Algoritmo
Kruskal

- É um algoritmo guloso usado para resolver o problema da AGM
- Estratégia: Sempre adiciona a aresta de menor peso que conecta dois componentes distintos, desde que não formem ciclos.
- Usa a estrutura de Disjoint-Set (Union-Find) para manter os componentes disjuntos.
- Complexidade: O(E log V).

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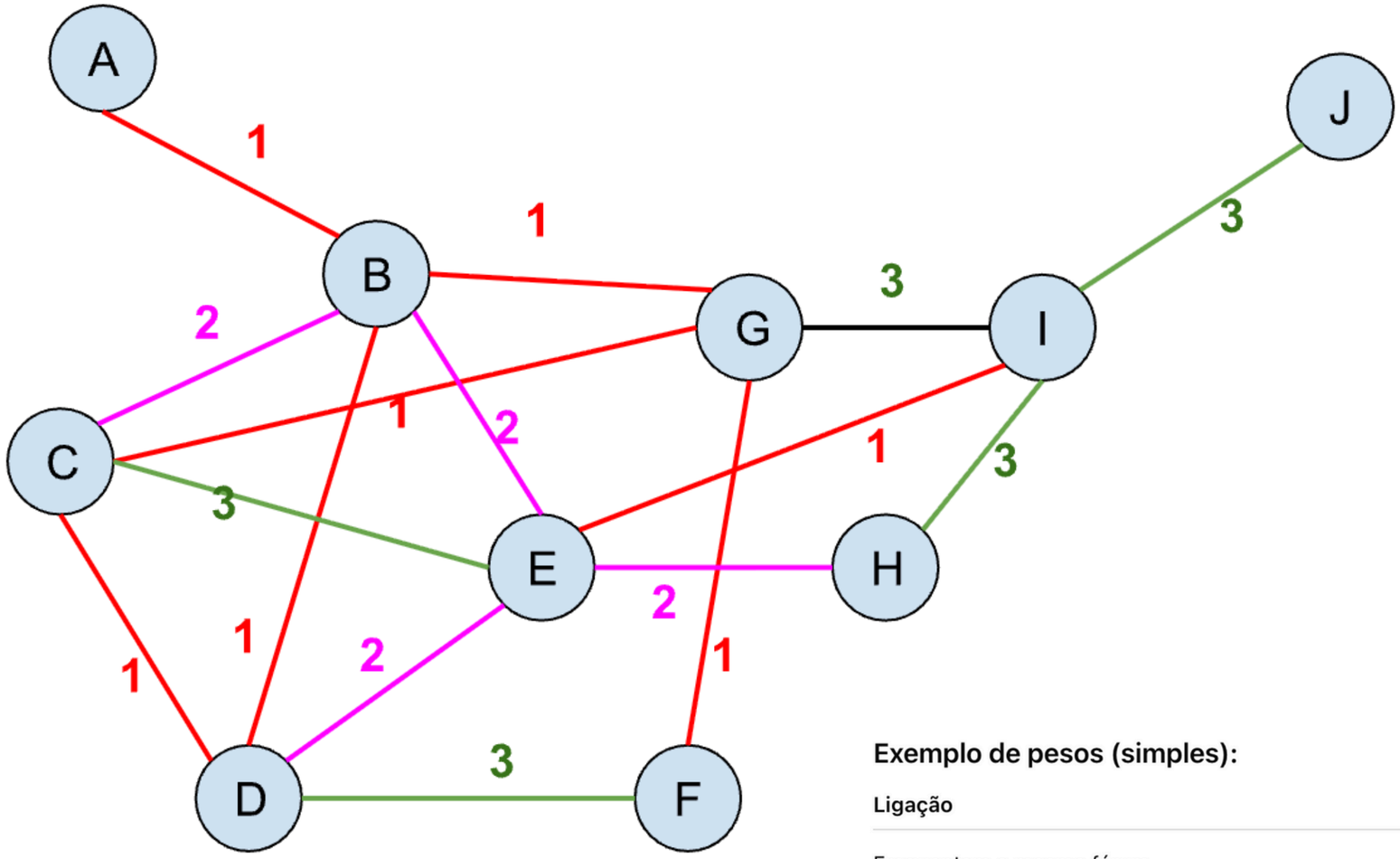

Exemplo de pesos (simples):

Ligação	Peso (custo)
Frequentam o mesmo fórum	3
Comunicação direta	2
Troca de arquivos ilegais	1

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```
Vertex = str
Edge = Tuple[Vertex, Vertex]
Graph = Tuple[Set[Vertex], List[Edge]]
WeightFunction = Dict[Edge, float]

def kruskal(g: Graph, w: WeightFunction) -> List[Edge]:
```

- **MAKE-SET(v)**: Cria um conjunto inicial para cada vértice v com um único elemento v.

```
parent = {v: v for v in g[0]}
rank = {v: 0 for v in g[0]}
```

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rank = {v: 0 for v in g[0]}
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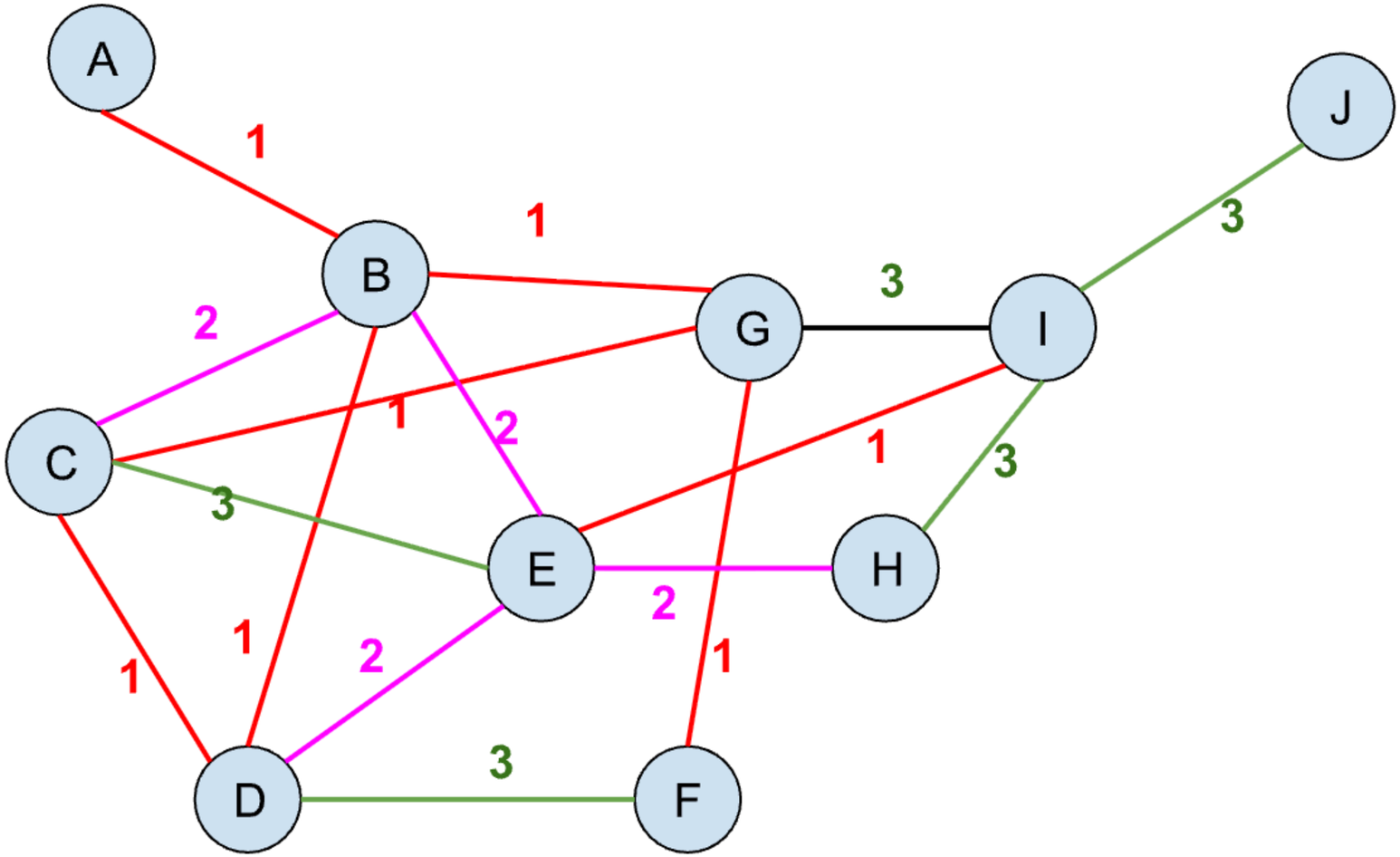

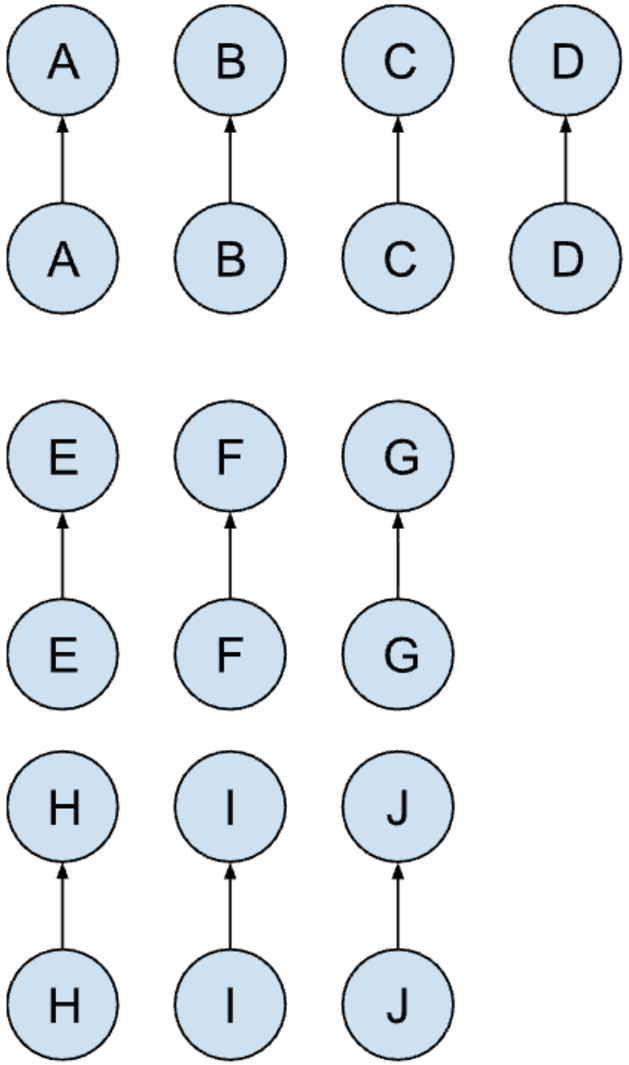

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- **FIND-SET(u)**: Verificar se dois vértices pertencem ao mesmo conjunto (árvore) comparando seus representantes (raizes).

```
sorted_edges = sorted(g[1], key=lambda edge: w[edge])
for edge in sorted_edges:
    u, v = edge
    rootU = find_set(vertex_set, u)
    rootV = find_set(vertex_set, v)
```

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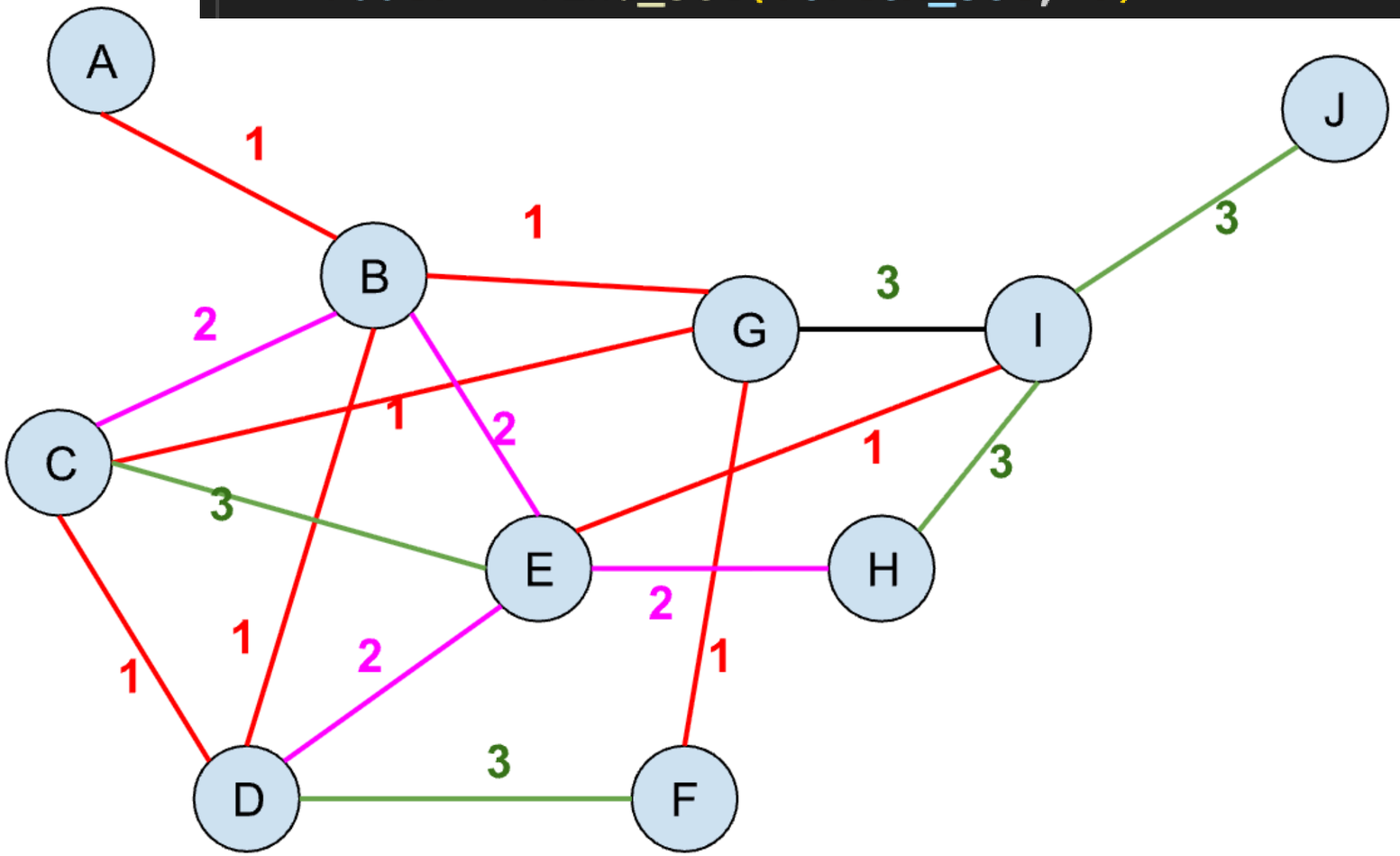

(A,B,1)
(B,D,1)
(B,G,1)
(C,D,1)
(C,G,1)
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(F,G,1)

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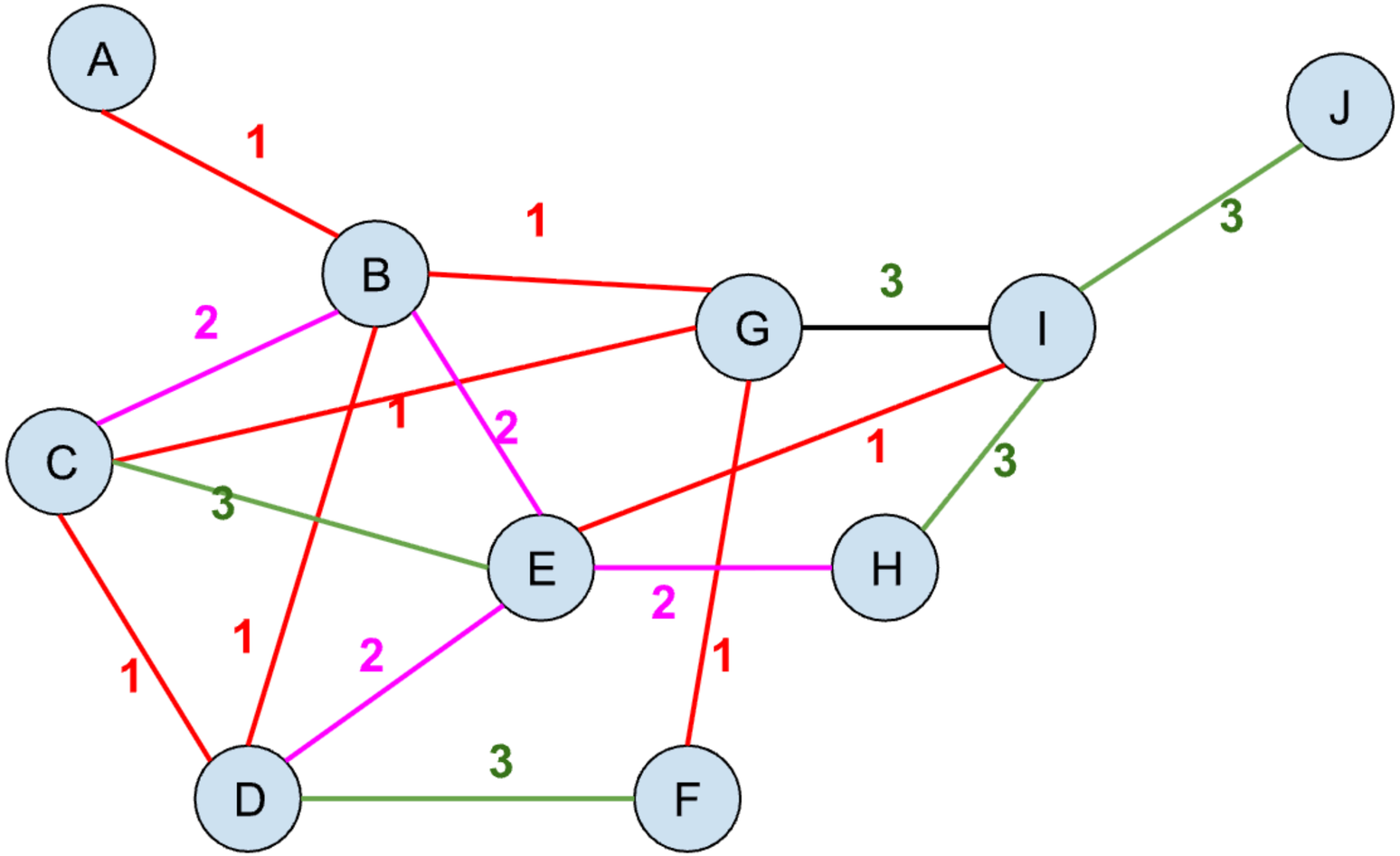

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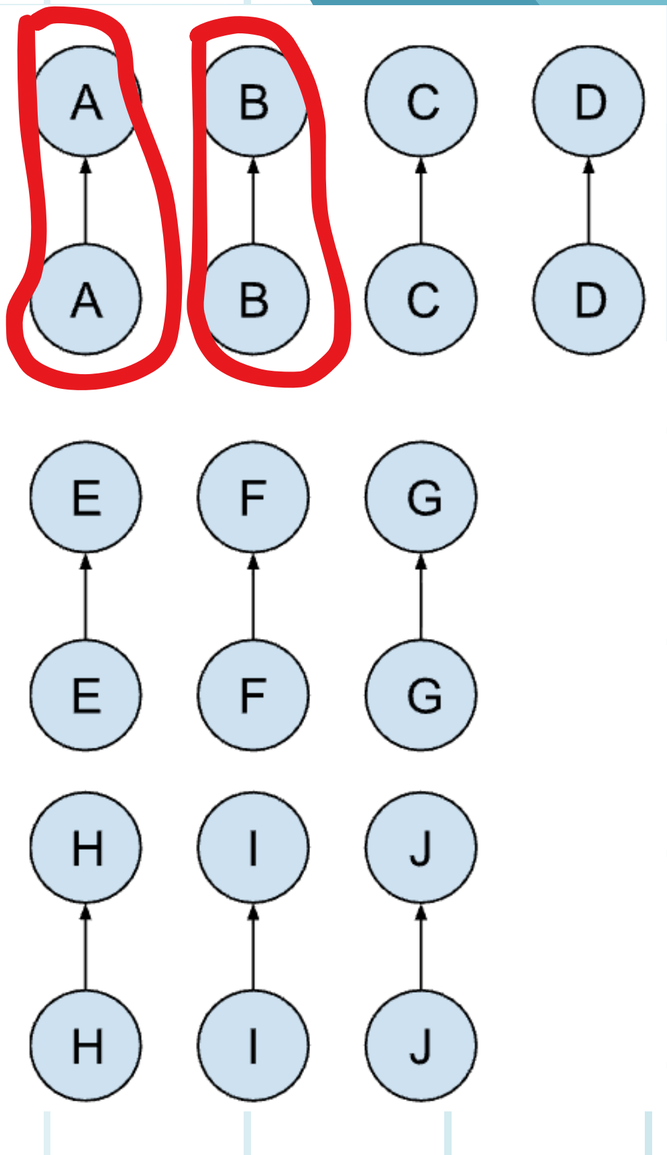

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Edge = Tuple[Vertex, Vertex]
Graph = Tuple[Set[Vertex], List[Edge]]
WeightFunction = Dict[Edge, float]

def kruskal(g: Graph, w: WeightFunction) -> List[Edge]:
```

- **UNION(u,v)**: Une os conjuntos de u e v em uma única árvore, apenas se pertencerem a componentes distintas, evitando a formação de ciclos.

```
if rootU != rootV:
    if rank[rootU] < rank[rootV]:
        vertex_set[rootU] = rootV
    elif rank[rootU] > rank[rootV]:
        vertex_set[rootV] = rootU
    else:
        vertex_set[rootV] = rootU
        rank[rootU] += 1
    A.append(edge)
    if len(A) == len(g[0]) - 1:
        break
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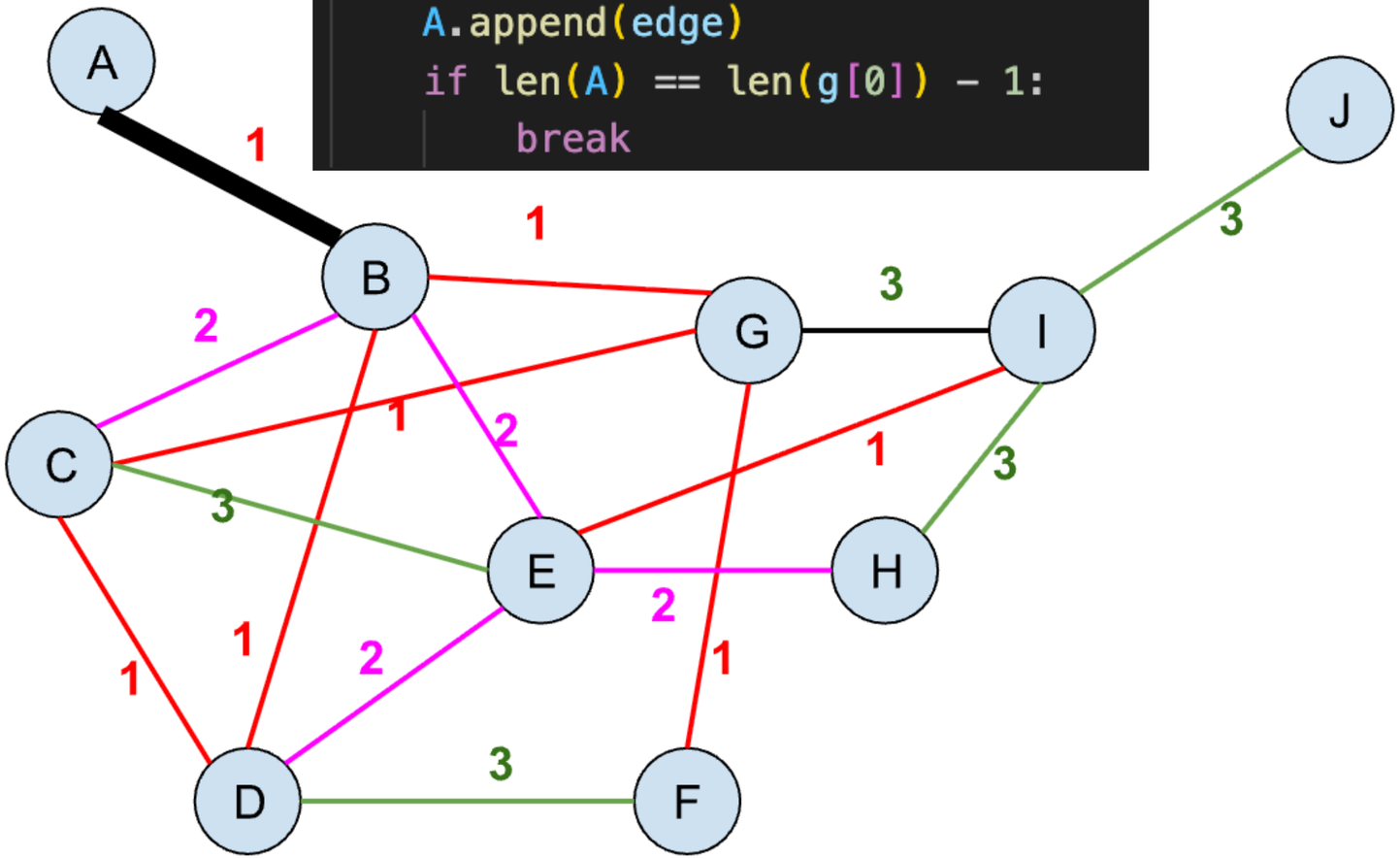

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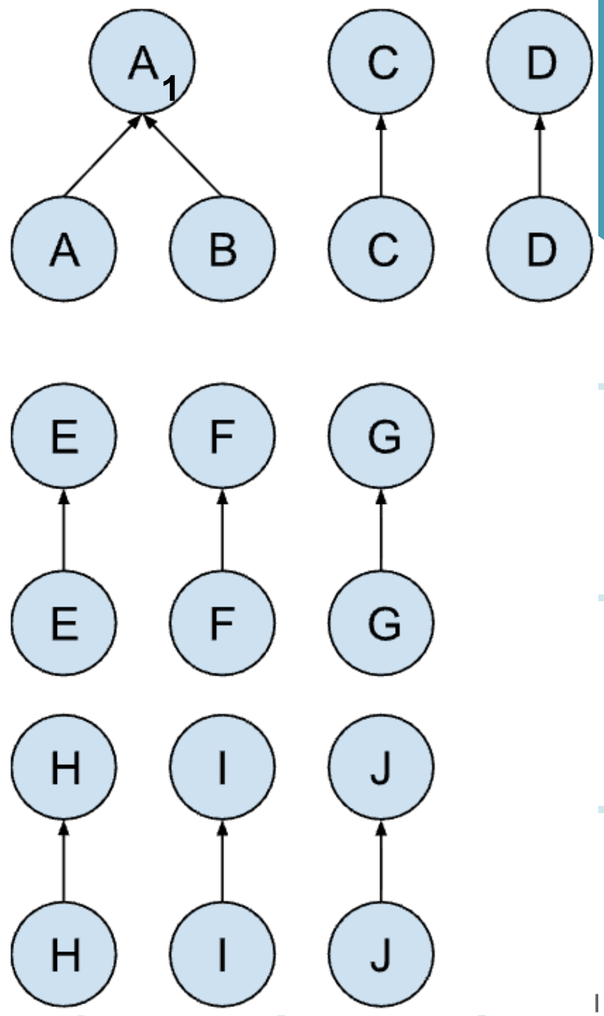

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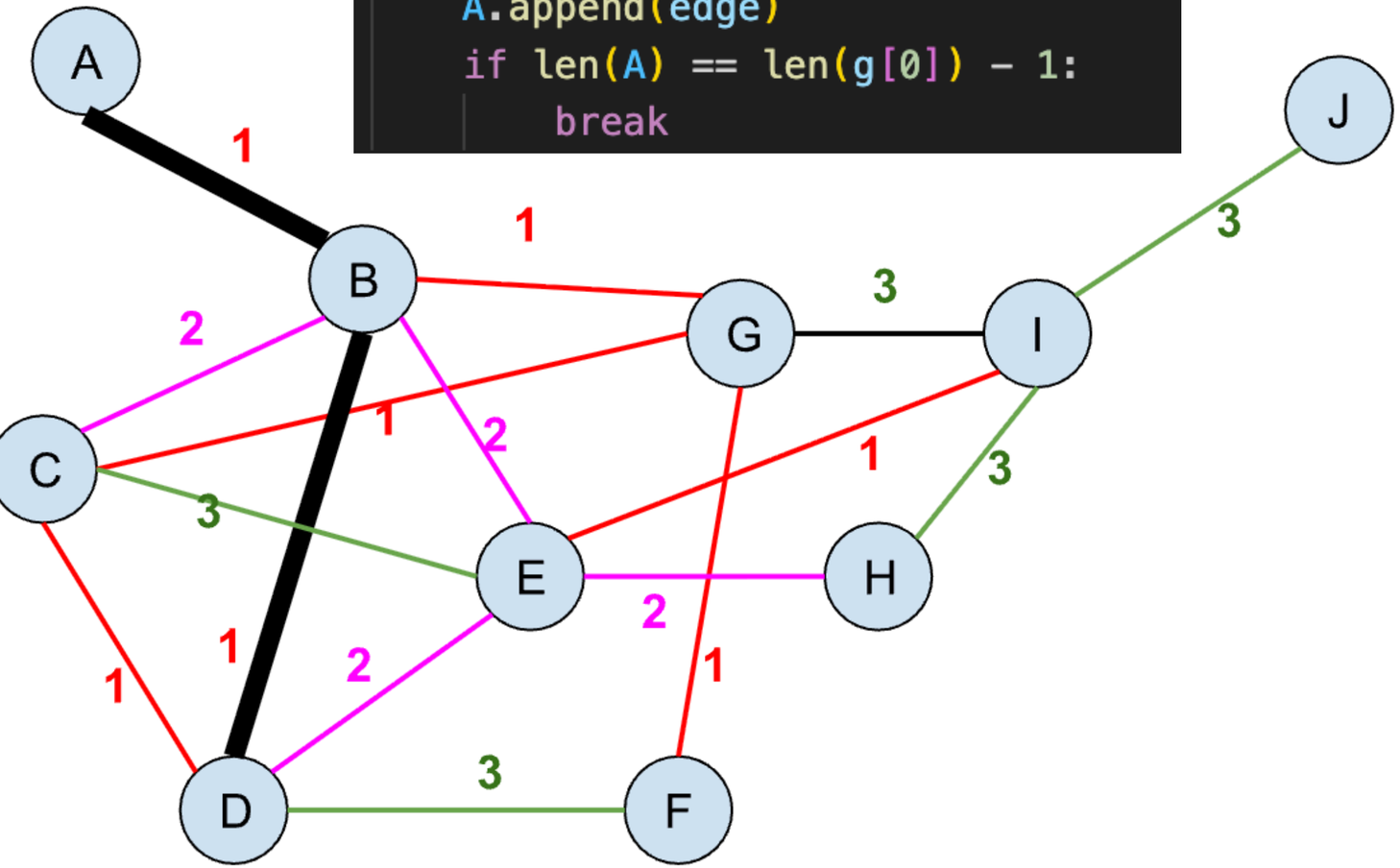

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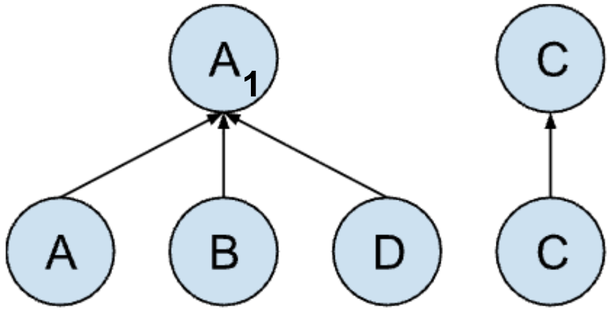

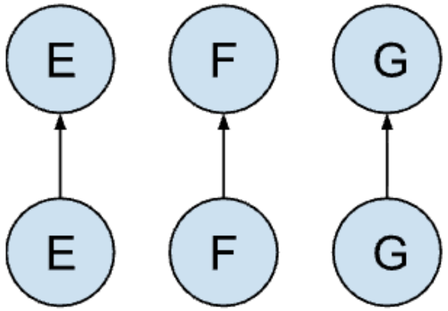

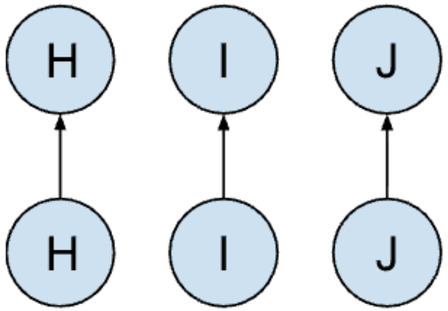

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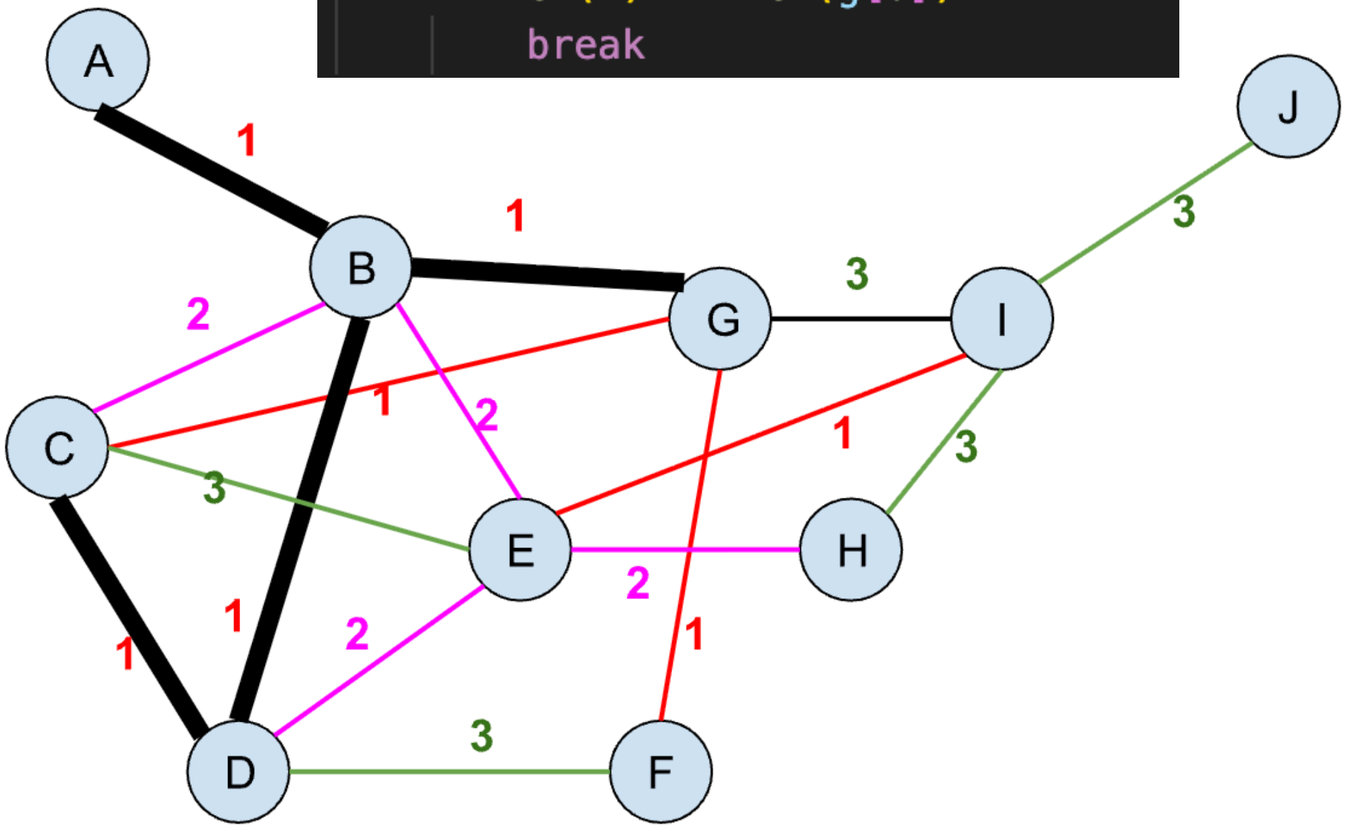

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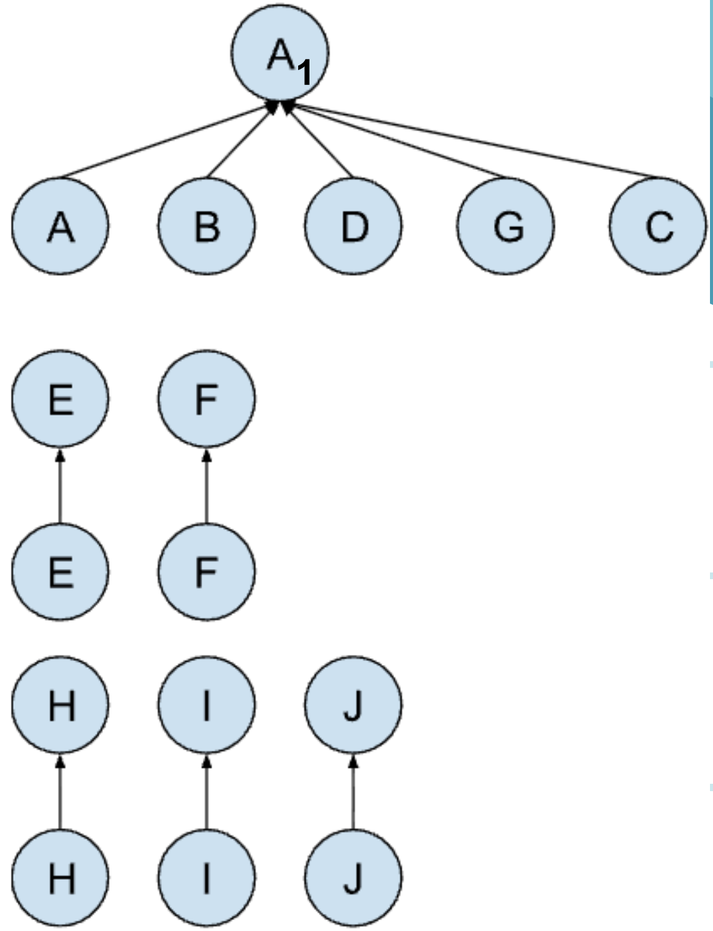

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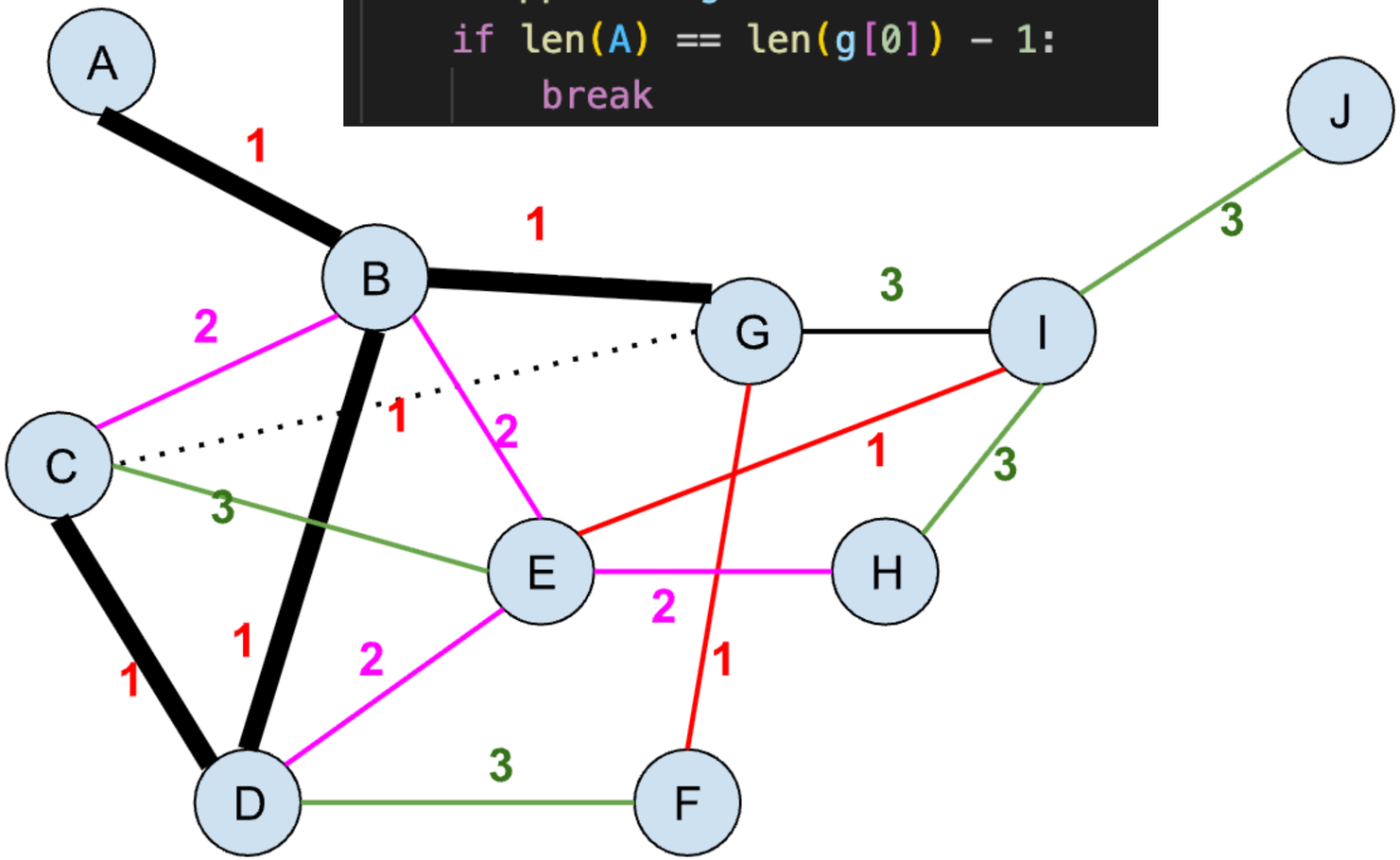

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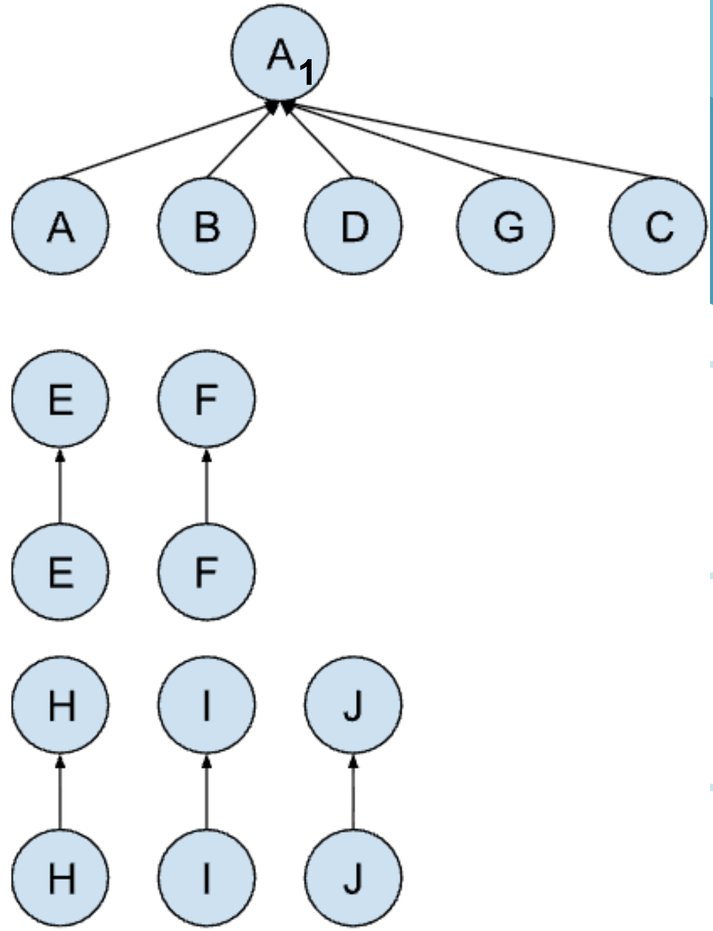

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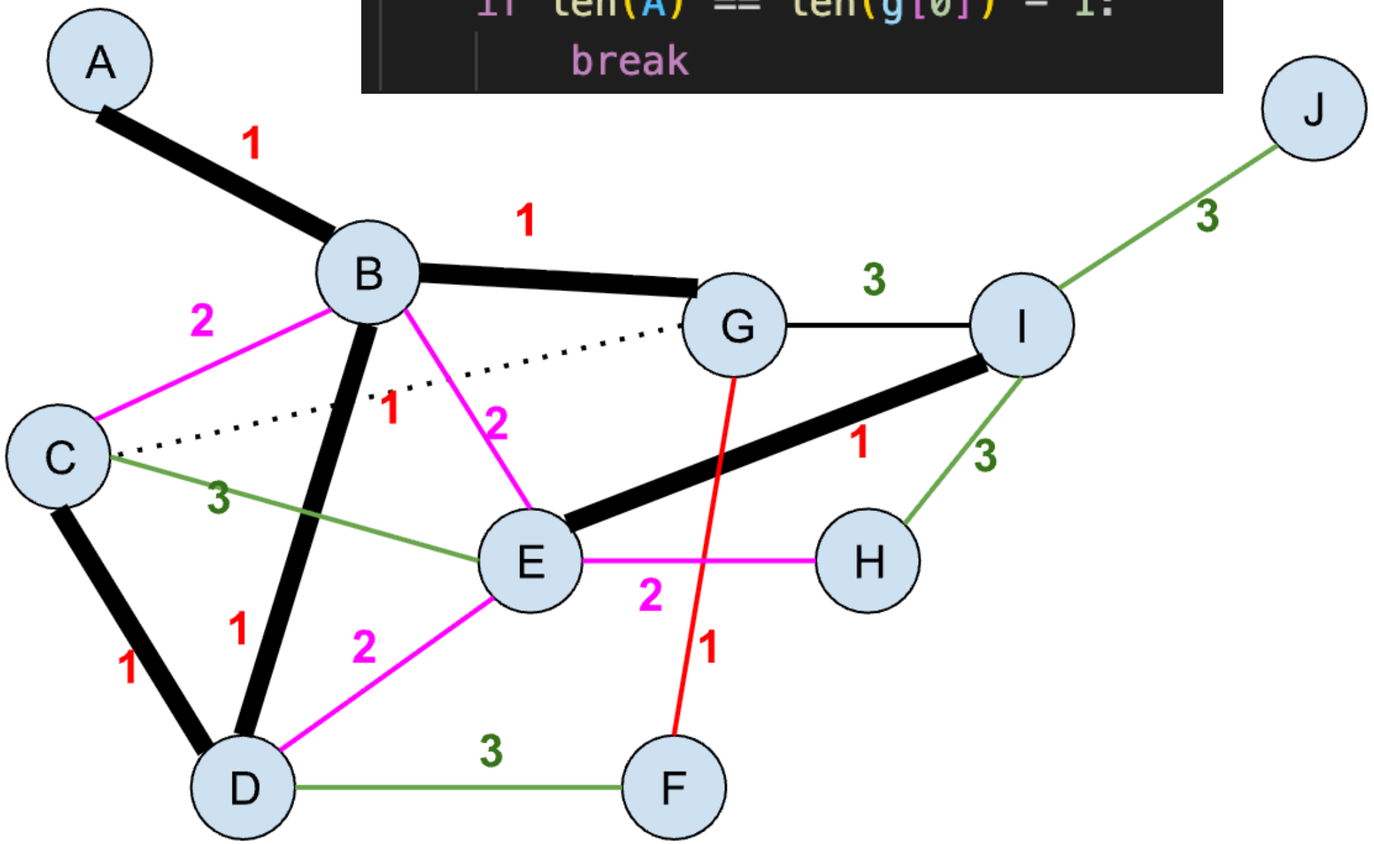

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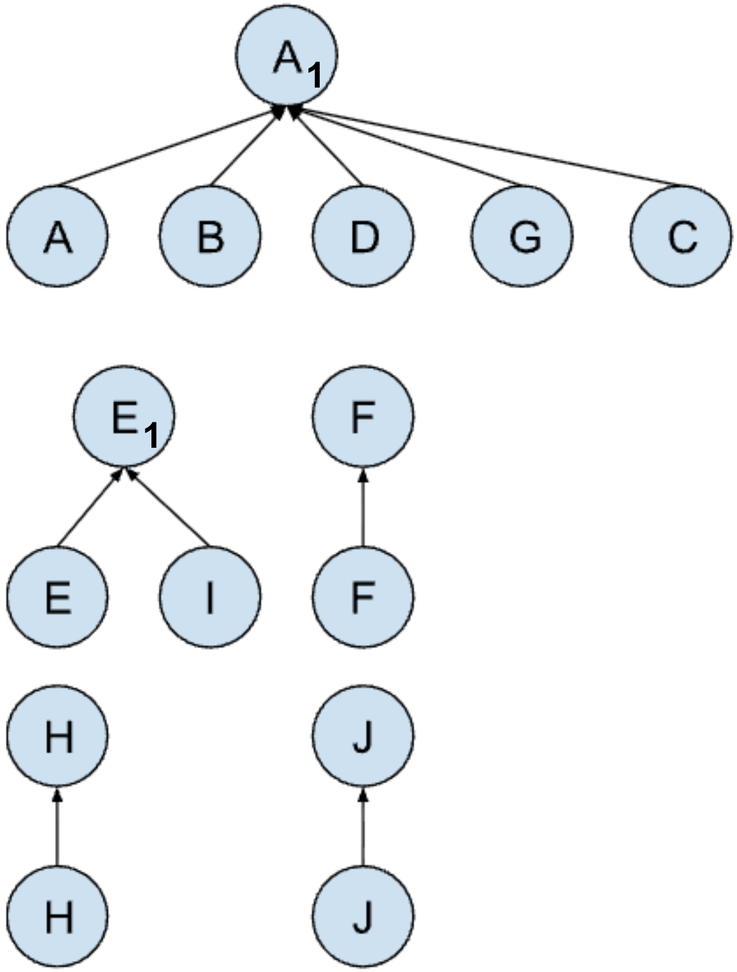

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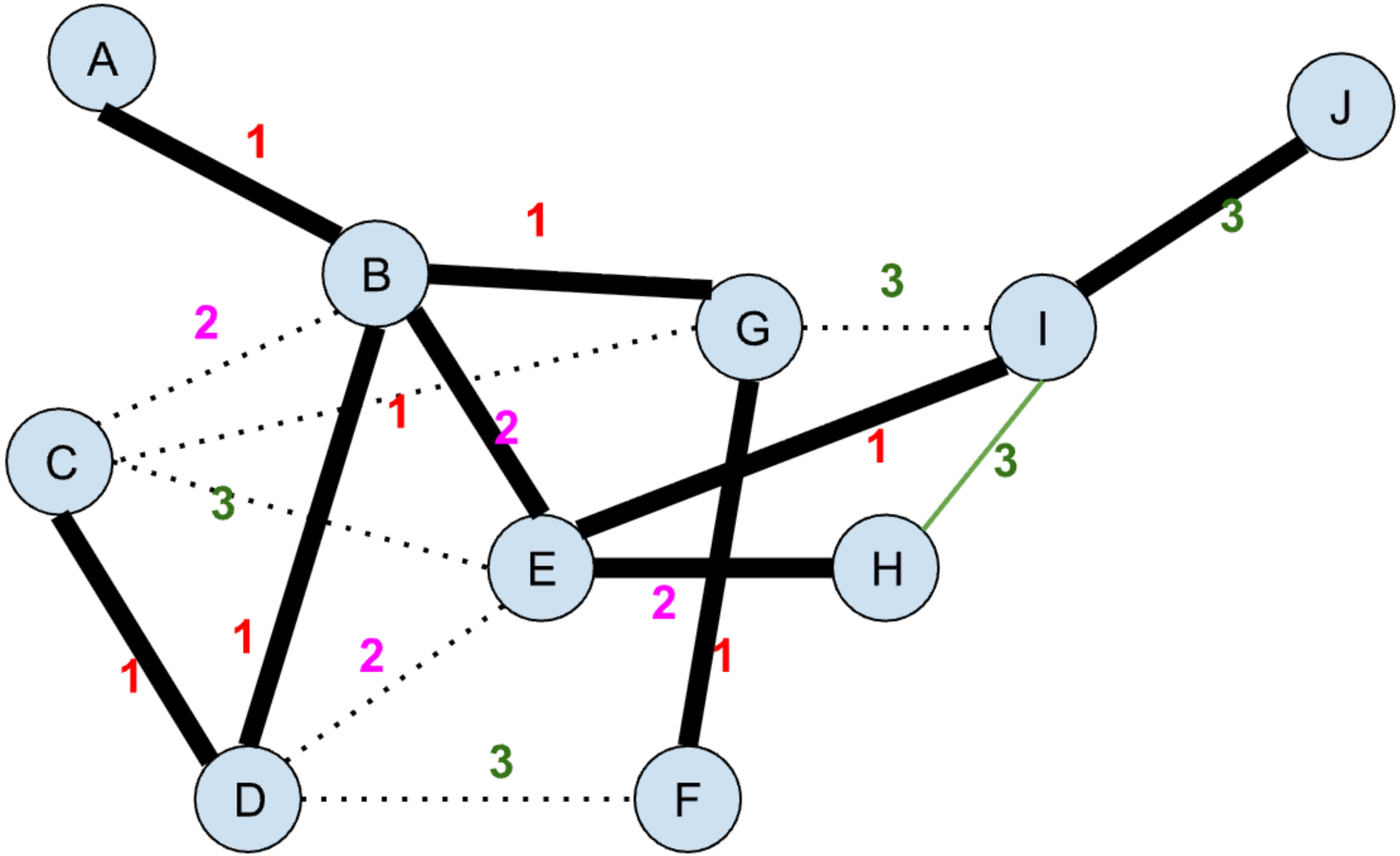

Resultados Esperados

Aplicação da AGM

- AGM favoreceria a estratégia de inanição e alto impacto investigativo
- AGM revelaria a estrutura essencial da rede criminosa
- Apoiaria decisões estratégicas com foco em conexões críticas.
- Viabilizaria desmonte do núcleo com menos intervenções.
- Permitiria derrubar o núcleo com eficiência, reduzindo custo e aumentando impacto.