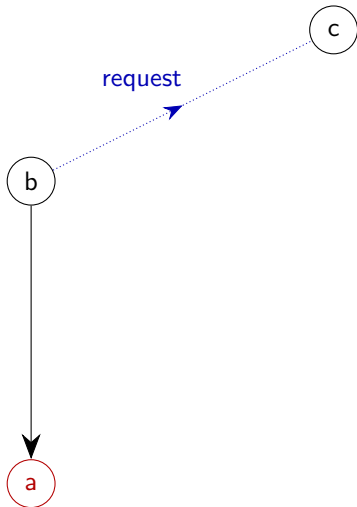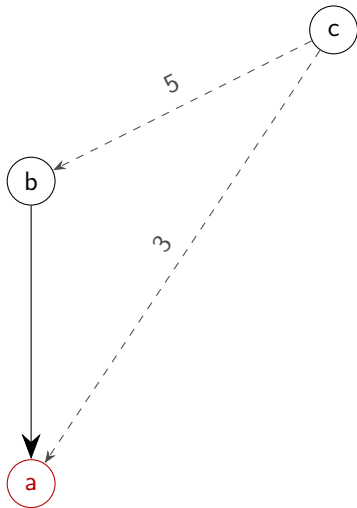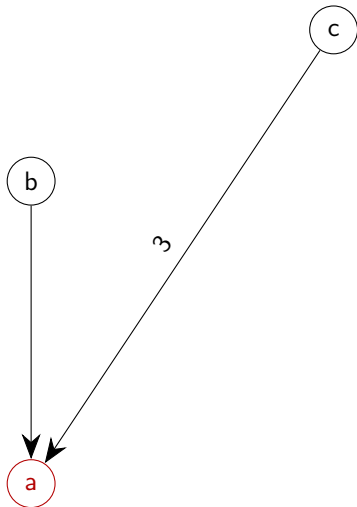
# Edge Distance Minimizer

# Edge Distance Minimizer

# Edge Distance Minimizer
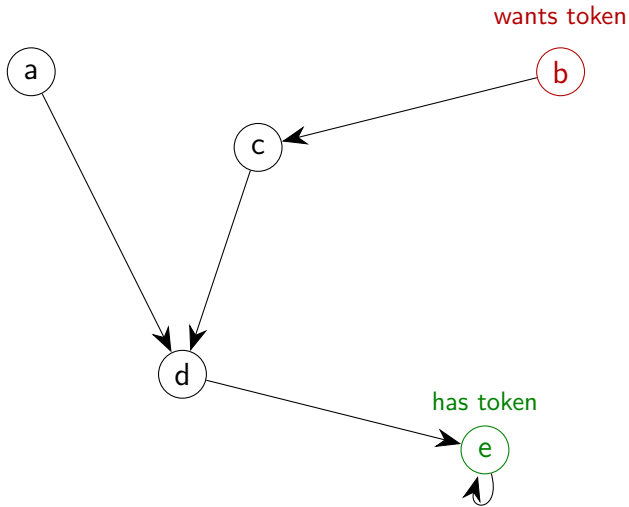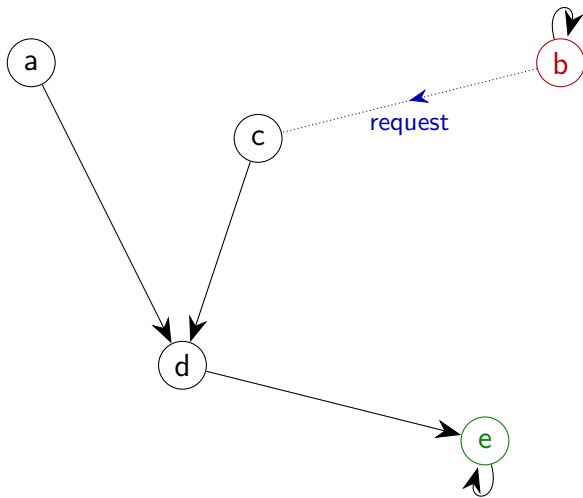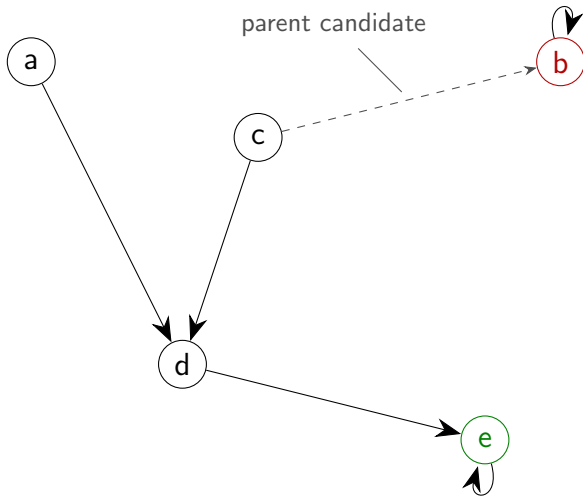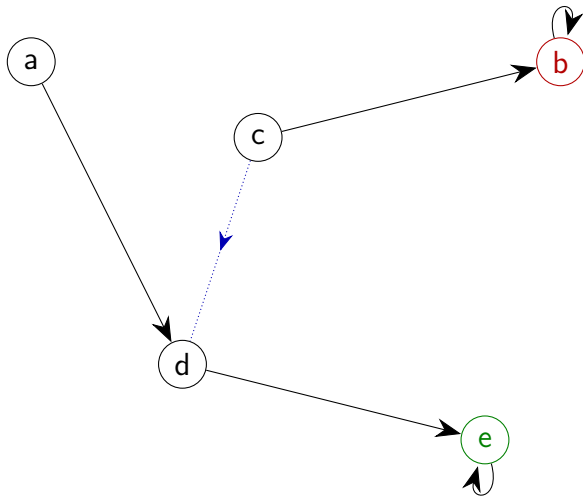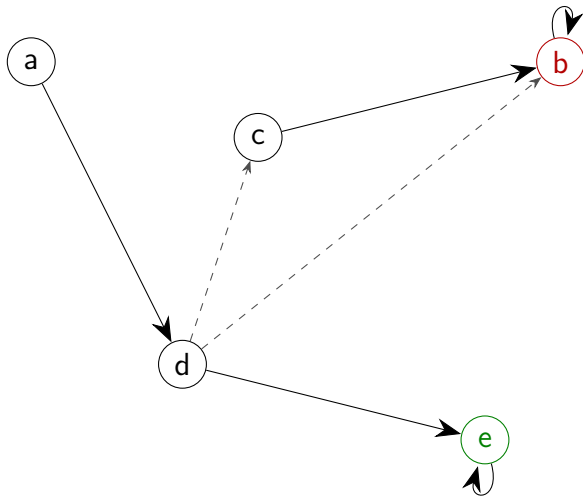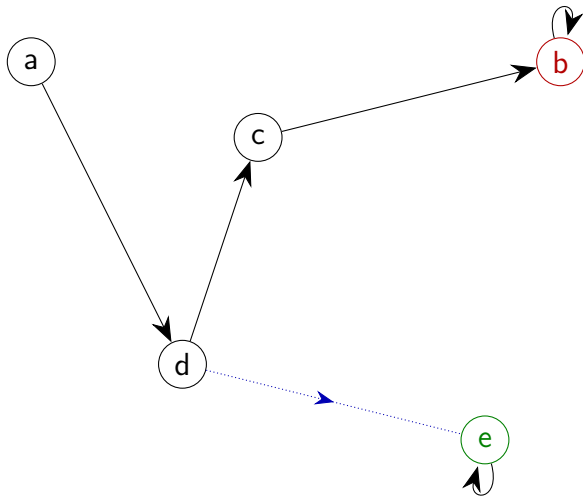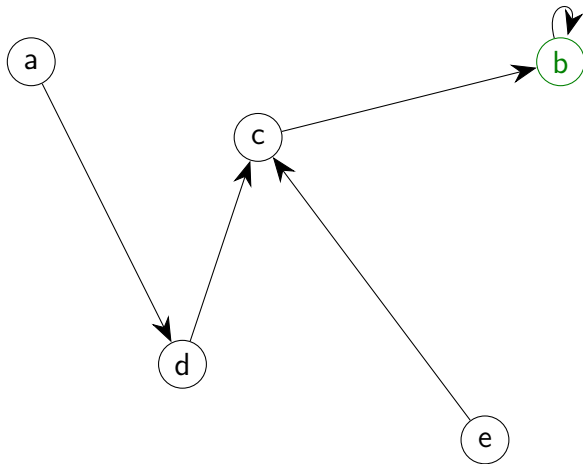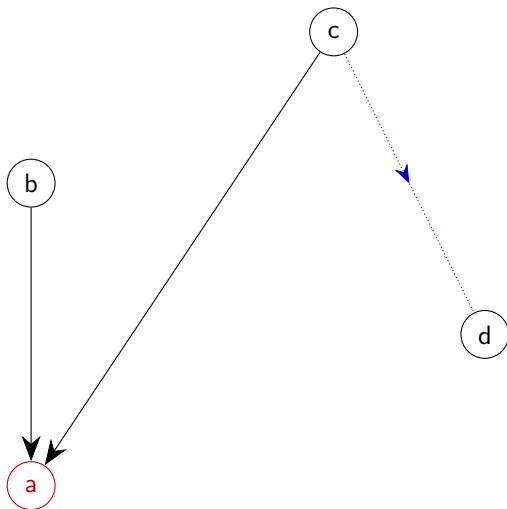
# Edge Distance Minimizer
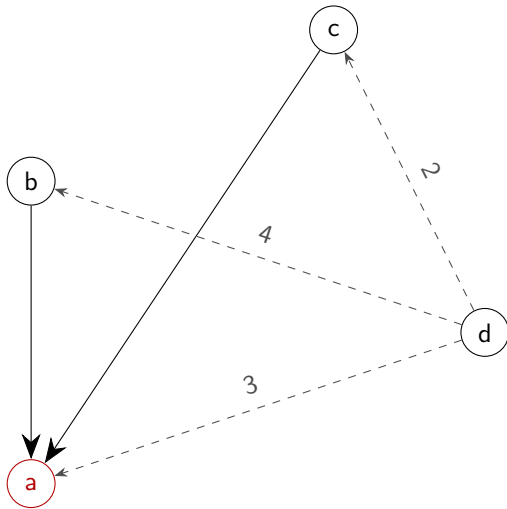
# Edge Distance Minimizer
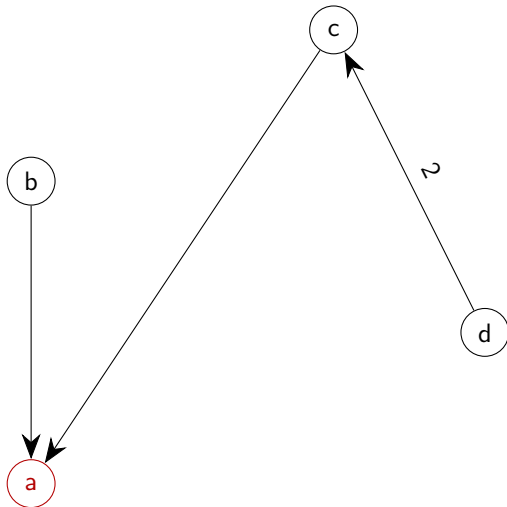
# Local Pair Distance Minimizer
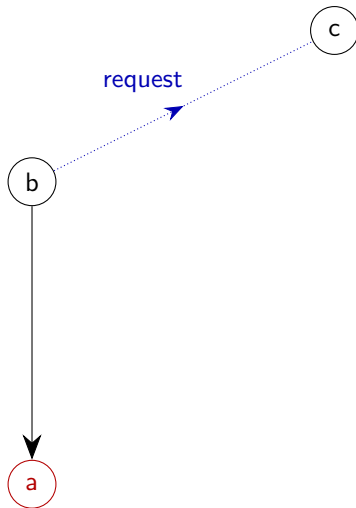
# Local Pair Distance Minimizer
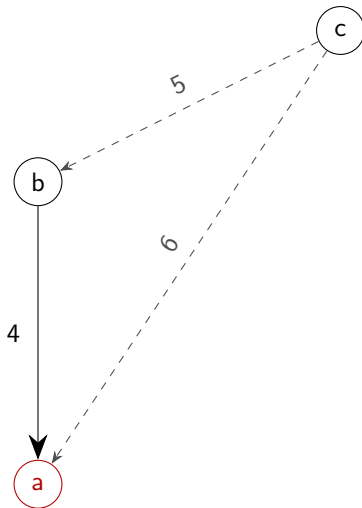


Total tree pair distance

b as new parent: 18

a as new parent: 20

# Local Pair Distance Minimizer
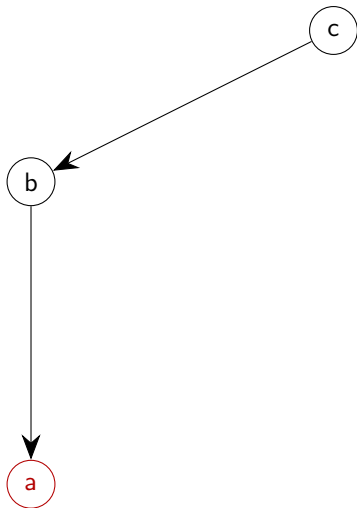
# Local Pair Distance Minimizer
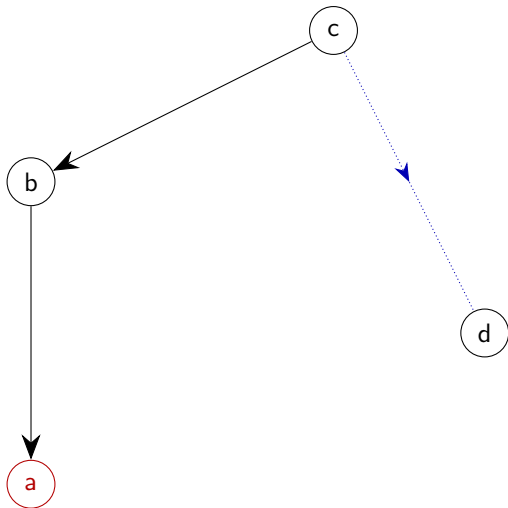
# Local Pair Distance Minimizer
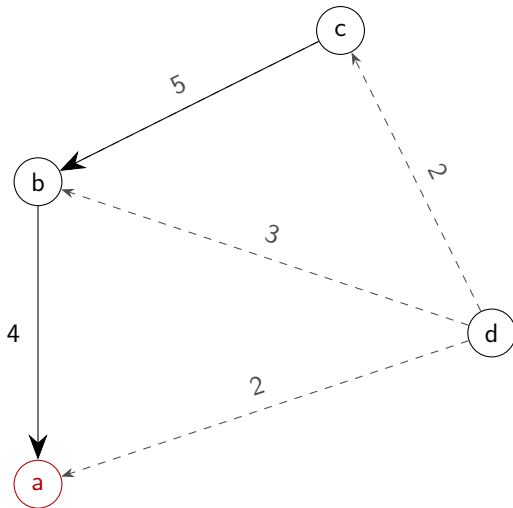


Total tree pair distance

c as new parent: 38

b as new parent: 36

a as new parent: 37

# Local Pair Distance Minimizer
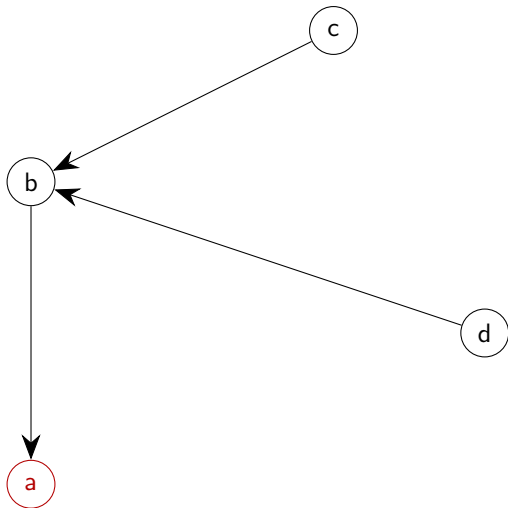
# Dynamic Star

For known probability distributions, there is a best star
2-approximation of the optimum[1]

## Idea

- ▶ Measure frequency of requests for each node
- ▶ Choose node with best estimated performance as star
  center

---

[1]**Peleg**

# Dynamic Star
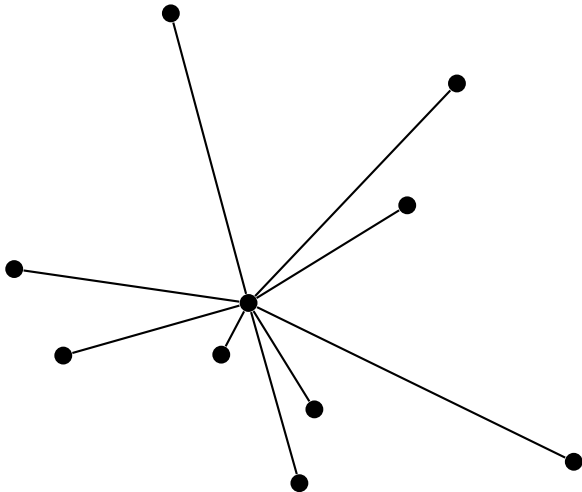
# Dynamic Star

# Results

- Graph weights: Euclidean distances between uniformly random points in a unit square
- Requests: Random or adversarial
- Performance: Total time needed to satisfy all requests

# Tree Behavior

# Tree Behavior

# Tree Behavior
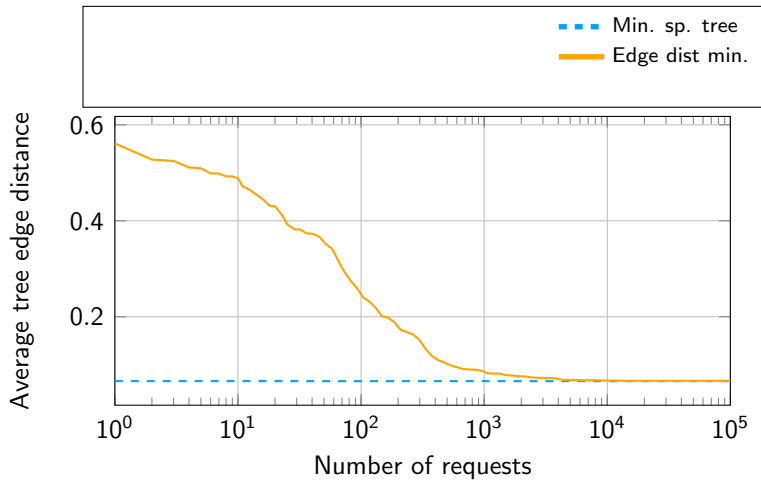
# Tree Behavior

# Tree Behavior
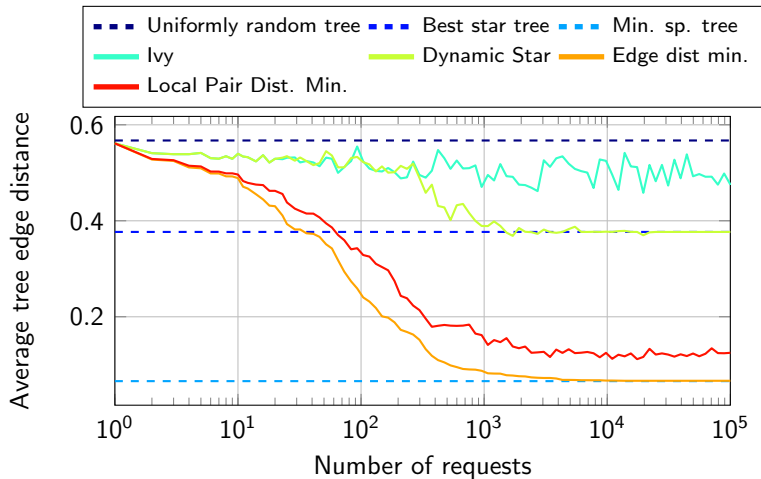
# Best Heuristic for Random Requests

# Best Heuristic for Adversarial Requests

# Conclusion
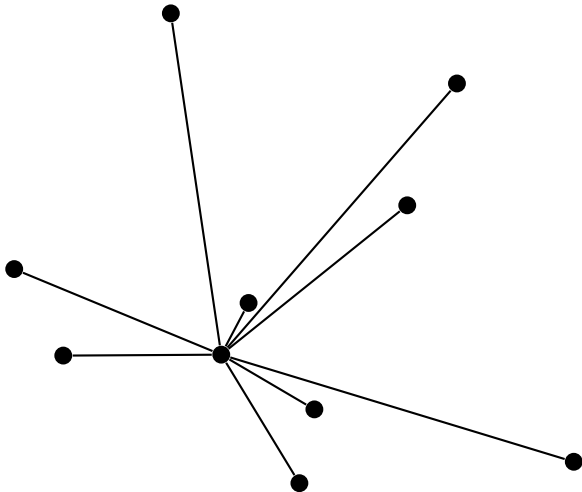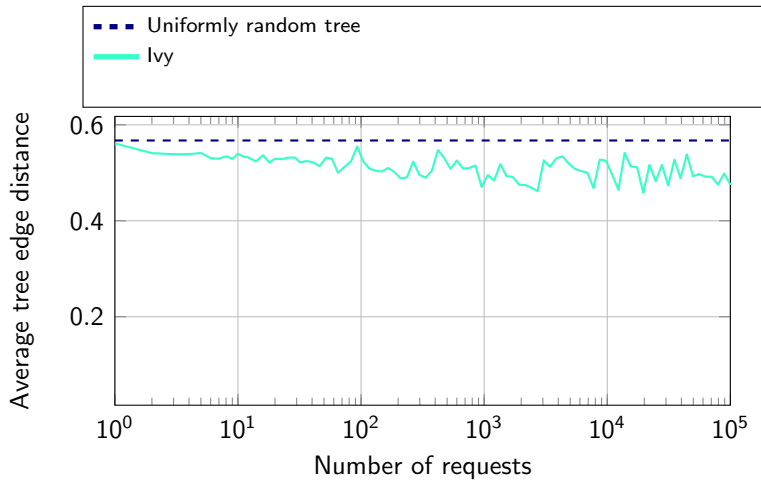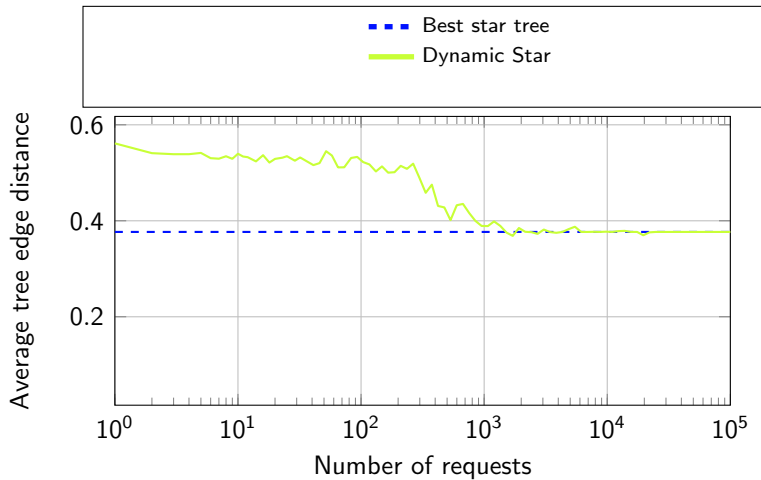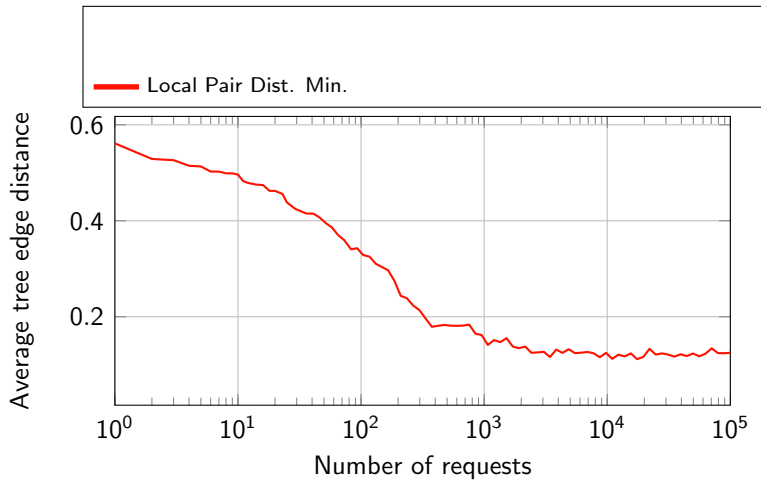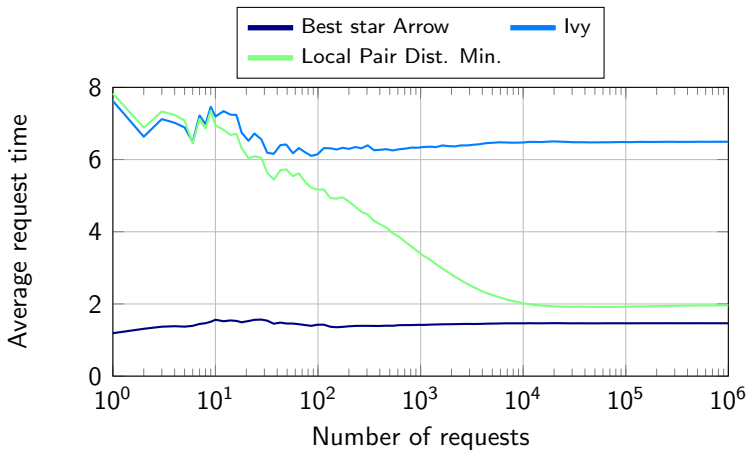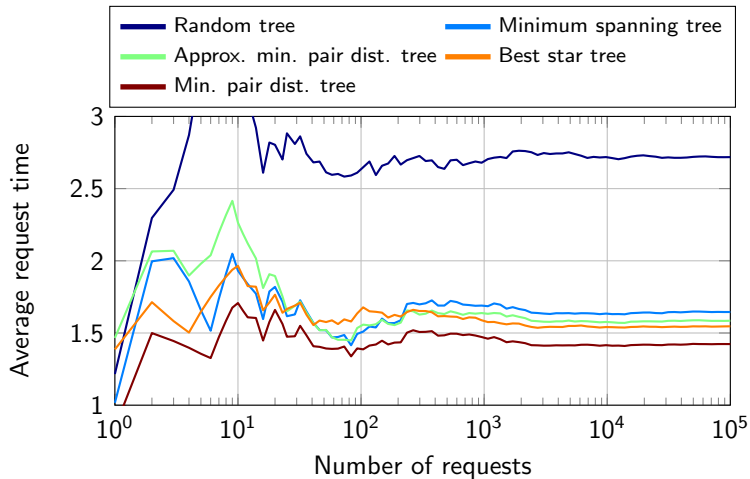
- Arrow with the best star is very good for uniformly random requests
- The Dynamic Star heuristic outperforms all others for adversarial requests
- The Local Pair Distance Minimizer heuristic has decent performance and interesting properties

Thanks for your attention

Questions?

# Best Tree for Arrow

# Ivy in Small Cliques

Average request completion time between Arrow and Ivy in small cliques:

| Node count | Arrow | Ivy |
|---:|---|---|
| 3 | 1.334 | 1.250 |
| 4 | 1.499 | 1.443 |
| 5 | 1.600 | 1.603 |
| 6 | 1.665 | 1.739 |
| 7 | 1.713 | 1.859 |
| 8 | 1.749 | 1.963 |
| ⋮ | ⋮ | ⋮ |

# Recursive Clique