

Algoritmos e Estruturas de Dados III

Aula 3.3 intercalação por substituição

Prof. Hayala Curto
2022



PUC Minas

Estratégia 2

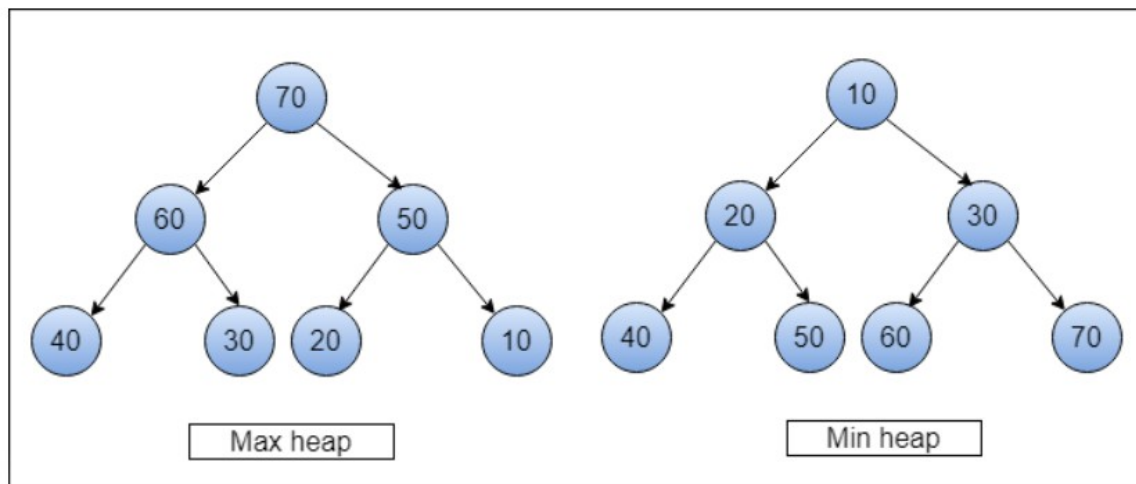
Intercalação por Substituição



Intercalação com seleção por substituição

A segunda estratégia de otimização é de gerar segmentos ordenados maiores na fase de distribuição

Requer o uso de uma fila de prioridades, como um heap.

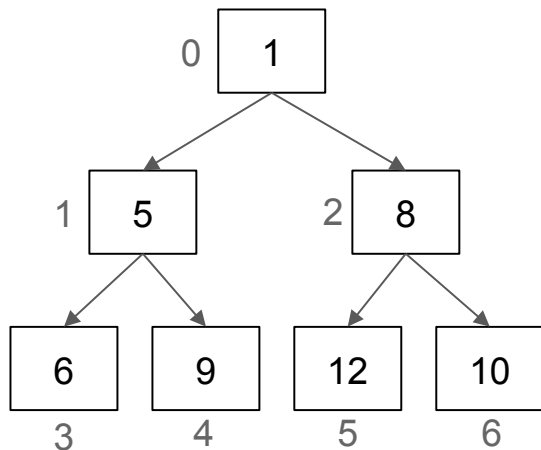


Intercalação com seleção por substituição

0	1	2	3	4	5	6
1	5	8	6	9	12	10

Operações:

- Inserir novo elemento (na raiz e afundá-lo)
- Remover a raiz (colocar o último elemento lá e afundá-lo)



$$\text{filhoesquerdo}(i) = i * 2 + 1$$

$$\text{filhodireito}(i) = i * 2 + 2$$

$$\text{pai}(i) = \text{int}((i-1)/2)$$

Intercalação com seleção por substituição

Arquivo a ser ordenado:

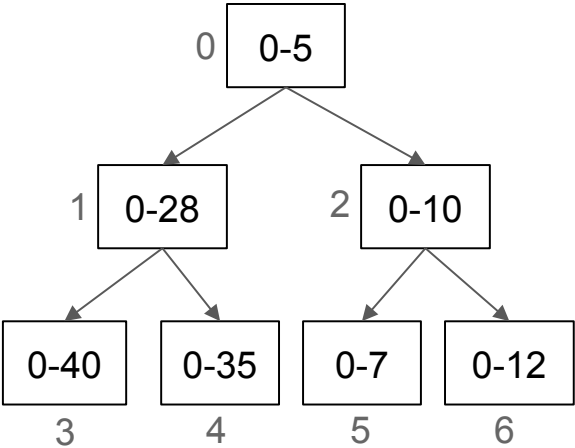
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Passo 1: Preenchimento do heap

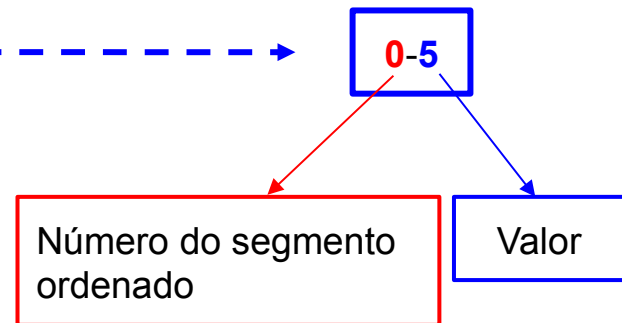
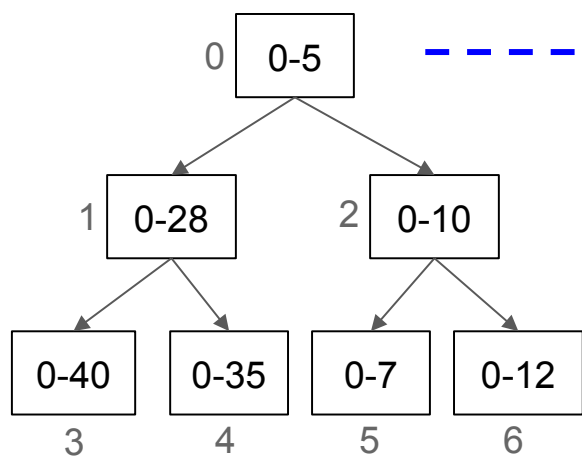
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-5	0-28	0-10	0-40	0-35	0-7	0-12



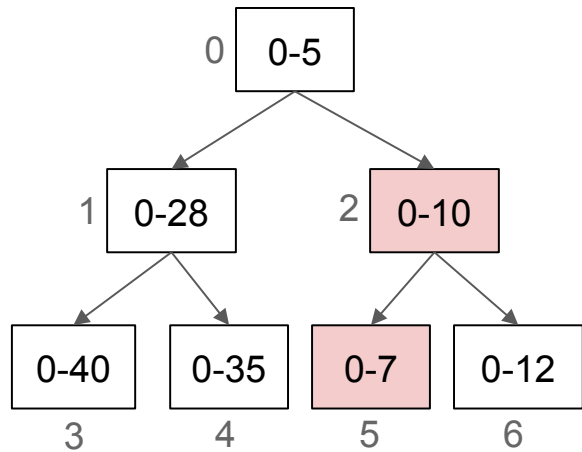
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-5	0-28	0-10	0-40	0-35	0-7	0-12



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

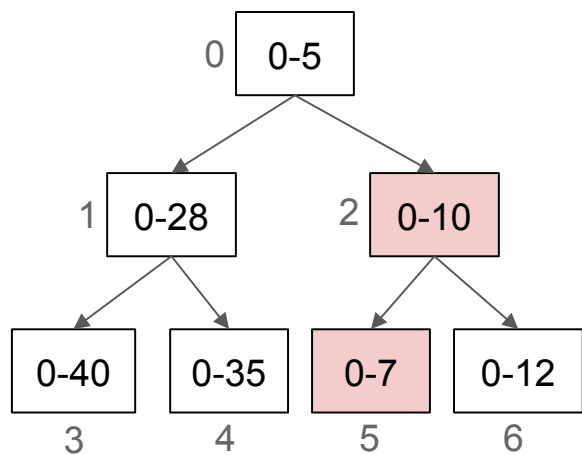
0	1	2	3	4	5	6
0-5	0-28	0-10	0-40	0-35	0-7	0-12



Passo 2: Organização do Heap

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-5	0-28	0-10	0-40	0-35	0-7	0-12



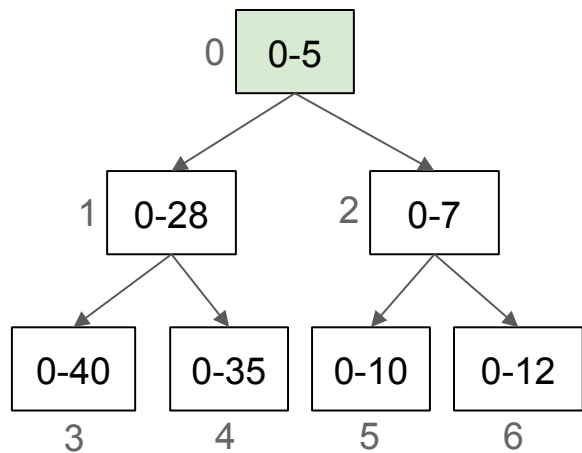
Da posição $(n-1)/2$, que representa o primeiro pai, até a posição 0, afundar cada elemento.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-5	0-28	0-7	0-40	0-35	0-10	0-12

Heap organizado:
Retira o menor elemento!

Saídas:

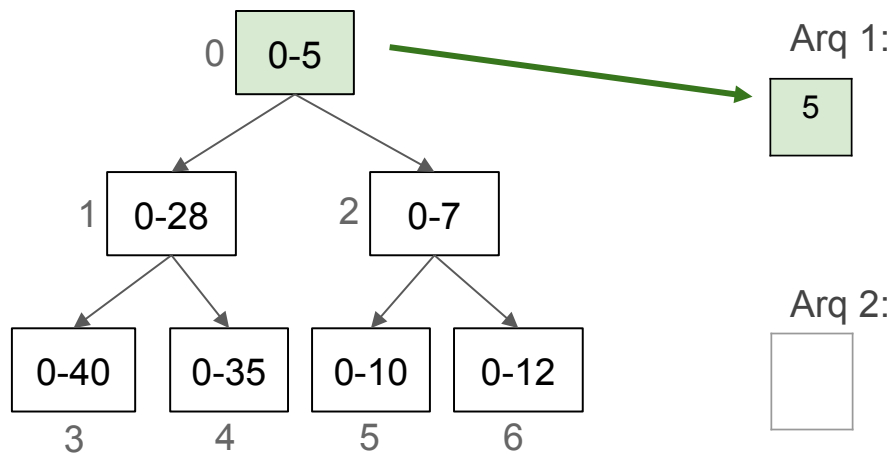


0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-5	0-28	0-7	0-40	0-35	0-10	0-12

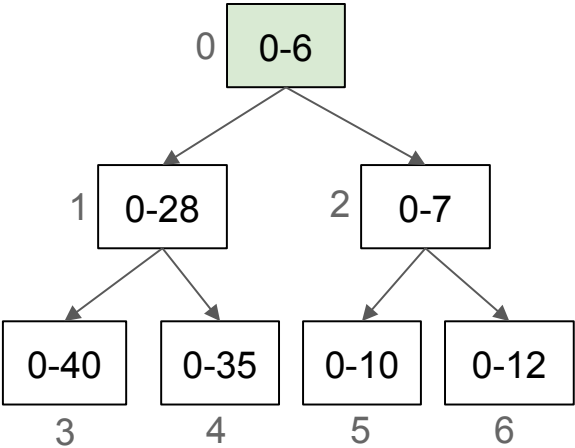
Heap organizado:
Retira o menor elemento!

Saídas:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-6	0-28	0-7	0-40	0-35	0-10	0-12



Saídas:

Arq 1:

5

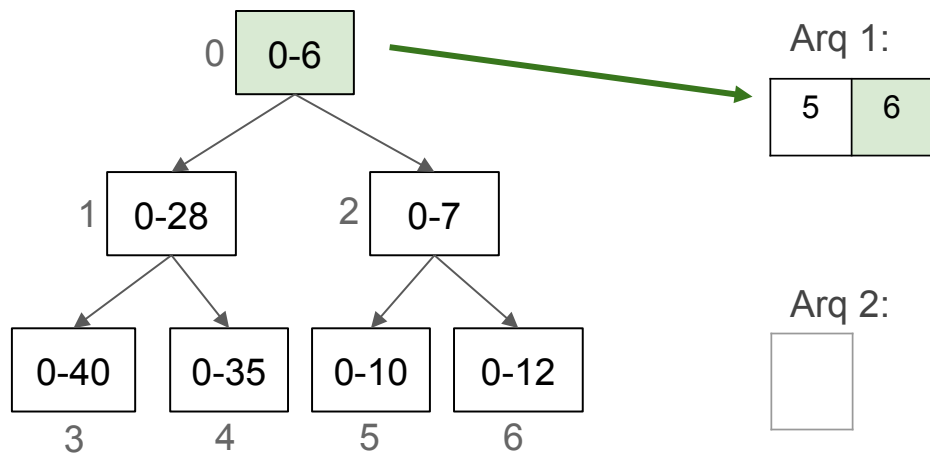
Arq 2:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-6	0-28	0-7	0-40	0-35	0-10	0-12

Heap organizado:
Retira o menor elemento!

Saídas:



Arq 1:

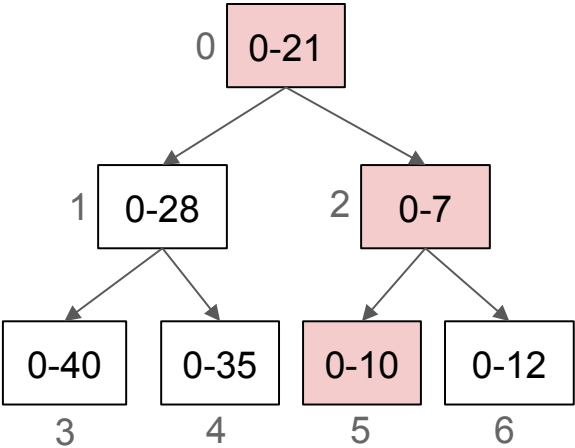
5	6
---	---

Arq 2:

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0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-21	0-28	0-7	0-40	0-35	0-10	0-12



Arq 1:

5	6
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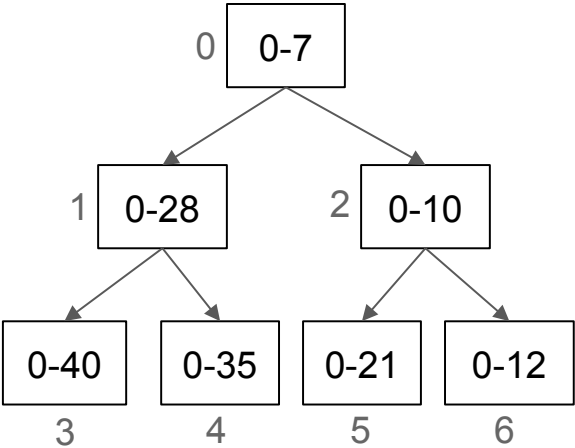
Arq 2:

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Saídas:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-7	0-28	0-10	0-40	0-35	0-21	0-12



Arq 1:

5	6
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Arq 2:

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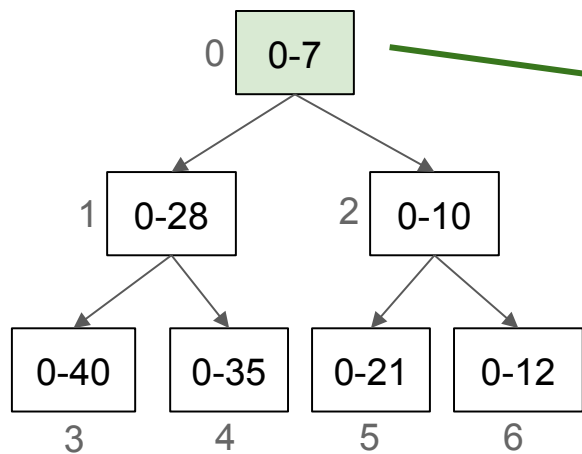
Saídas:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-7	0-28	0-10	0-40	0-35	0-21	0-12

Heap organizado:
Retira o menor elemento!

Saídas:



Arq 1:

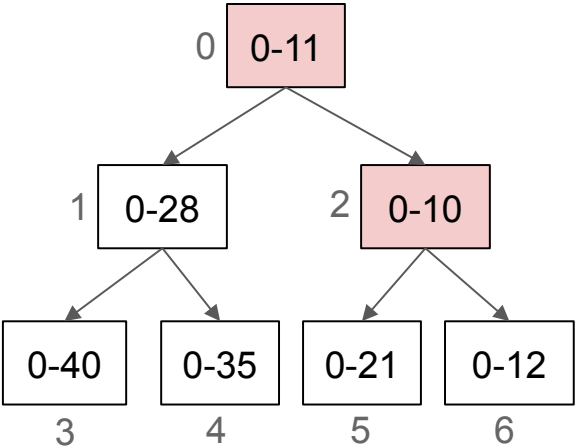
5	6	7
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Arq 2:

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0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-11	0-28	0-10	0-40	0-35	0-21	0-12



Arq 1:

5	6	7
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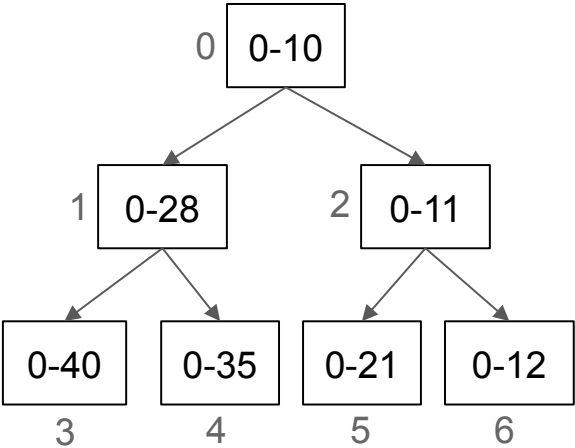
Arq 2:

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Saídas:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-10	0-28	0-11	0-40	0-35	0-21	0-12



Arq 1:

5	6	7
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Arq 2:

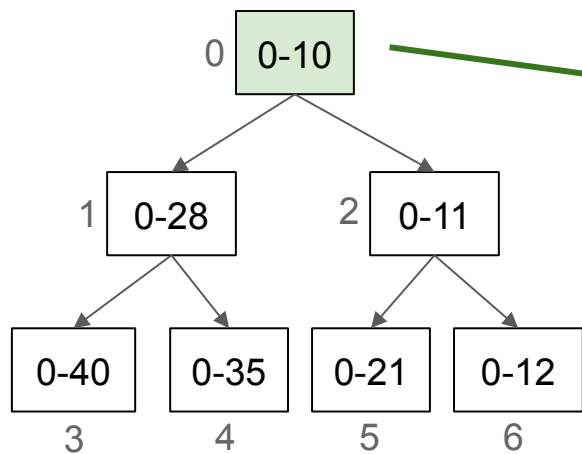
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Saídas:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-10	0-28	0-11	0-40	0-35	0-21	0-12

Saídas:



Arq 1:

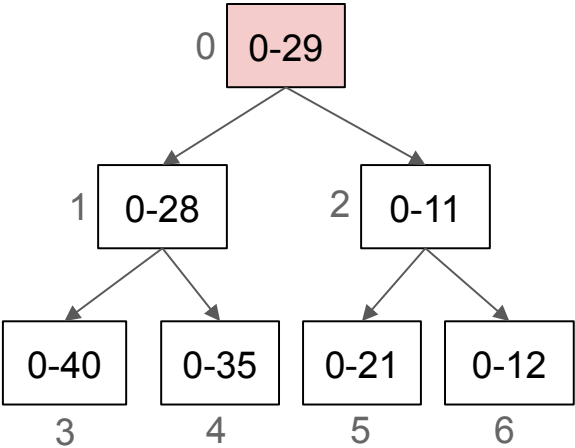
5	6	7	10
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Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

0	1	2	3	4	5	6
0-29	0-28	0-11	0-40	0-35	0-21	0-12



Saídas:

Arq 1:

5	6	7	10
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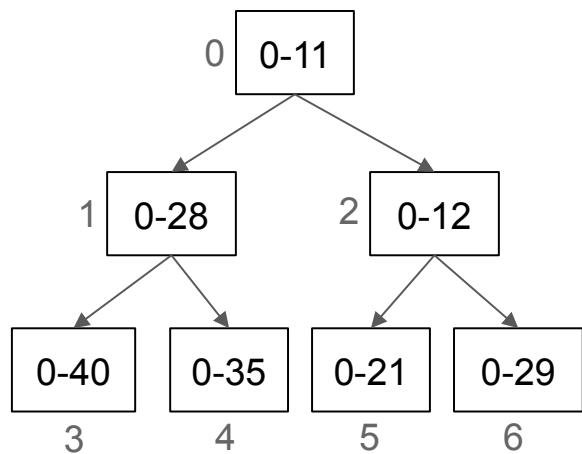
Arq 2:

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0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Estou retirando o vetor, mas ele
existe!

Saídas:



Arq 1:

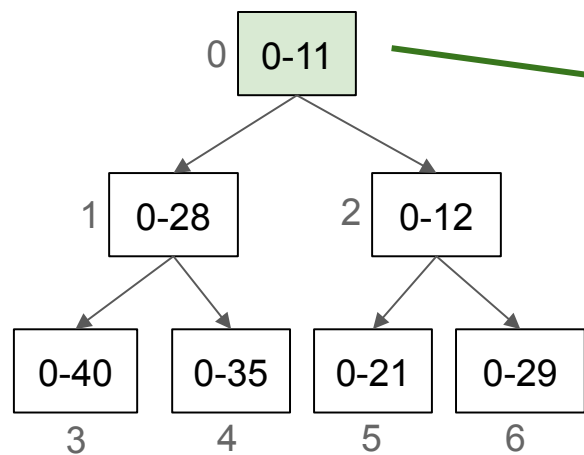
5	6	7	10
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Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

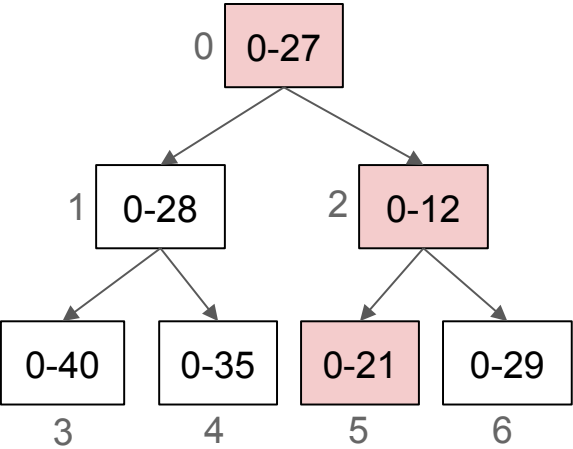
5	6	7	10	11
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Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

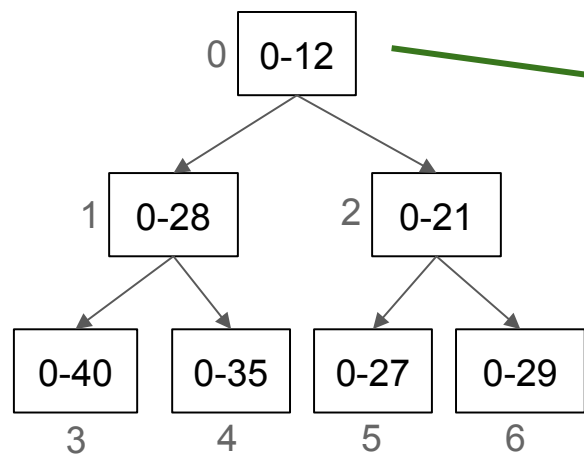
5	6	7	10	11
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Arq 2:

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0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

5	6	7	10	11	12
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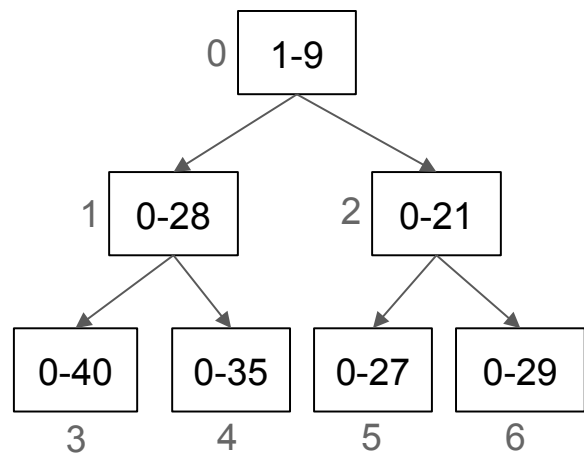
Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Criação de um novo número de segmento ordenado (1)

Saídas:



Arq 1:

5	6	7	10	11	12
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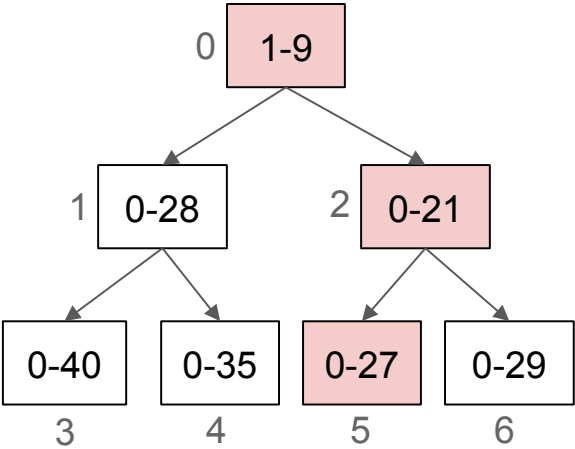
Arq 2:



$9 < 12$
Se ele entrar aqui, o
segmento ordenado é
finalizado

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

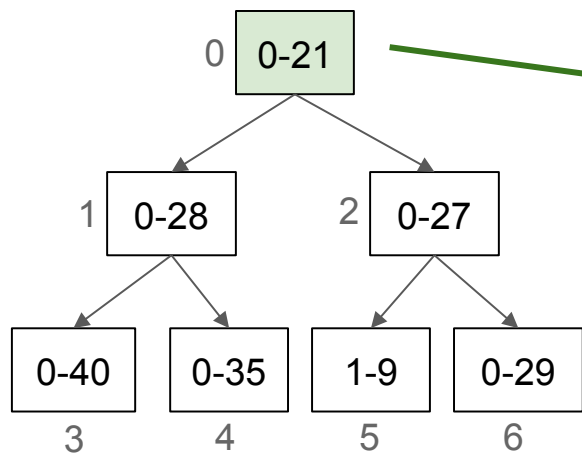
5	6	7	10	11	12
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Arq 2:

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0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



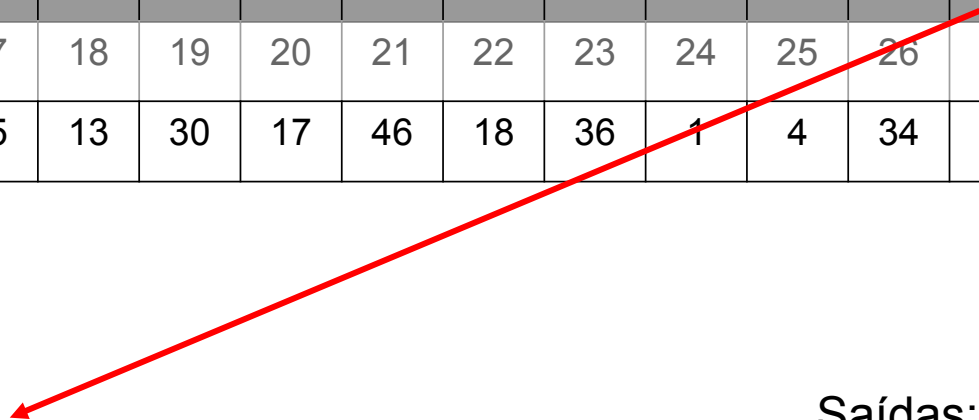
Arq 1:

5	6	7	10	11	12	21
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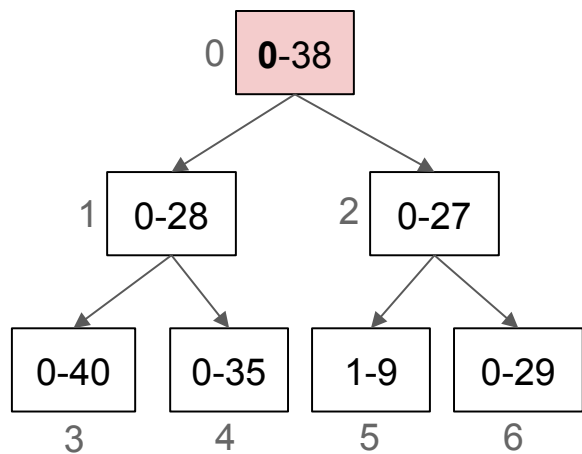
Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22



Saídas:



Arq 1:

5	6	7	10	11	12	21
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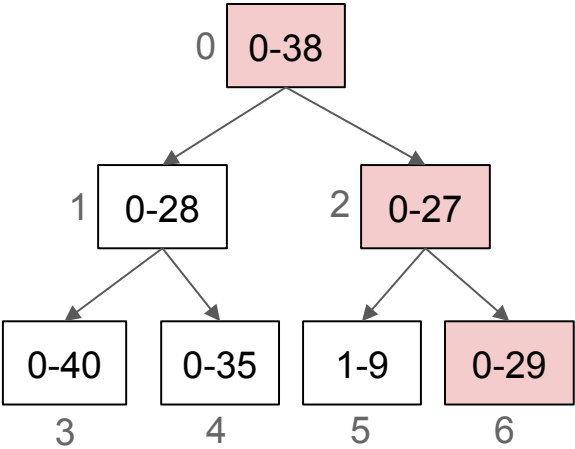
Arq 2:



$38 > 21$
Ele pode entrar aqui
sem quebrar a
ordenação do segmento

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



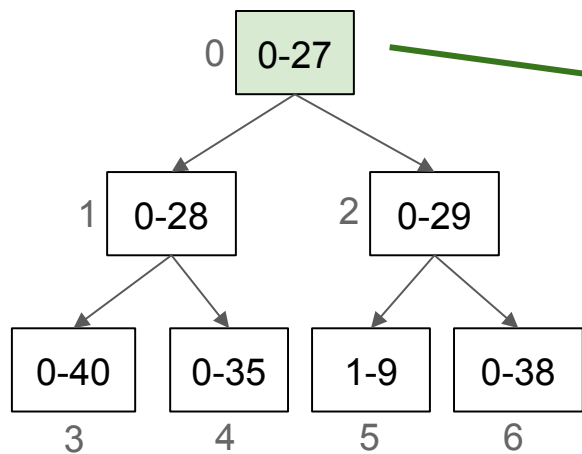
Arq 1:

5	6	7	10	11	12	21
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Arq 2:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

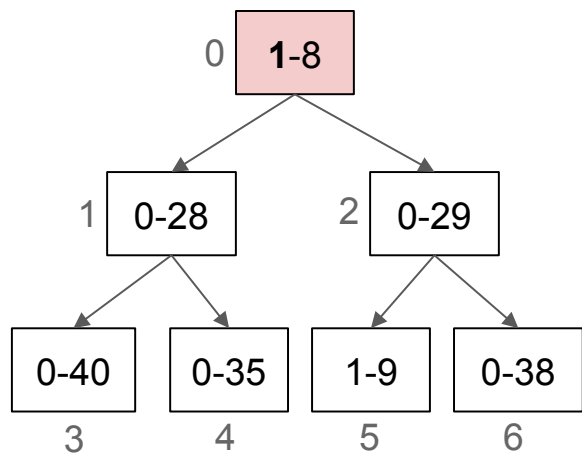
5	6	7	10	11	12	21	27
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Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

5	6	7	10	11	12	21	27
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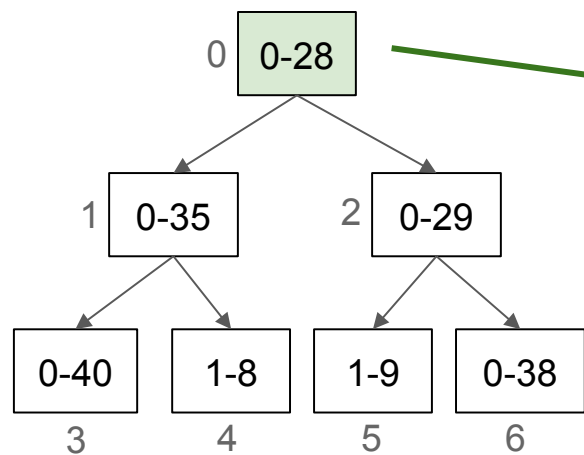
Arq 2:



$8 < 27$
Se ele entrar aqui, o
segmento ordenado é
finalizado

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

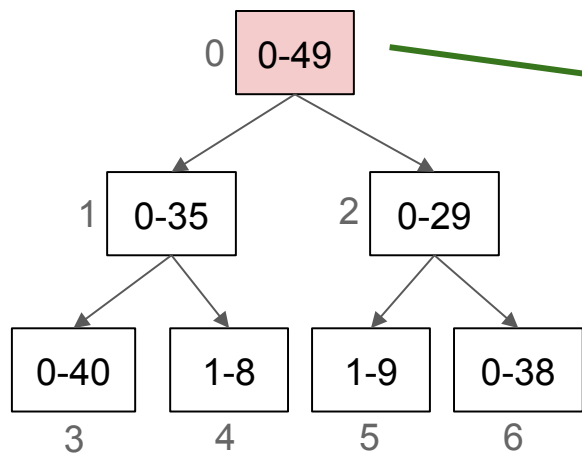
5	6	7	10	11	12	21	27	28
---	---	---	----	----	----	----	----	----

Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

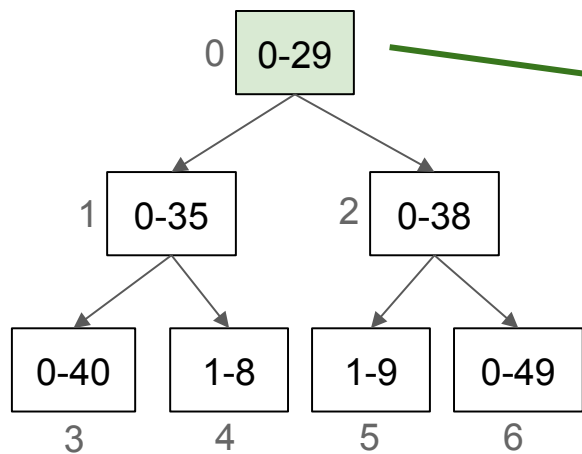
5	6	7	10	11	12	21	27	28
---	---	---	----	----	----	----	----	----

Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

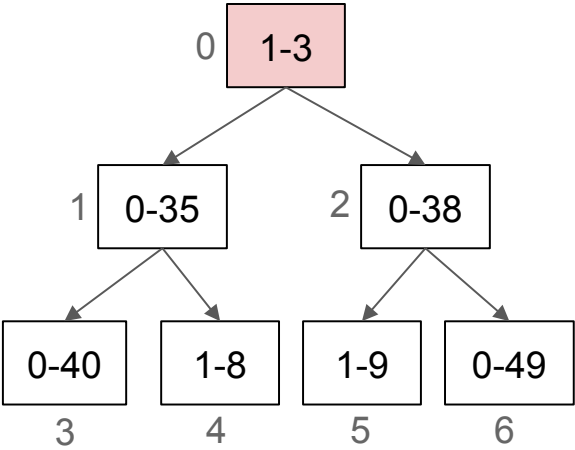
5	6	7	10	11	12	21	27	28	29
---	---	---	----	----	----	----	----	----	----

Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



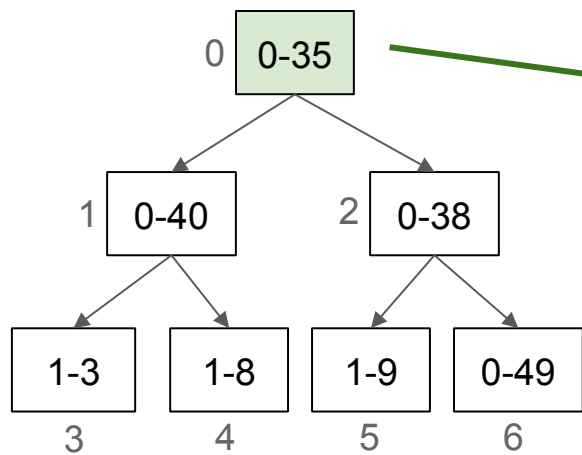
Arq 1:

5	6	7	10	11	12	21	27	28	29
---	---	---	----	----	----	----	----	----	----

Arq 2:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

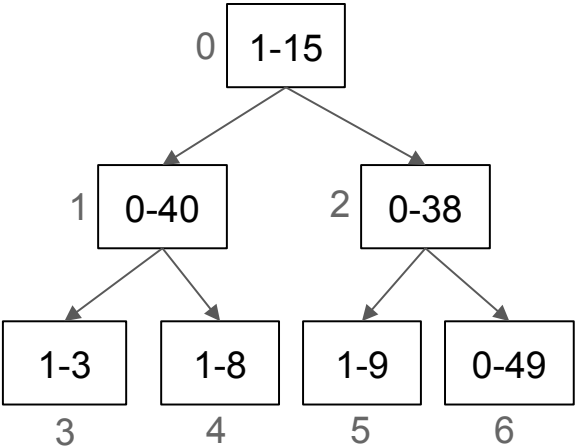
5	6	7	10	11	12	21	27	28	29
35									

Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

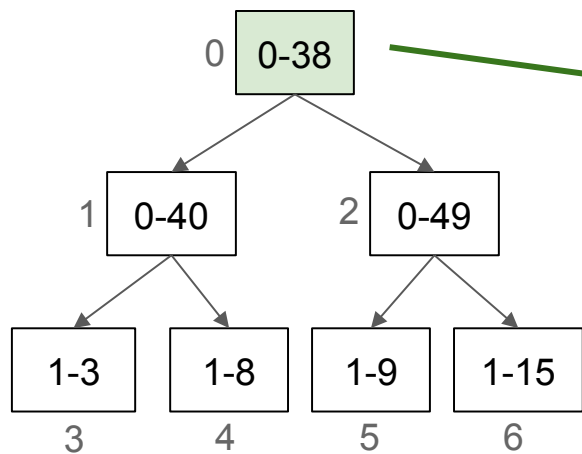
5	6	7	10	11	12	21	27	28	29
35									

Arq 2:

--

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

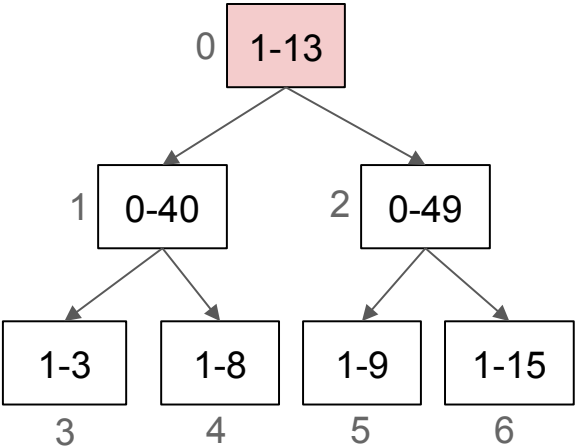
5	6	7	10	11	12	21	27	28	29
35	38								

Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

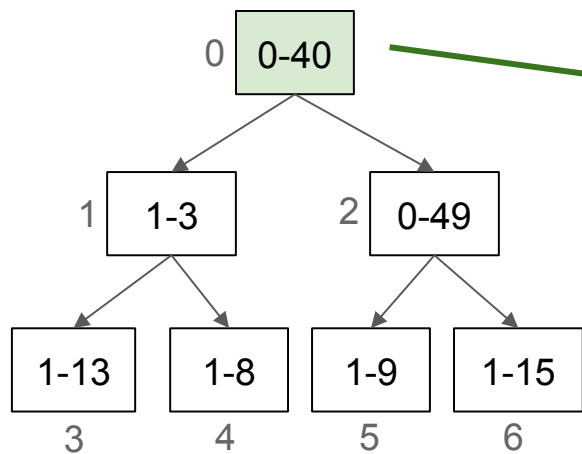
5	6	7	10	11	12	21	27	28	29
35	38								

Arq 2:

--

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

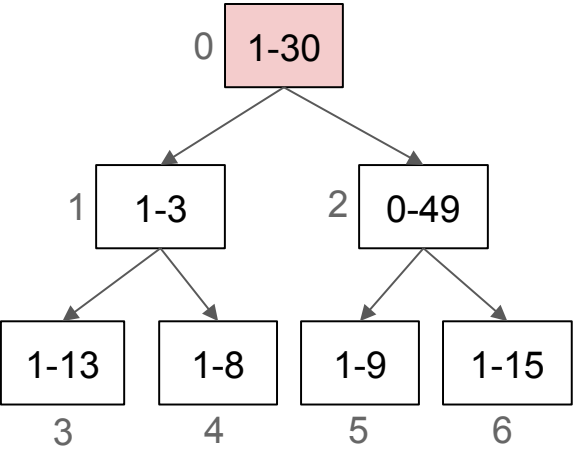
5	6	7	10	11	12	21	27	28	29
35	38	40							

Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

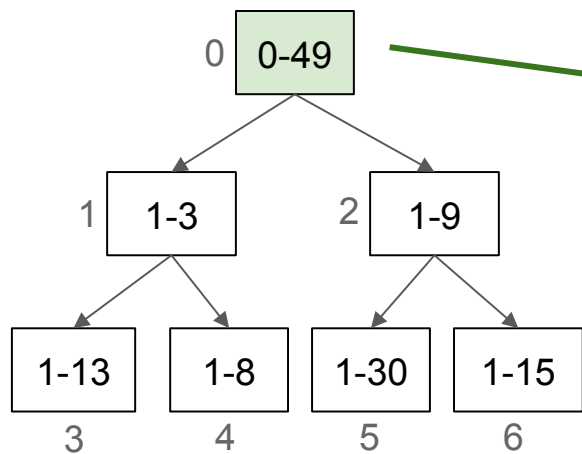
5	6	7	10	11	12	21	27	28	29
35	38	40							

Arq 2:

--

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

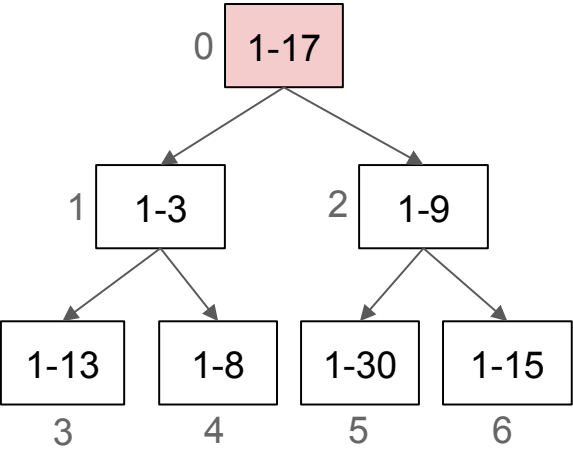
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

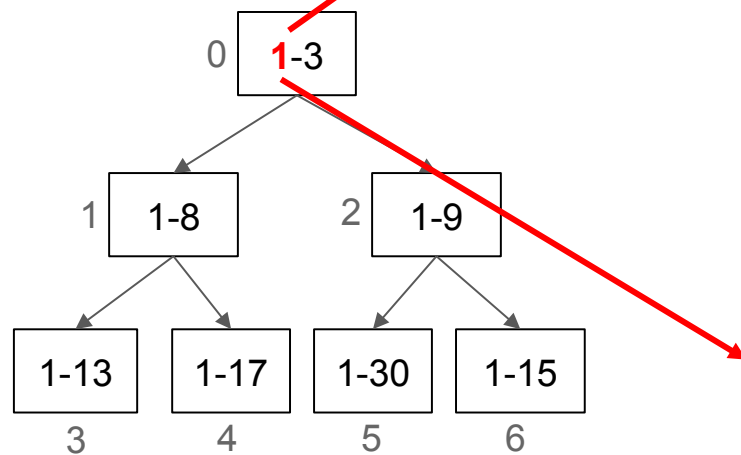
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

NOVO SEGMENTO

Saídas:



Arq 1:

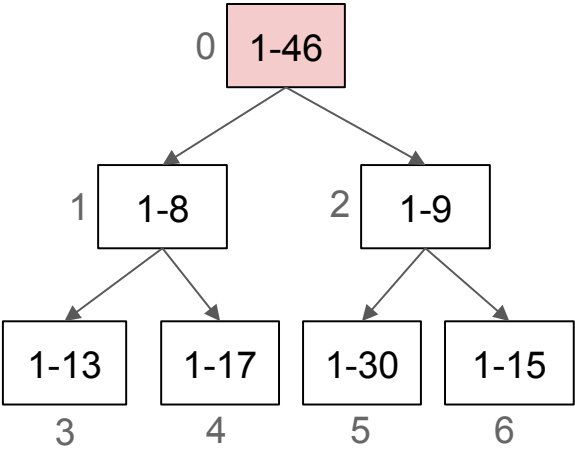
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

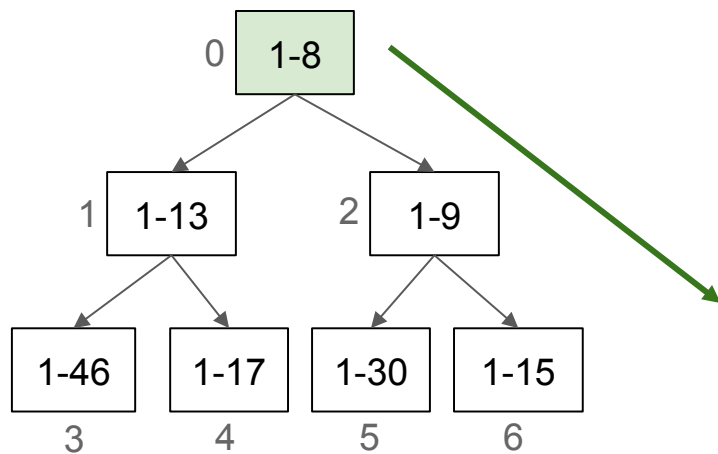
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

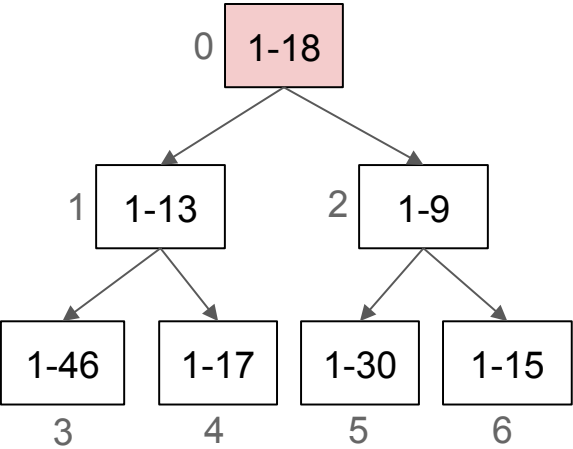
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8
---	---

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
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15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

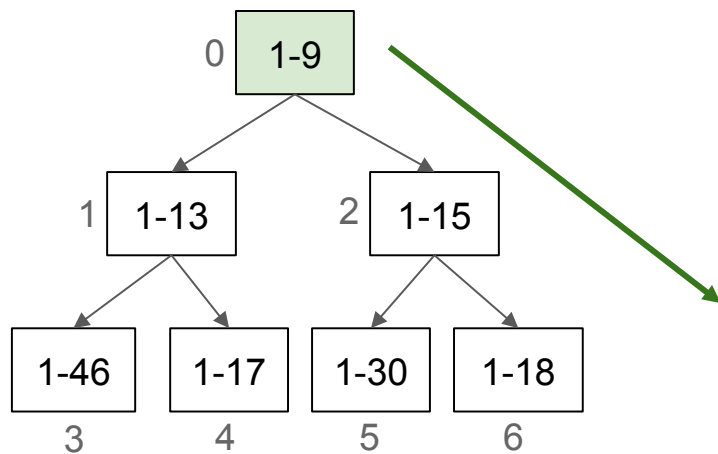
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8
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0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

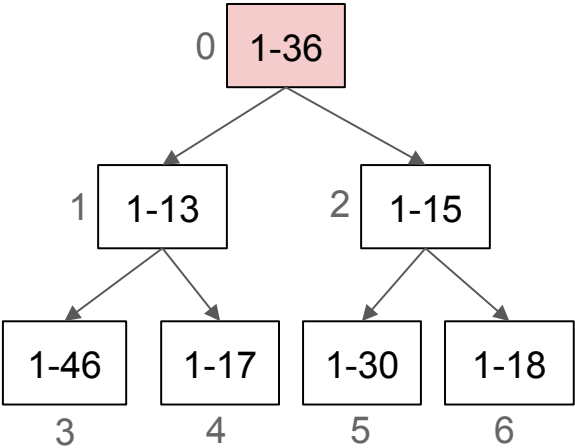
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9
---	---	---

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

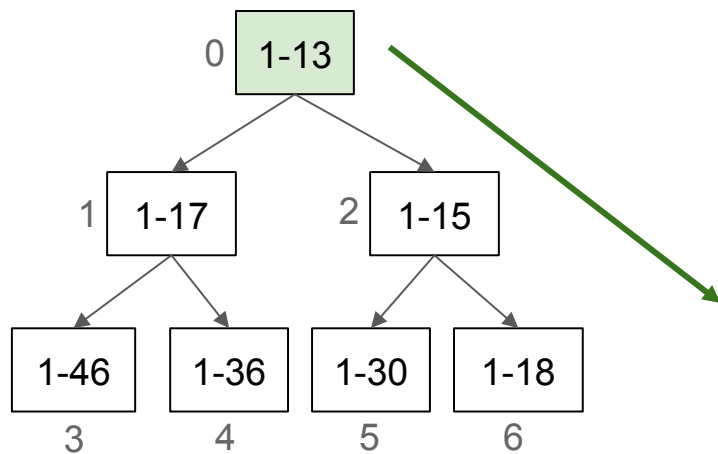
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9
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0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

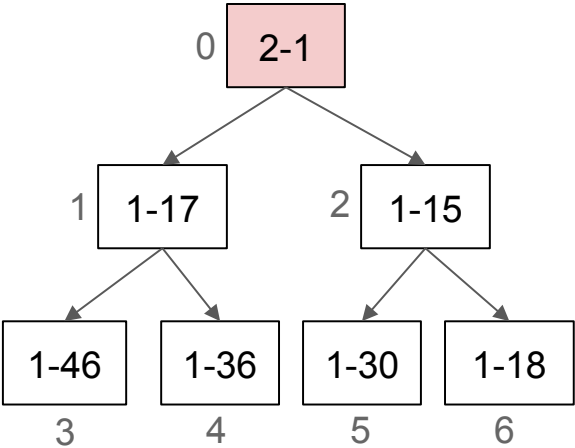
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13
---	---	---	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

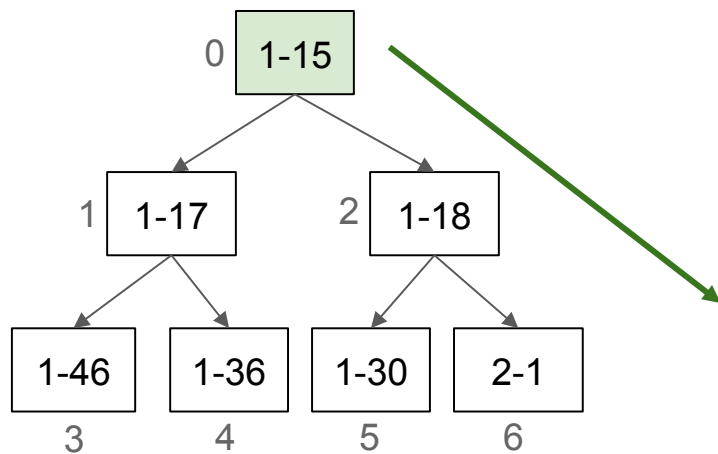
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13
---	---	---	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

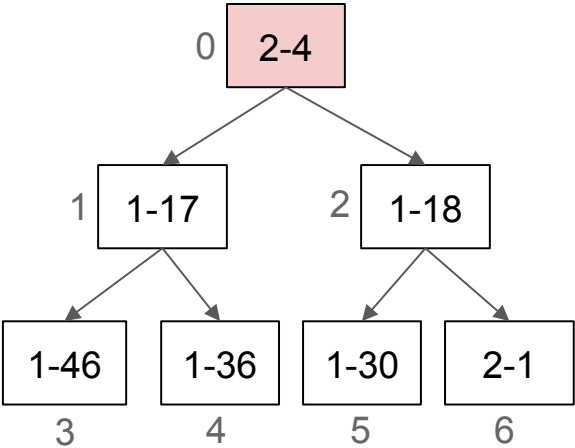
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15
---	---	---	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

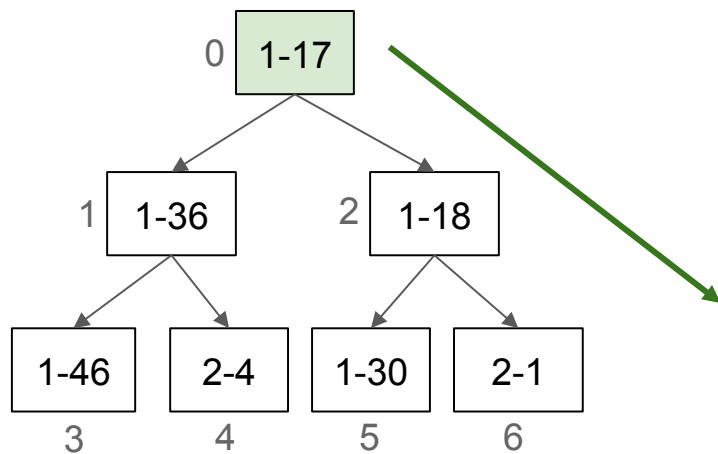
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15
---	---	---	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

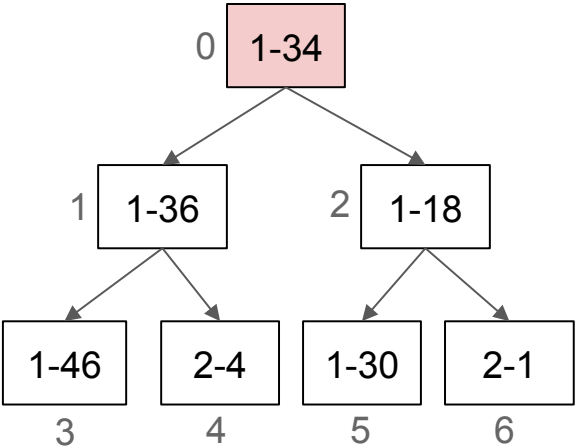
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17
---	---	---	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

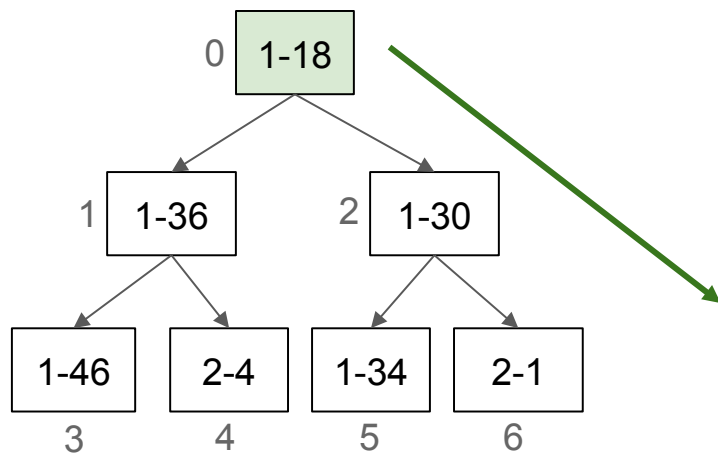
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17
---	---	---	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

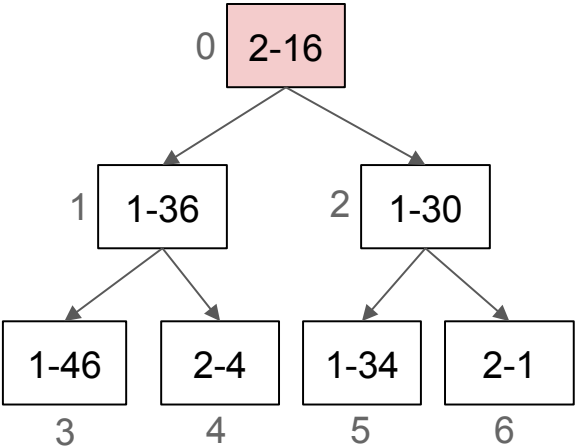
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18
---	---	---	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

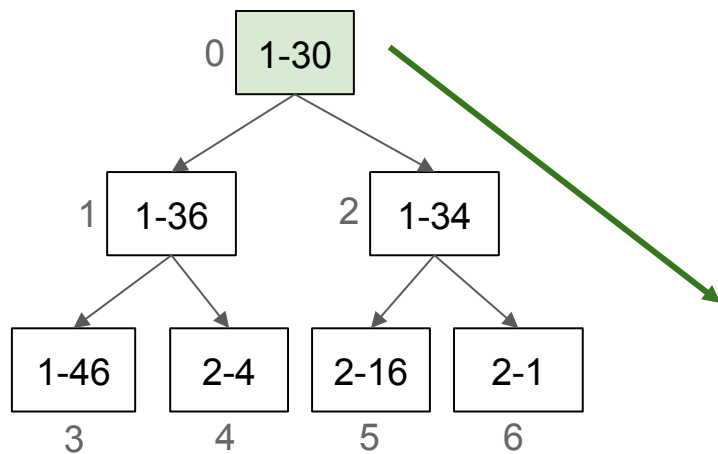
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18
---	---	---	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

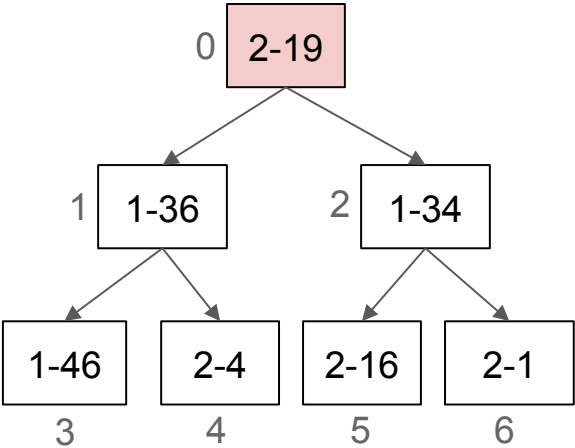
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18	30
---	---	---	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

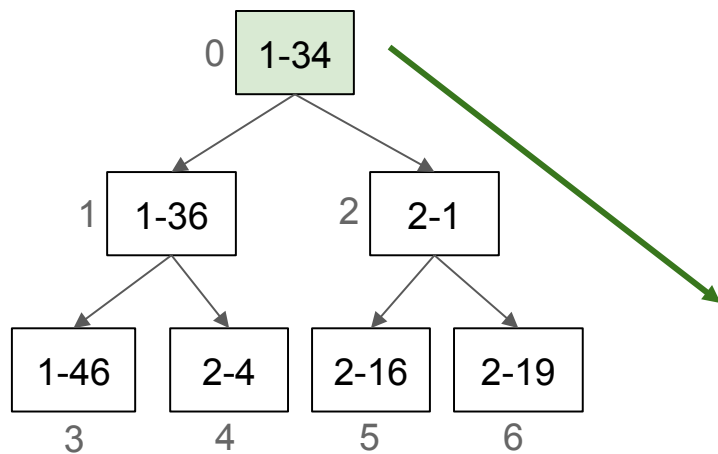
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18	30
---	---	---	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

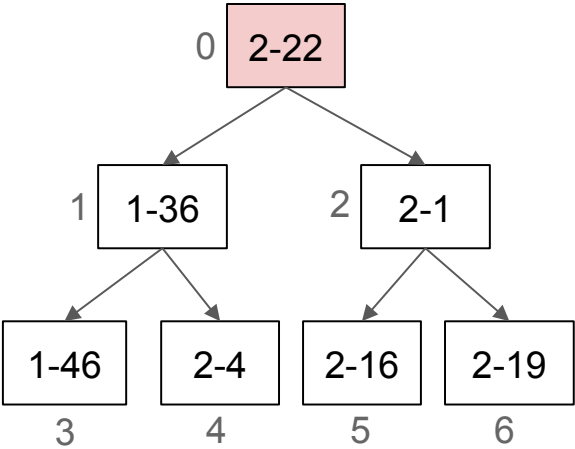
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18	30	34
---	---	---	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

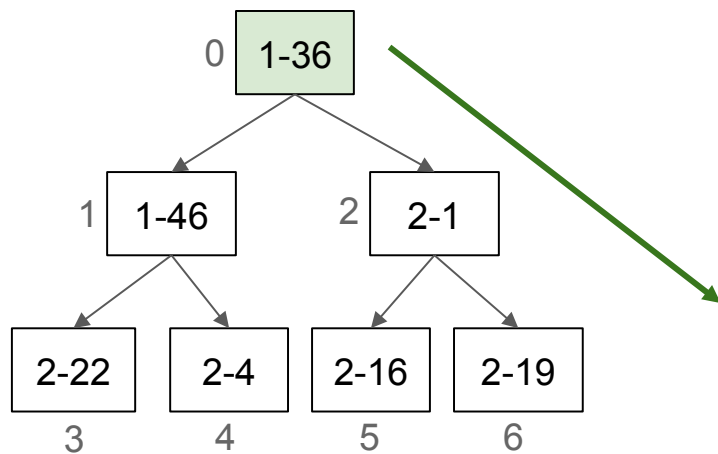
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18	30	34
---	---	---	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

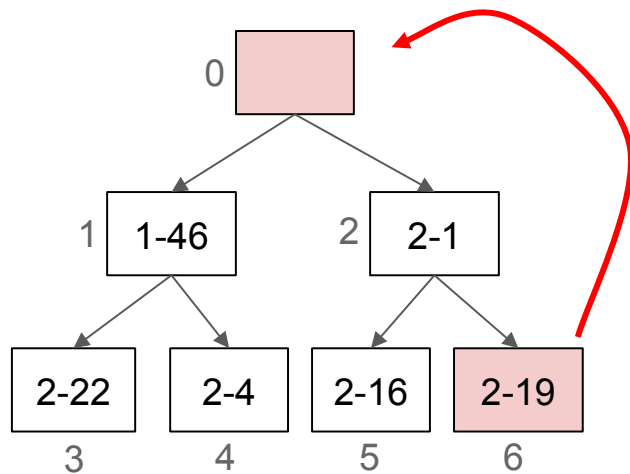
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18	30	34	36
---	---	---	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

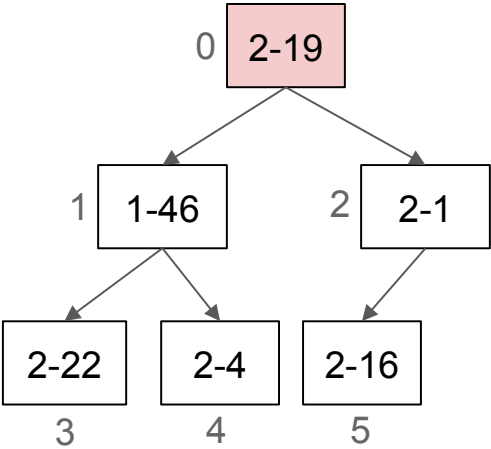
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18	30	34	36
---	---	---	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

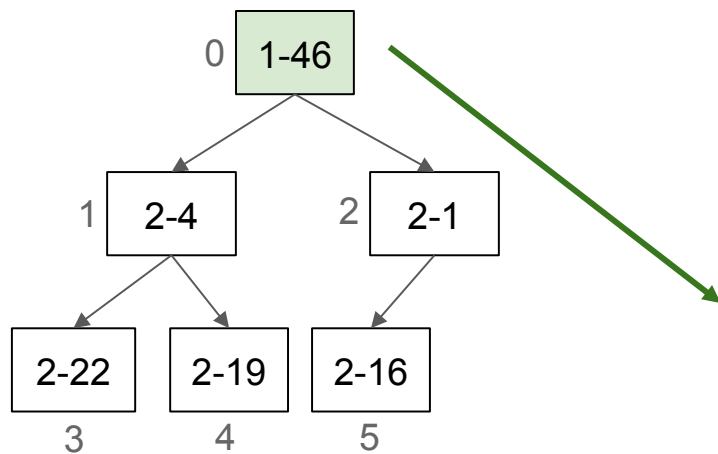
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18	30	34	36
---	---	---	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

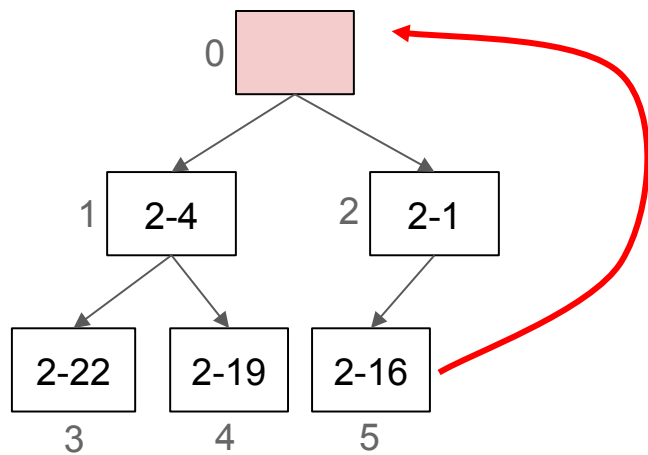
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

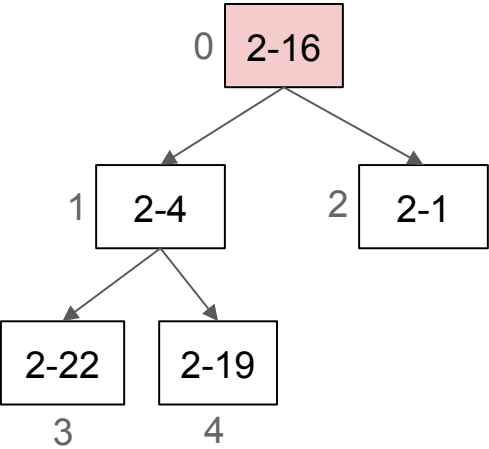
5	6	7	10	11	12	21	27	28	29
35	38	40	49						

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

5	6	7	10	11	12	21	27	28	29
35	38	40	49						

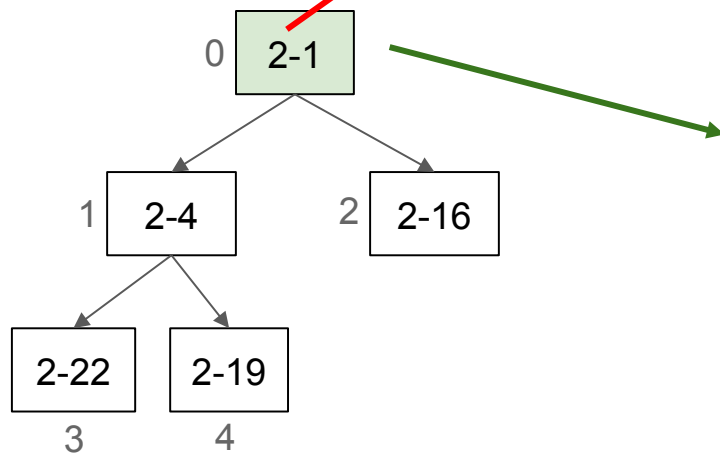
Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

NOVO SEGMENTO

Saídas:



Arq 1:

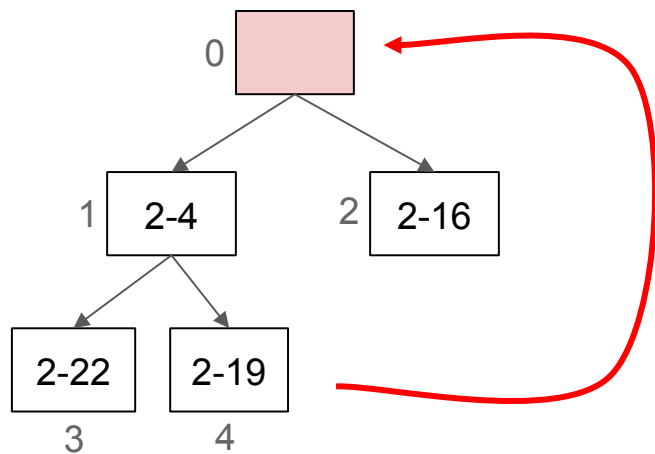
5	6	7	10	11	12	21	27	28	29
35	38	40	49	1					

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

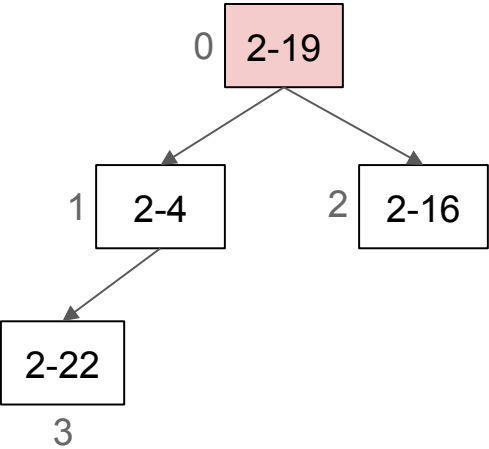
5	6	7	10	11	12	21	27	28	29
35	38	40	49	1					

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

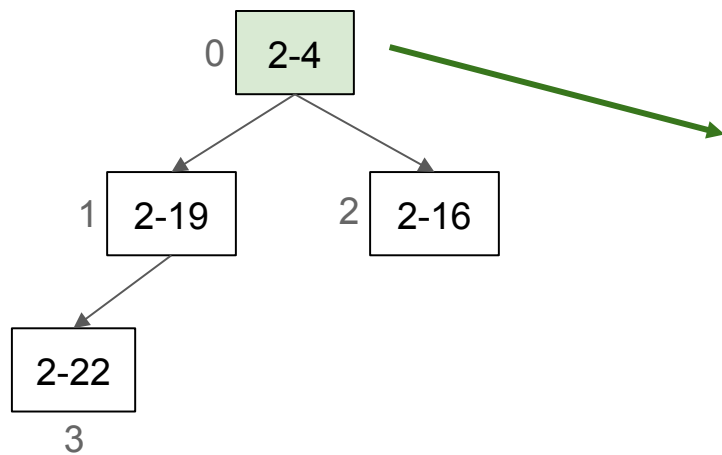
5	6	7	10	11	12	21	27	28	29
35	38	40	49	1					

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

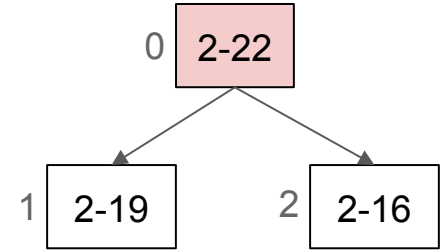
5	6	7	10	11	12	21	27	28	29
35	38	40	49	1	4				

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

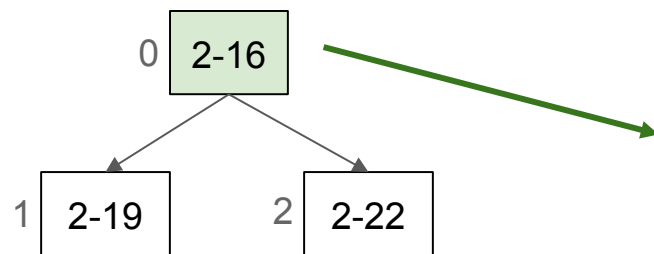
5	6	7	10	11	12	21	27	28	29
35	38	40	49	1	4				

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

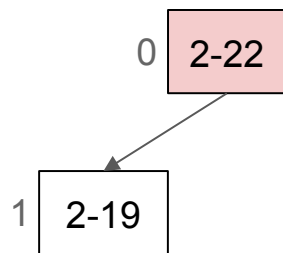
5	6	7	10	11	12	21	27	28	29
35	38	40	49	1	4	16			

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

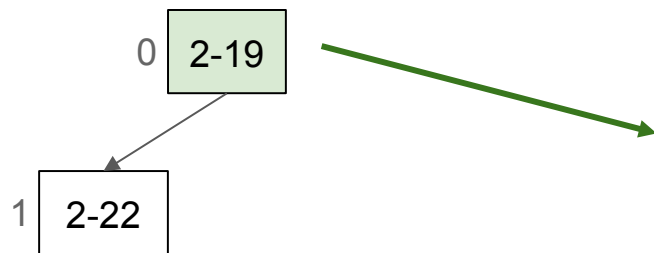
5	6	7	10	11	12	21	27	28	29
35	38	40	49	1	4	16			

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:



Arq 1:

5	6	7	10	11	12	21	27	28	29
35	38	40	49	1	4	16	19		

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Saídas:

0 2-22



Arq 1:

5	6	7	10	11	12	21	27	28	29
35	38	40	49	1	4	16	19	22	

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
---	---	---	----	----	----	----	----	----	----	----

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5	28	10	40	35	7	12	6	21	11	29	27	9	38	8
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
49	3	15	13	30	17	46	18	36	1	4	34	16	19	22

Agora é só fazer as intercalações!!!

Saídas:

Arq 1:

5	6	7	10	11	12	21	27	28	29
35	38	40	49	1	4	16	19	22	

Arq 2:

3	8	9	13	15	17	18	30	34	36	46
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Estratégia 3

Economia de arquivos temporários



Intercalação Balanceada

No exemplo, foram utilizadas **2M** fontes para uma intercalação de **M**-caminhos.

É possível usar apenas $M + 1$ fitas, a saber:

- Encaminhe todos os blocos para uma única fita de saída.
- Redistribua estes blocos entre as fitas de onde eles foram lidos.

Custo: uma passada a mais em cada intercalação.