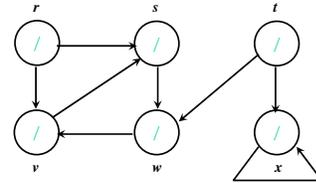


Teoria dos Grafos

Componentes Fortemente Conectados

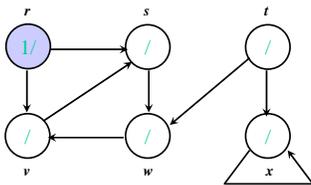
Teoria dos Grafos © João F. Rodrigues, 2012-2013

Exemplo DFS



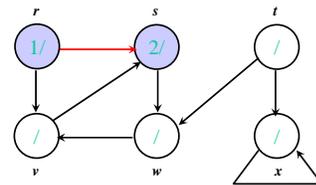
Teoria dos Grafos © João F. Rodrigues, 2012-2013

Exemplo DFS



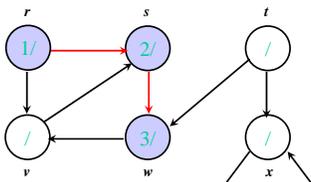
Teoria dos Grafos © João F. Rodrigues, 2012-2013

Exemplo DFS



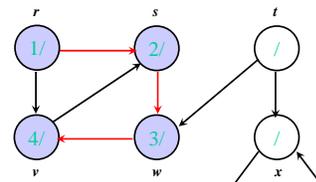
Teoria dos Grafos © João F. Rodrigues, 2012-2013

Exemplo DFS



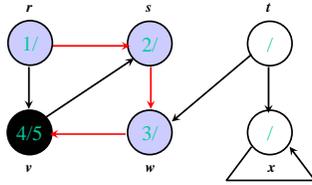
Teoria dos Grafos © João F. Rodrigues, 2012-2013

Exemplo DFS

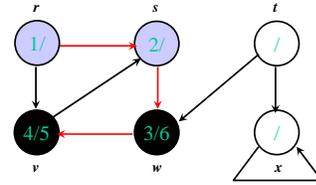


Teoria dos Grafos © João F. Rodrigues, 2012-2013

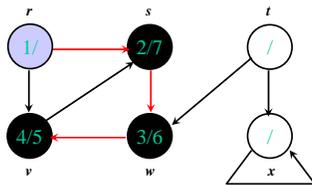
Exemplo DFS



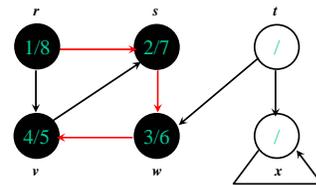
Exemplo DFS



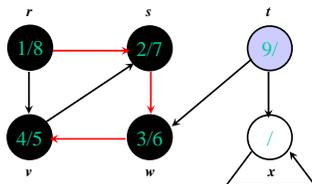
Exemplo DFS



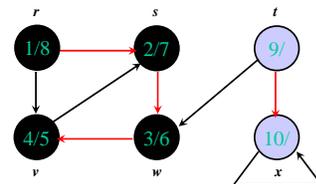
Exemplo DFS



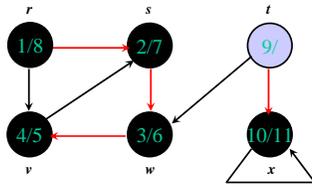
Exemplo DFS



Exemplo DFS



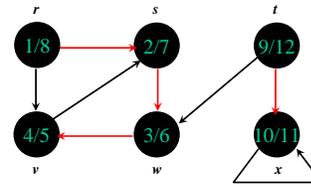
Exemplo DFS



Talvo dos Cursos

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Exemplo DFS



Talvo dos Cursos

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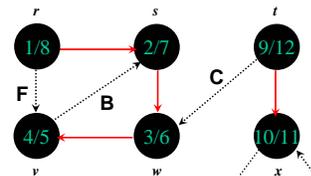
Busca em Profundidade (Revisão)

- A busca em profundidade produz uma floresta de árvores.
- É possível identificar 4 tipos de arcos:
 - **Arcos da árvore**: arcos na árvore de profundidade.
 - **Arcos de retorno**: aqueles que conectam um vértice u a um vértice ancestral na árvore de profundidade.
 - **Arcos forward**: aqueles que conectam um vértice u a um vértice descendente na árvore de profundidade.
 - **Arcos de cruzamento**: os demais arcos.

Talvo dos Cursos

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DFS (Tipos de Arcos)

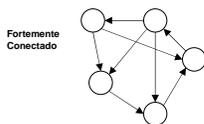


Talvo dos Cursos

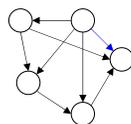
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Componente Fortemente Conectado (SCC)

- Um Grafo G é fortemente conectado se, $\forall u, v \in V$, existe um caminho entre u e v e um caminho entre v e u .
- Um **componente fortemente conectado** de um grafo é um subconjunto maximal de vértices (juntamente com os seus correspondentes arcos) que é fortemente conectado.



Fortemente Conectado

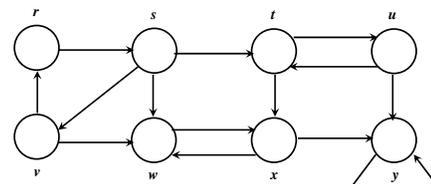


Não é Fortemente Conectado

Talvo dos Cursos

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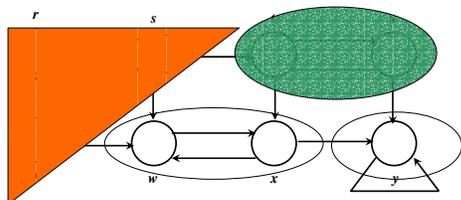
Exemplo SCC



Talvo dos Cursos

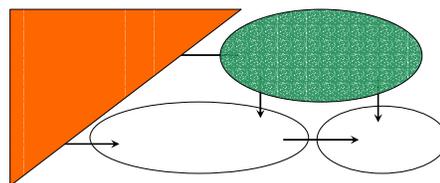
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Exemplo SCC



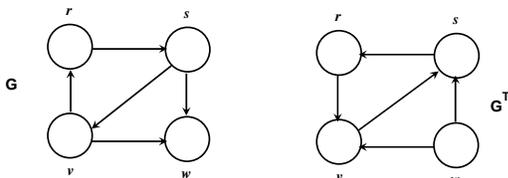
Grafo de Componentes

- $G^{SCC} = (V^{SCC}, E^{SCC})$.
- V^{SCC} tem um vértice para cada SCC em G .
- E^{SCC} tem um arco se existe um arco entre os correspondentes SCCs em G .



Transposto de um Grafo Dirigido

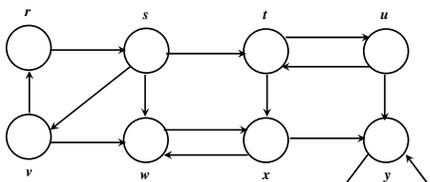
- G^T é transposto de um grafo dirigido:
 - $G^T = (V, E^T)$, $E^T = \{(u, v) : (v, u) \in E\}$.
 - G^T é G com todos os arcos revertidos.



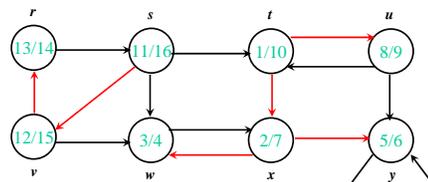
Algoritmo SCC

SCC(G)
 DFS(G)
 Calcula G^T
 DFS(G^T)
 Saída: os arcos de árvore formam SCCs

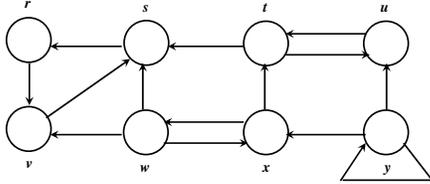
Exemplo Grafo de SCCs



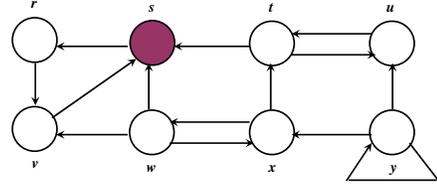
Passo 1: Aplicar DFS



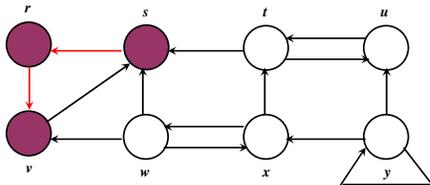
Passo 2: Calcular G^T



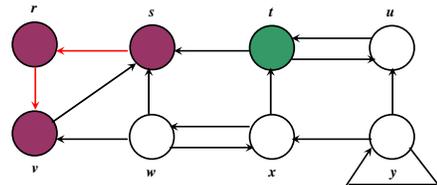
Passo 3: DFS de G^T



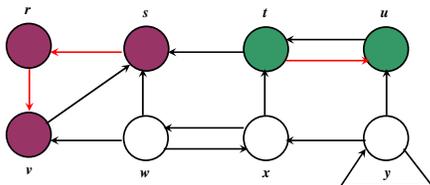
Passo 3: DFS de G^T



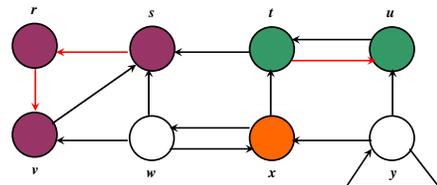
Passo 3: DFS de G^T



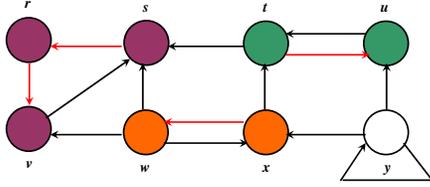
Passo 3: DFS de G^T



Passo 3: DFS de G^T

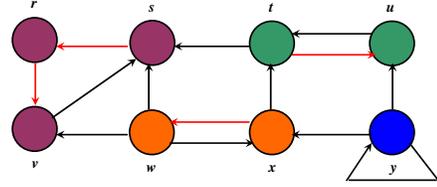


Passo 3: DFS de G^T



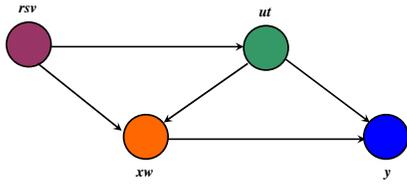
Tarefa dos Grafos © João Figueiredo, DSC/UFPA

Passo 3: DFS de G^T



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Passo 4: Componentes de G^T



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