Aula 03

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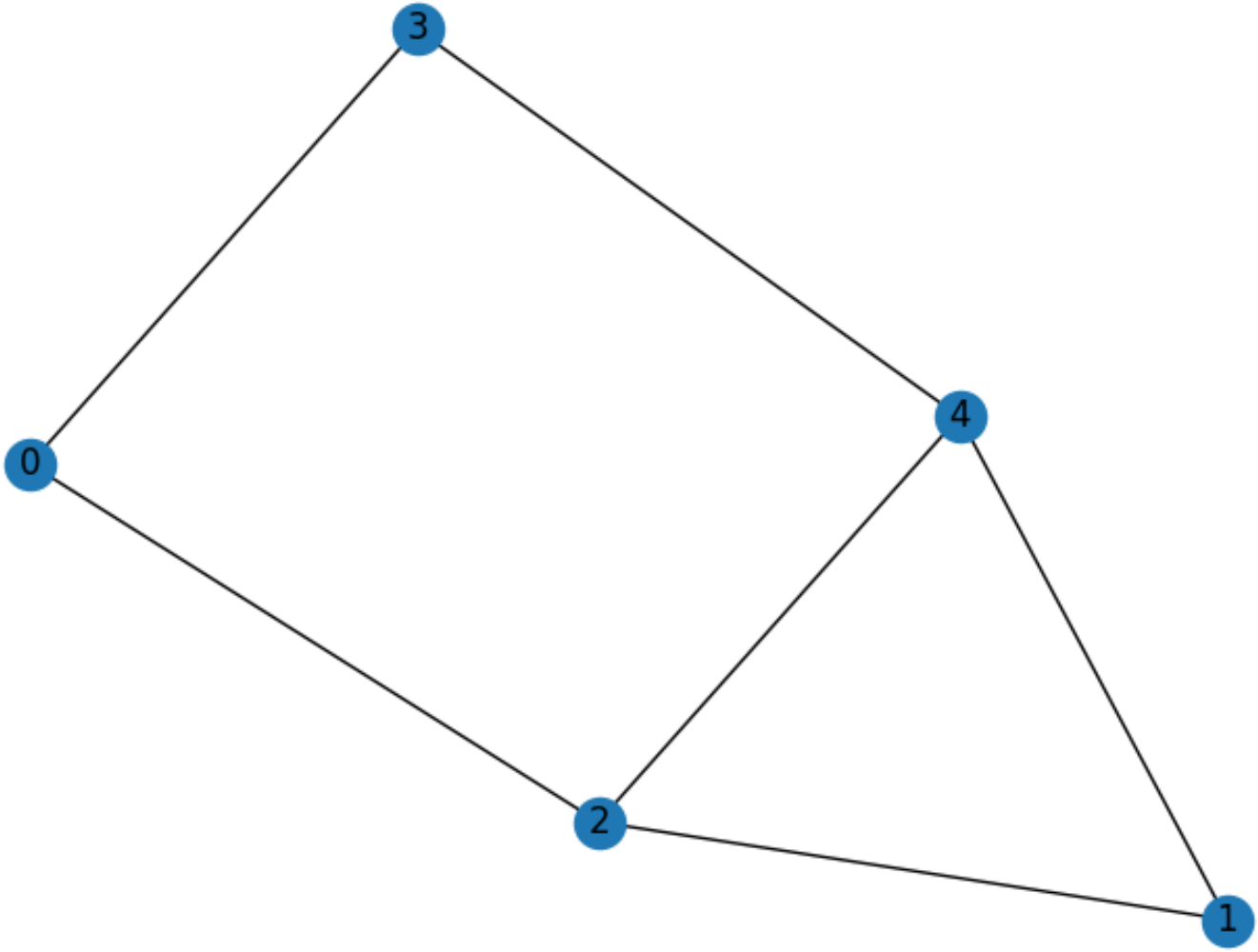
29/07/2019

Introdução a Teoria dos Grafos



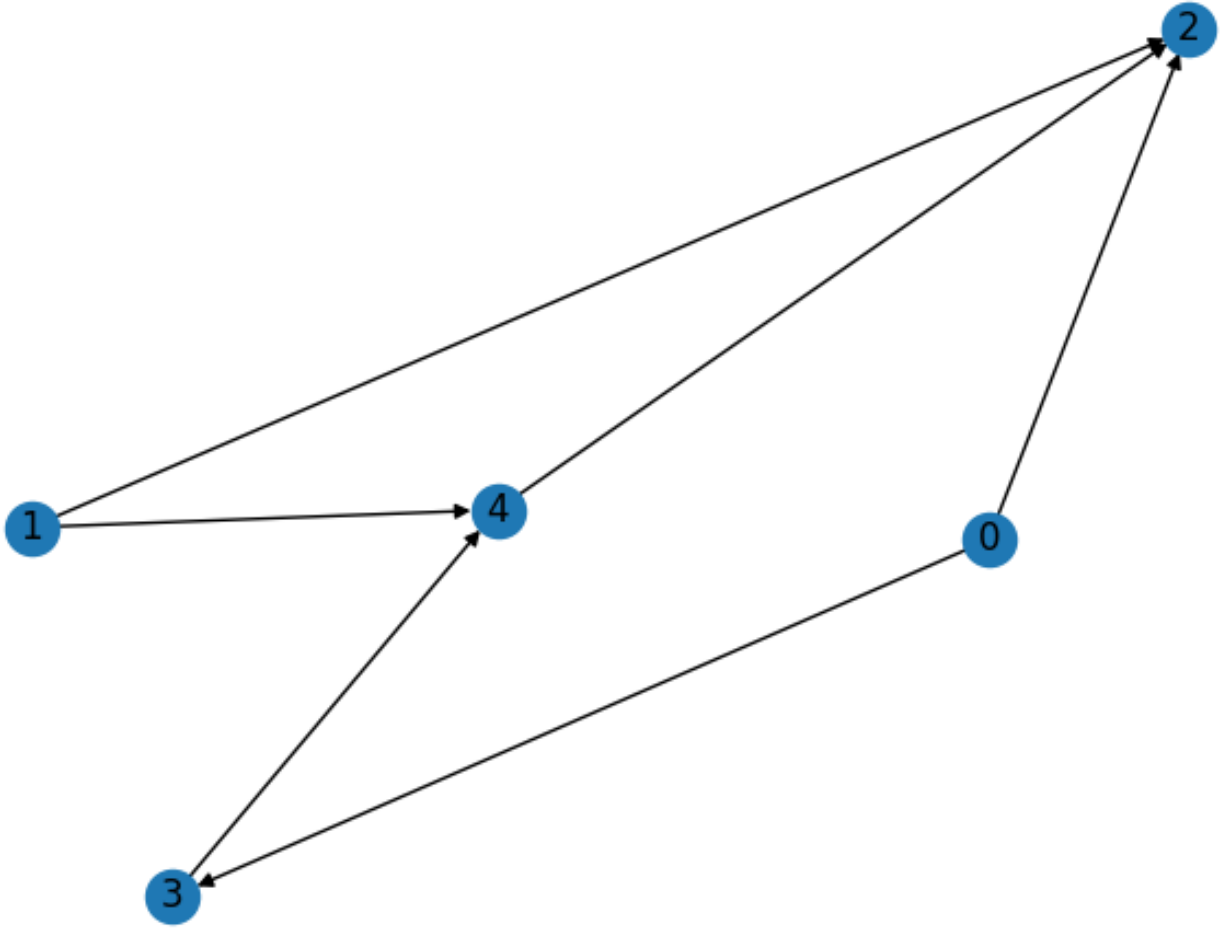
Lista de Adjacência

```
lista_adj = {
      0:[2, 3],
      1:[2, 4],
      2:[1, 4],
      3:[0, 4],
      4:[1, 2, 3]
}
```

Matriz de Adjacência

```
matriz_adj = [
    [1, 0, 1, 1, 0],
    [0, 1, 1, 0, 1],
    [0, 1, 1, 0, 1],
    [1, 0, 0, 1, 1],
    [0, 1, 1, 1, 1],
]
```

Grafo Direcionado

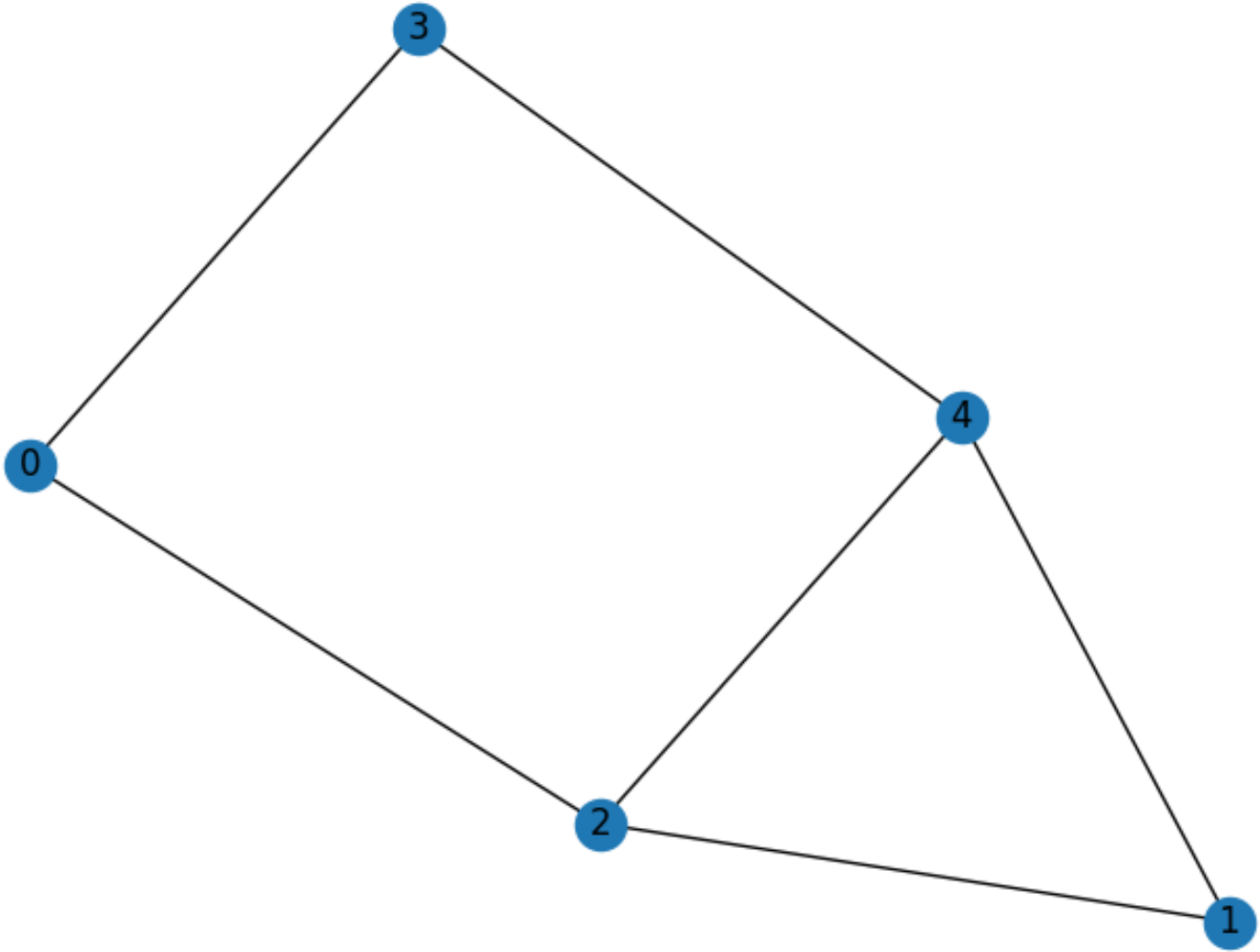


Problema Simples

```
lista_adj = {
    0:[2, 3],
    1:[2, 4],
    2:[],
    3:[4],
    4:[2]
}

qtd_entradas = 0
vertice_buscado = int(input())
for vertice in lista_adj:
    if vertice_buscado in vertice:
        qtd_entradas += 1
print(qtd_entradas)
```

BFS



BFS

```
from collections import deque


def initialize(dist, graph):
    for i in range(verticies):
        dist[i] = -1

    for i in range(verticies):
        graph[i] = set()
```

BFS

```
def populate(graph, arestas, bi=False):
    for _ in range(arestas):
        v, w = map(int, input().split())
        graph[v].add(w)
        if bi:
            graph[w].add(v)
```

BFS

```
def bfs(start, graph, dist):
    fila = deque()
    dist[start] = 0
    fila.append(start)
    while fila:
            v = fila.popleft()
            for w in graph[v]:
                    if dist[i] == -1:
                            dist[w] = dist[v] + 1
                            fila.append(w)
```

BFS

```
graph, dist = dict(), dict()
initialize(dist, graph)
verticies, arestas = map(int, input().split())
populate(graph, arestas)

bfs(0)
print(dist)
```

Exercicios

A - Maximum in Table

```
n = int(input())
linha = [1]*n
for _ in range(n-1):
    nova_linha = list()
    for i in range(1, n+1):
        nova_linha.append(sum(linha[:i]))
    linha = nova_linha
print(linha[-1])
```

Exercicios

B - Prison Transfer

```python
presos, crime_maximo, tamanho_maximo = map(int, input().split())
crimes = map(int, input().split())
possiveis, fila_atual = 0, 0
for crime in crimes:
    if crime <= crime_maximo:
        fila_atual += 1
        if fila_atual >= tamanho_maximo:
            possiveis += 1
    else:
        fila_atual = 0
print(possiveis)
```

Exercicios

C - Metro

```
from collections import deque

def initialize(dist, graph, vertices):
    for i in range(vertices):
        dist[i] = -1

    for i in range(vertices):
        graph[i] = set()
```

Exercicios

C - Metro

```
def bfs(start, graph, dist):
    fila = deque()
    dist[start] = 0
    fila.append(start)
    while fila:
        v = fila.popleft()
        for w in graph[v]:
            if dist[w] == -1:
                dist[w] = dist[v] + 1
                fila.append(w)
```

Exercicios

C - Metro

```
graph, dist = dict(), dict()
vertices, final = map(int, input().split())
initialize(dist, graph, vertices)

# ida
estacoes = list(map(int, input().split()))
for i in range(vertices):
    for j in range(i+1, vertices):
        if estacoes[i] == 1 and estacoes[j] == 1:
            graph[i].add(j)
```

Exercicios

C - Metro

```
# volta
estacoes = list(map(int, input().split()))
for i in range(vertices-1, -1, -1):
    for j in range(i-1, -1, -1):
        if estacoes[i] == 1 and estacoes[j] == 1:
            graph[i].add(j)

bfs(0, graph, dist)
print('NO' if dist[final-1] == -1 else 'YES')
```

Exercicios

D - Love Triangle

```
vertices = int(input())
avioes = list(map(lambda x: int(x)-1, input().split()))
for vertice in range(vertices):
    if avioes[avioes[avioes[vertice]]] == vertice:
        print('YES')
        exit(0)
print('NO')
```

Exercicios

E - Two Buttons

```python
from collections import defaultdict, deque

def bfs(start, end, visitados):
    fila = deque()
    fila.append( (0, start) )
    while fila:
        apertos, vertice = fila.popleft()
        if vertice == end:
            return apertos
        if vertice in visitados:
            continue
        visitados.add(vertice)
        if vertice < end:
            fila.append( (apertos+1, vertice*2) )
        if vertice - 1 >= 1:
            fila.append( (apertos+1, vertice-1) )

graph, visitados = defaultdict(set), set()
start, end = map(int, input().split())
print(bfs(start, end, visitados))
```