Greedy methods ...
Dijkstra’s algorithm

- **Input:** A directed connected weighted graph G and a source vertex $s$
- **Output:** For every vertex $v$ in G, find the shortest path from $s$ to $v$
- **Dijkstra’s algorithm** runs in iterations:
  - in the i-th iteration, the vertex which is the i-th closest to $s$ is found,
  - for every remaining vertices, the current shortest path to $s$ found so far (this shortest path will be updated as the algorithm runs)
Dijkstra’s algorithm

![Graph illustration](image-url)
Dijkstra’s algorithm

Tree vertices: $a(-,0)$

Remaining vertices: $b(a,3)$, $c(-,\infty)$, $d(a,7)$, $e(-,\infty)$

Illustration:

- $a$ to $b$: 3
- $a$ to $d$: 7
- $b$ to $c$: 4
- $b$ to $d$: 2
- $c$ to $e$: 6
- $d$ to $e$: 5
Dijkstra’s algorithm

Tree vertices: $b(a,3)$

Remaining vertices:
- $c(b,3+4)$
- $d(b,3+2)$
- $e(-,\infty)$
Dijkstra’s algorithm

Tree vertices: Remaining vertices

\(d(b, 5)\)  \(c(b, 7)\)  \(e(d, 5 + 4)\)
Dijkstra’s algorithm

Tree vertices: Remaining vertices

c(b,7) e(d, 9)
Exercise

1. Find an MST for this graph
2. Find the shortest paths from vertex a to all other vertices

![Graph with vertices a, b, c, d, e, f and edges with weights as follows:
- a to b: 3
- a to f: 6
- b to f: 4
- b to c: 10
- c to e: 3
- c to d: 6
- d to e: 5
- e to f: 4]
Exercise - MST
Exercise – Shortest paths from a