

Algoritmos e Teoria dos Grafos

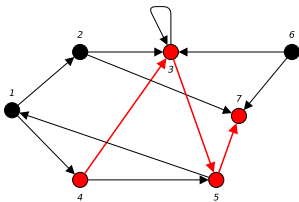
Tópico 12: Passeios em Grafos Direcionados e Ponderados

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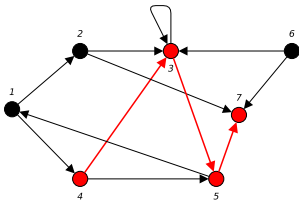
Departamento de Informática da UFPR

2023

Passeio Direcionado

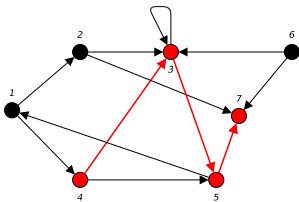


Passeio Direcionado



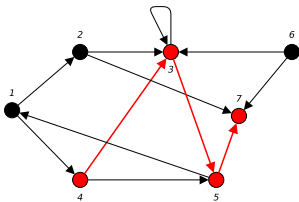
passeio direcionado

Passeio Direcionado



passeio direcionado: sequência $(v_0, \dots, v_n)$ de vértices

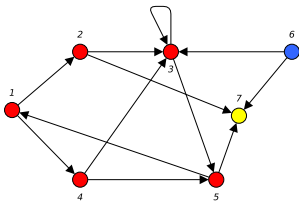
Passeio Direcionado



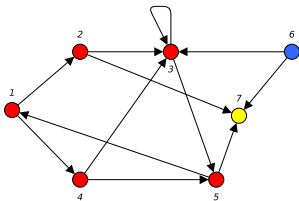
passeio direcionado: sequência $(v_0, \dots, v_n)$ de vértices, satisfazendo

$(v_{i-1}, v_i) \in A(G)$, para todo $1 \leq i \leq n$

Conexidade Forte

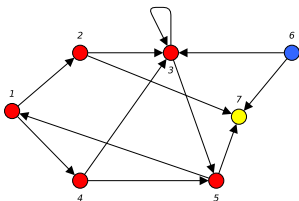


Conexidade Forte



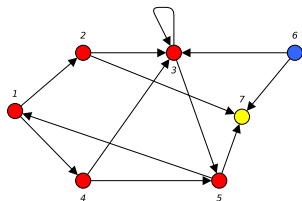
G é fortemente conexo

Conexidade Forte



G é **fortemente conexo**: existe passeio direcionado de qualquer vértice a qualquer outro

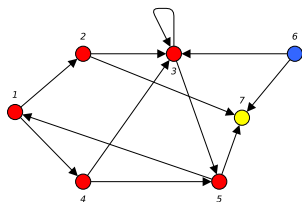
Conexidade Forte



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componente forte

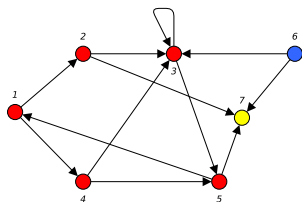
Conexidade Forte



G é **fortemente conexo**: existe passeio direcionado de qualquer vértice a qualquer outro

componente forte: subgrafo fortemente conexo maximal

Conexidade Forte

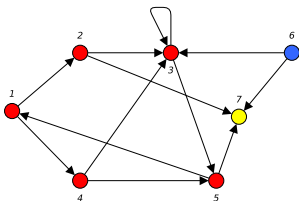


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componente forte: subgrafo fortemente conexo maximal

$\mathcal{C}(G)$

Conexidade Forte

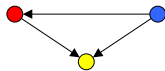
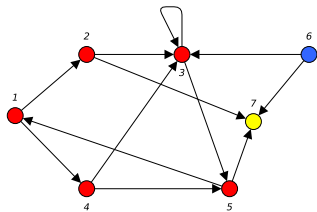


G é **fortemente conexo**: existe passeio direcionado de qualquer vértice a qualquer outro

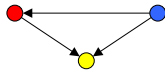
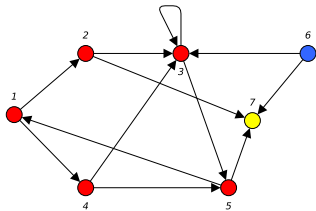
componente forte: subgrafo fortemente conexo maximal

$\mathcal{C}(G)$: conjunto dos componentes fortes de G

Grafo Condensado

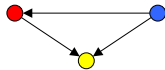
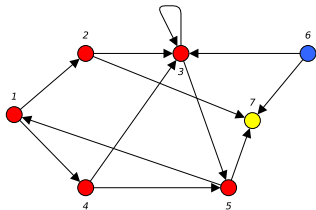


Grafo Condensado



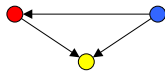
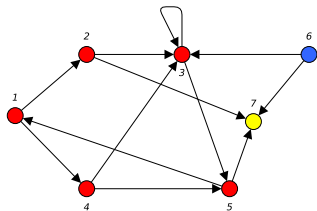
grafo condensado de G

Grafo Condensado



grafo condensado de G : $C(G)$

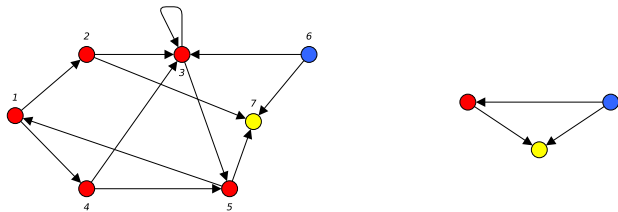
Grafo Condensado



grafo condensado de G : $C(G)$

$V(C(G))$

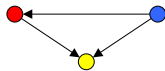
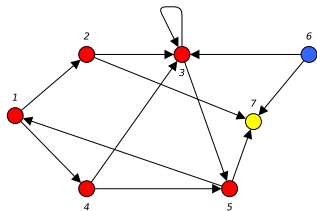
Grafo Condensado



grafo condensado de G : $C(G)$

$V(C(G))$: componentes fortes de G ($\mathcal{C}(G)$)

Grafo Condensado

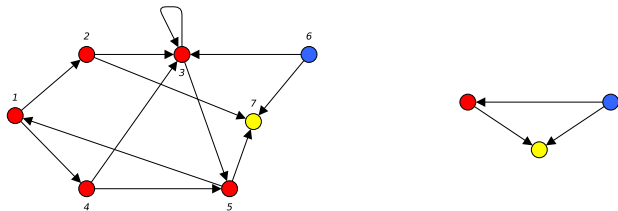


grafo condensado de G : $C(G)$

$V(C(G))$: componentes fortes de G ($\mathcal{C}(G)$)

$A(C(G))$

Grafo Condensado

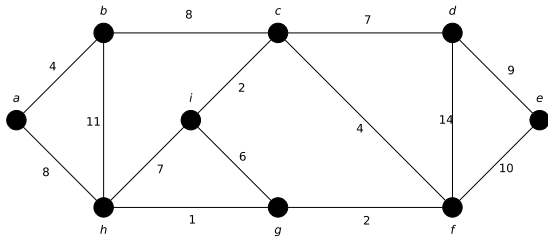


grafo condensado de G : $C(G)$

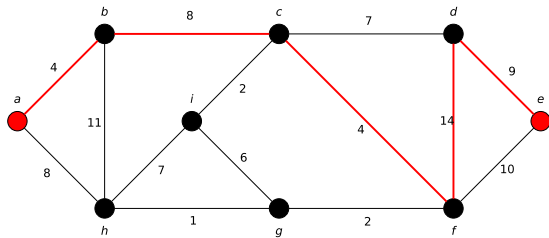
$V(C(G))$: componentes fortes de G ($\mathcal{C}(G)$)

$A(C(G))$: $\{(X, Y) \mid \text{existe arco de } V(X) \text{ para } V(Y) \text{ em } G\}$

Grafos ponderados



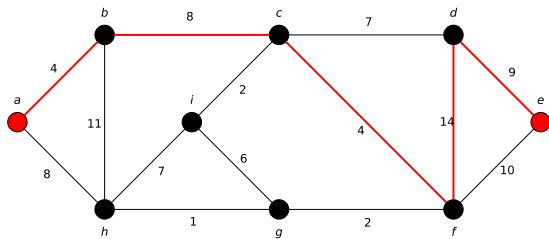
Grafos ponderados



$$P = (a, b, c, f, d, e)$$

$$P = (v_0, \dots, v_n)$$

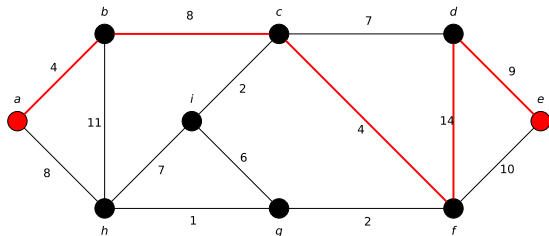
Grafos ponderados



$$P = (a, b, c, f, d, e)$$

$P = (v_0, \dots, v_n)$: passeio no grafo ponderado (G, w)

Grafos ponderados

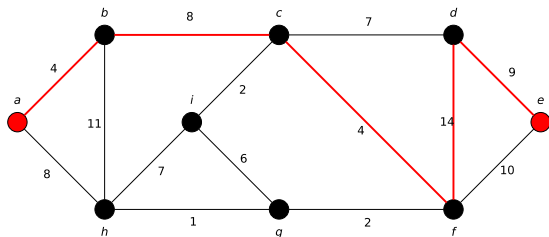


$$P = (a, b, c, f, d, e)$$

$P = (v_0, \dots, v_n)$: passeio no grafo ponderado (G, w)

peso de P

Grafos ponderados

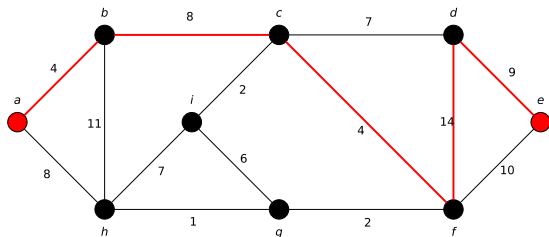


$$P = (a, b, c, f, d, e)$$

$P = (v_0, \dots, v_n)$: passeio no grafo ponderado (G, w)

peso de P : $w(P)$

Grafos ponderados

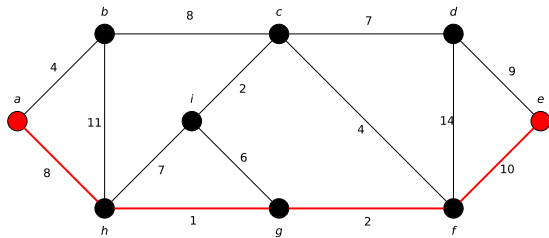


$$P = (a, b, c, f, d, e), w(P) = 39$$

$P = (v_0, \dots, v_n)$: passeio no grafo ponderado (G, w)

peso de P : $w(P) := \sum_{i=1}^n w(\{v_{i-1}, v_i\})$

Grafos ponderados



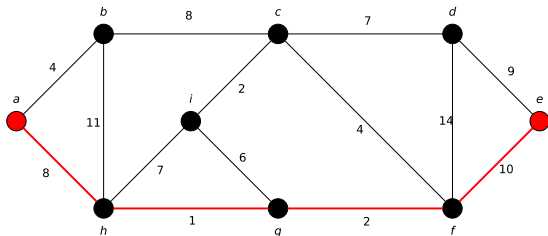
$$P' = (a, h, g, f, e)$$

$P = (v_0, \dots, v_n)$: passeio no grafo ponderado (G, w)

peso de P : $w(P) := \sum_{i=1}^n w(\{v_{i-1}, v_i\})$

distância de u a v

Grafos ponderados



$$P' = (a, h, g, f, e),$$
$$\text{dist}_{G,w}(a, e) = w(P') = 21$$

$P = (v_0, \dots, v_n)$: passeio no grafo ponderado (G, w)

peso de P : $w(P) := \sum_{i=1}^n w(\{v_{i-1}, v_i\})$

distância de u a v : peso de um passeio de peso mínimo de u a v