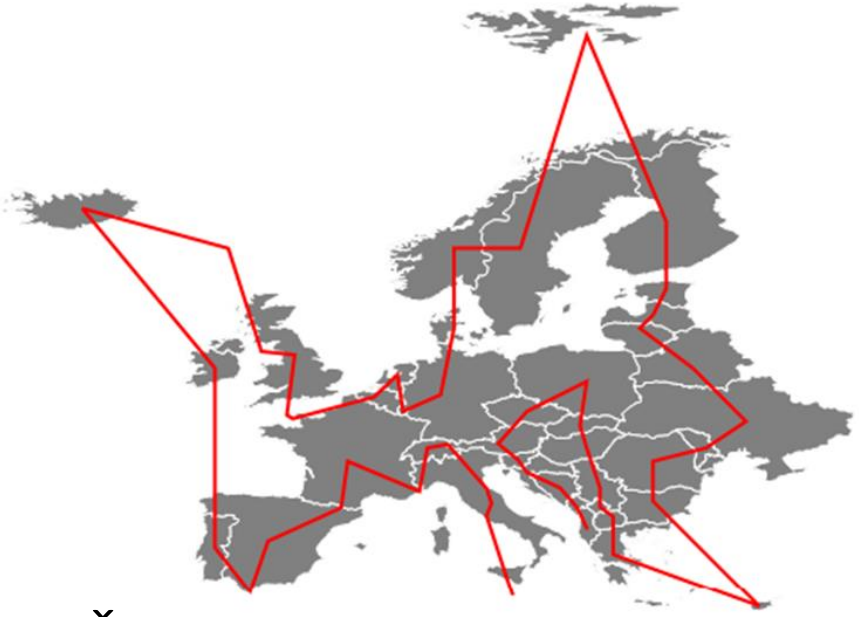
University of Ljubljana, Faculty of Computer and Information Science

Approximation Algorithms



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Analysis of Algorithms and Heuristic Problem Solving
Edition 2024

Contents

- performance ratios
- examples of approximation algorithms
- non-existance of approximation algorithms

- Literature:
  Cormen et al.: Introduction to algorithms, 2009/2022, Chapter 35

- to better understand the context of approximation algorithms,. refresh your knowledge about NP-completeness in Cormen et al.: Introduction to algorithms, 2009, Chapter 34

Performance ratios

- approximation ratio is a ratio between the cost of approximate and optimal solution of a problem

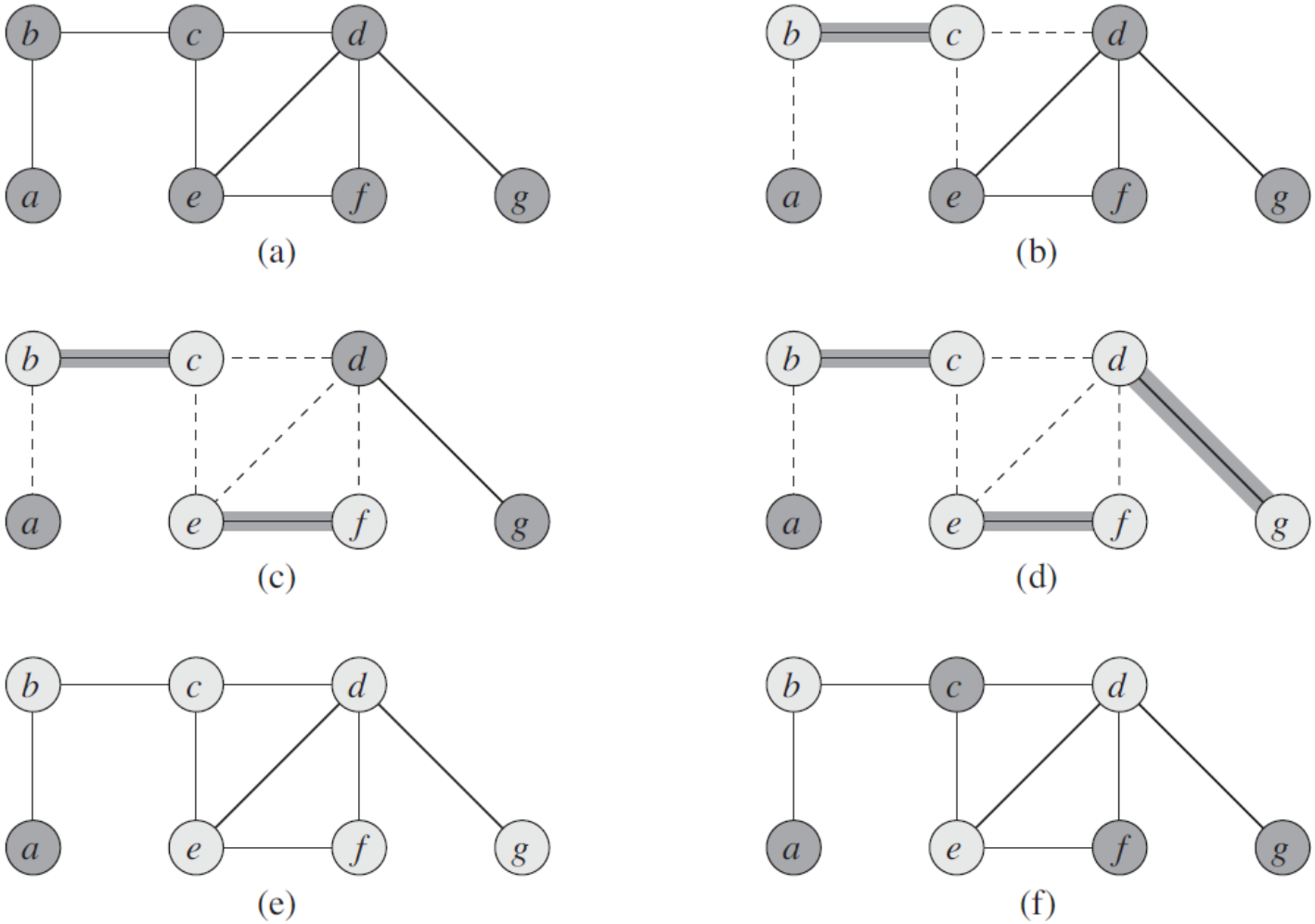
- see Cormen et al: Introduction to algorithms, 2009/2022, Chapter 35

Vertex-cover

Vertex cover of a graph G=(V, E) is a set of vertices that cover all edges of the graph.

```
APPROX-VERTEX-COVER(G)
1  C = ∅
2  E' = G.E
3  while E' ≠ ∅
4      let (u, v) be an arbitrary edge of E'
5      C = C ∪ {u, v}
6      remove from E' every edge incident on either u or v
7  return C
```

Illustration of Approx-Vertex-Cover algorithm



General TSP

- Non-existence of approximation algorithm for general TSP

MAX-3CNF-SAT

- expected approximation ratio is an expected ratio between the cost of approximate and optimal solution of a problem of a randomized algorithm
- randomized algorithm: randomly assign each of the variables with 0 or 1 with probability 0.5
- this algorithm is 8/7-approximation algorithm