Heapsort

Koffman & Wolfgang

- kapitel 8, avsnitt 8

Heapsort

Mergesort har komplexitet O(n log n)

- men det kräver temporärt ett extra fält

Heapsort kräver inte något extraminne

- det är en in-place-algoritm
- som namnet antyder använder algoritmen en heap för att sortera fältet

Första versionen av Heapsort

En enkel Heapsort-algoritm:

- skapa en tom heap
- tag ett element i taget ur fältet och stoppa in i heapen
- tag sedan ut elementen ur heapen ett i taget och stoppa tillbaka i fältet

Denhär versionen kräver extraminne

- hur gör man detta in-place?

Heapsort in-place

Antag att vi har ett fält med n element

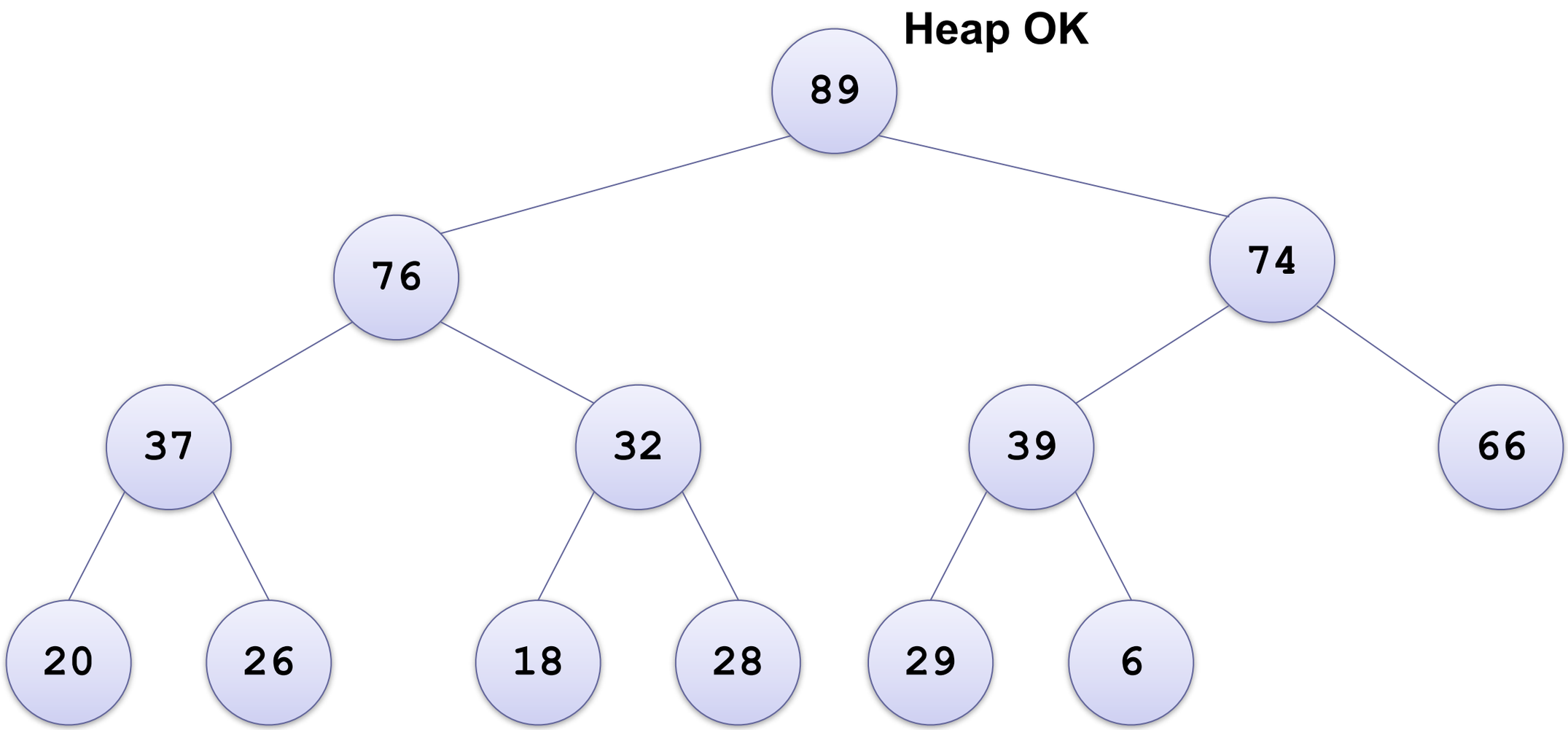
- låt första elementet vara en heap med ett element
- utöka heapen med ett element i taget
- låt elementet bubbla upp till rätt plats i heapen

Nu har vi en heap; hur gör vi den till en lista?

- byt ut det översta elementet med det sista
- minska heapens storlek, och låt det nya översta elementet bubbla ner till rätt ställe
- fortsätt så tills heapen bara har ett element

Vi måste bygga heapen som en max-heap,
eftersom vi flyttar elementen sist i fältet hela tiden

Trace of Heapsort



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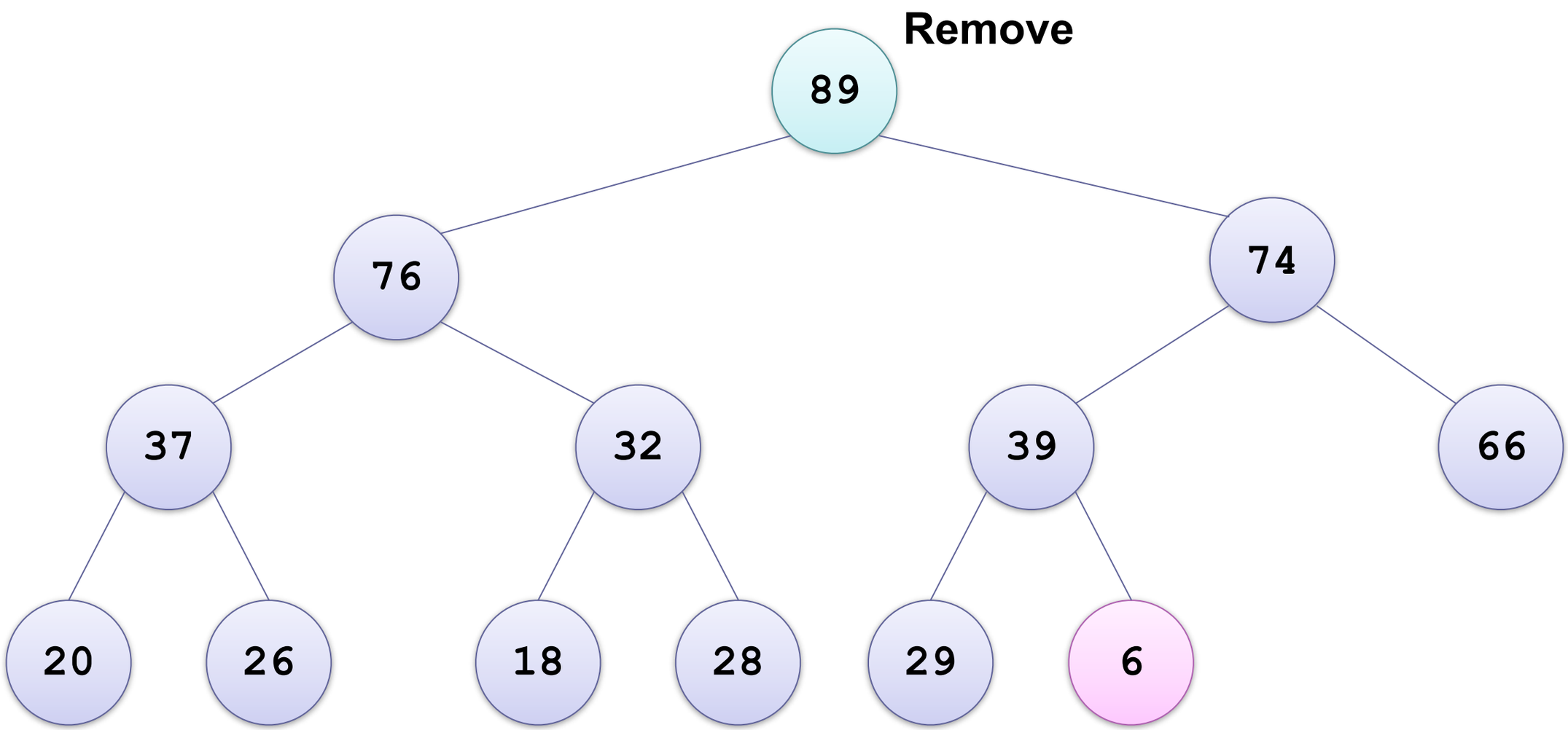

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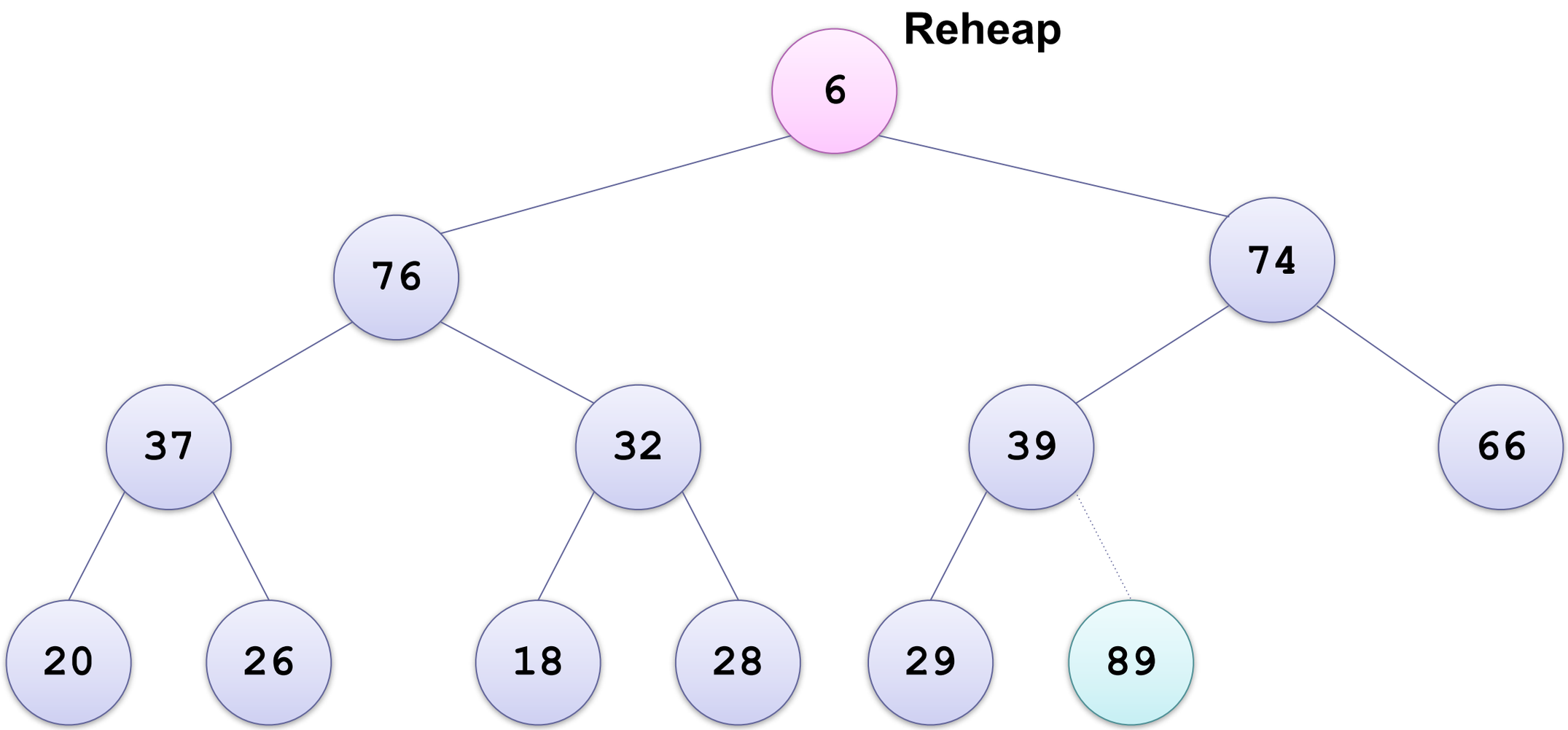

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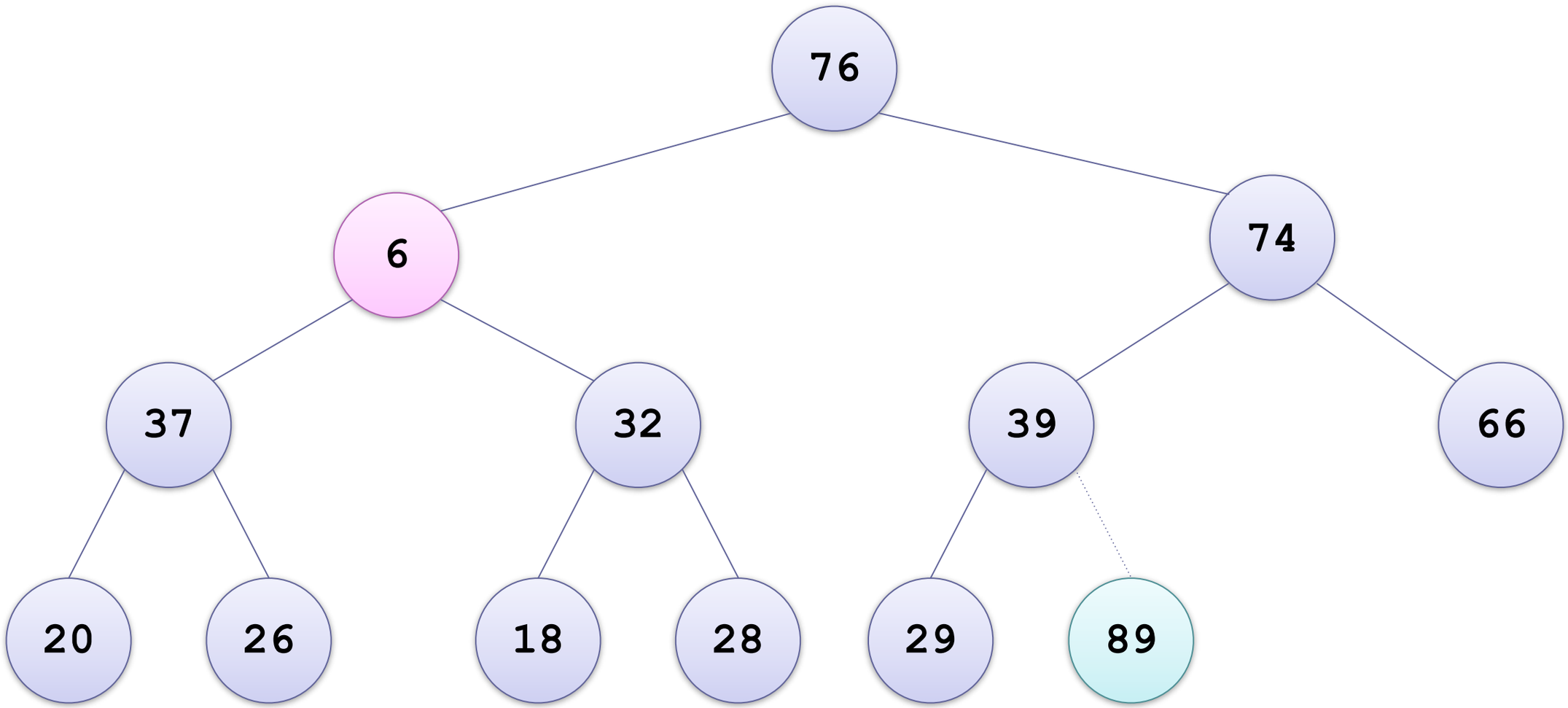

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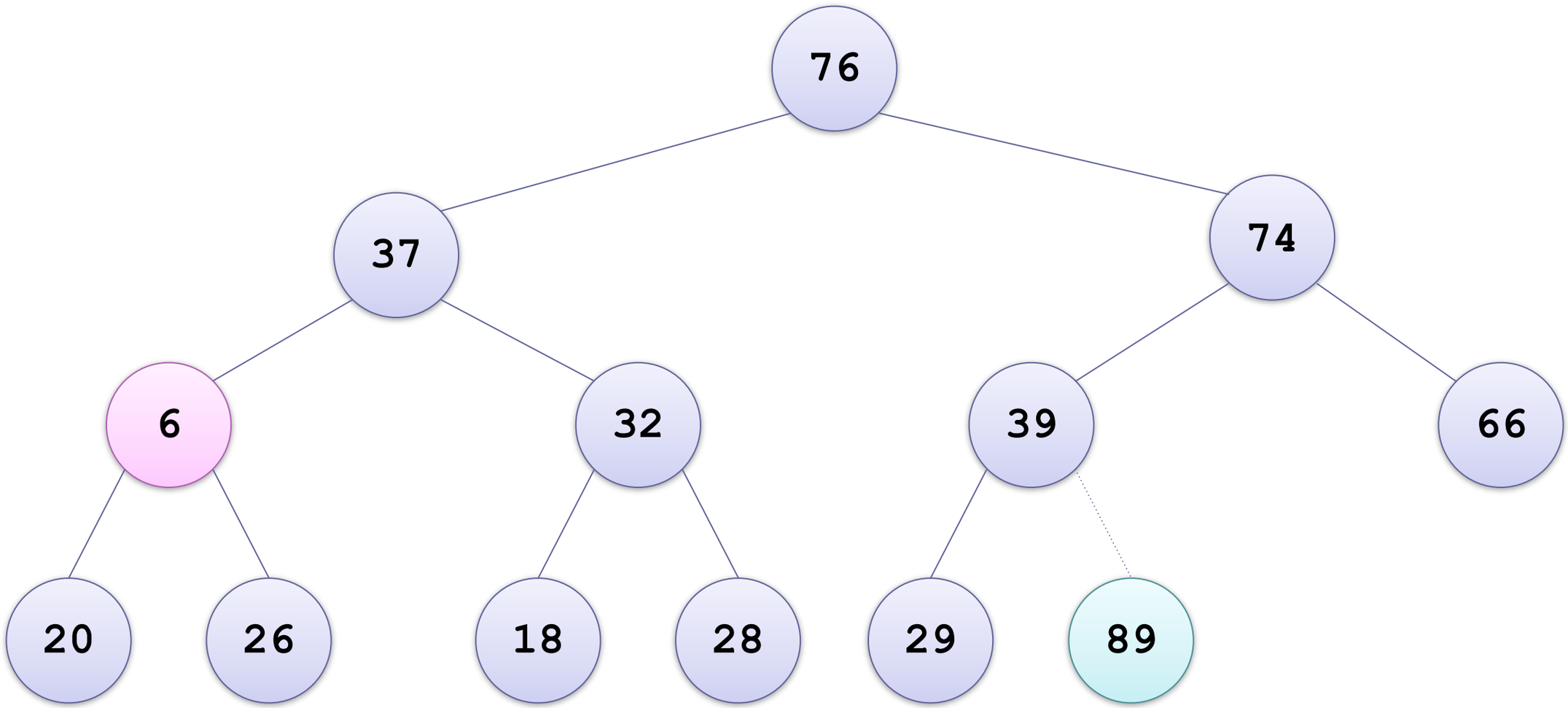

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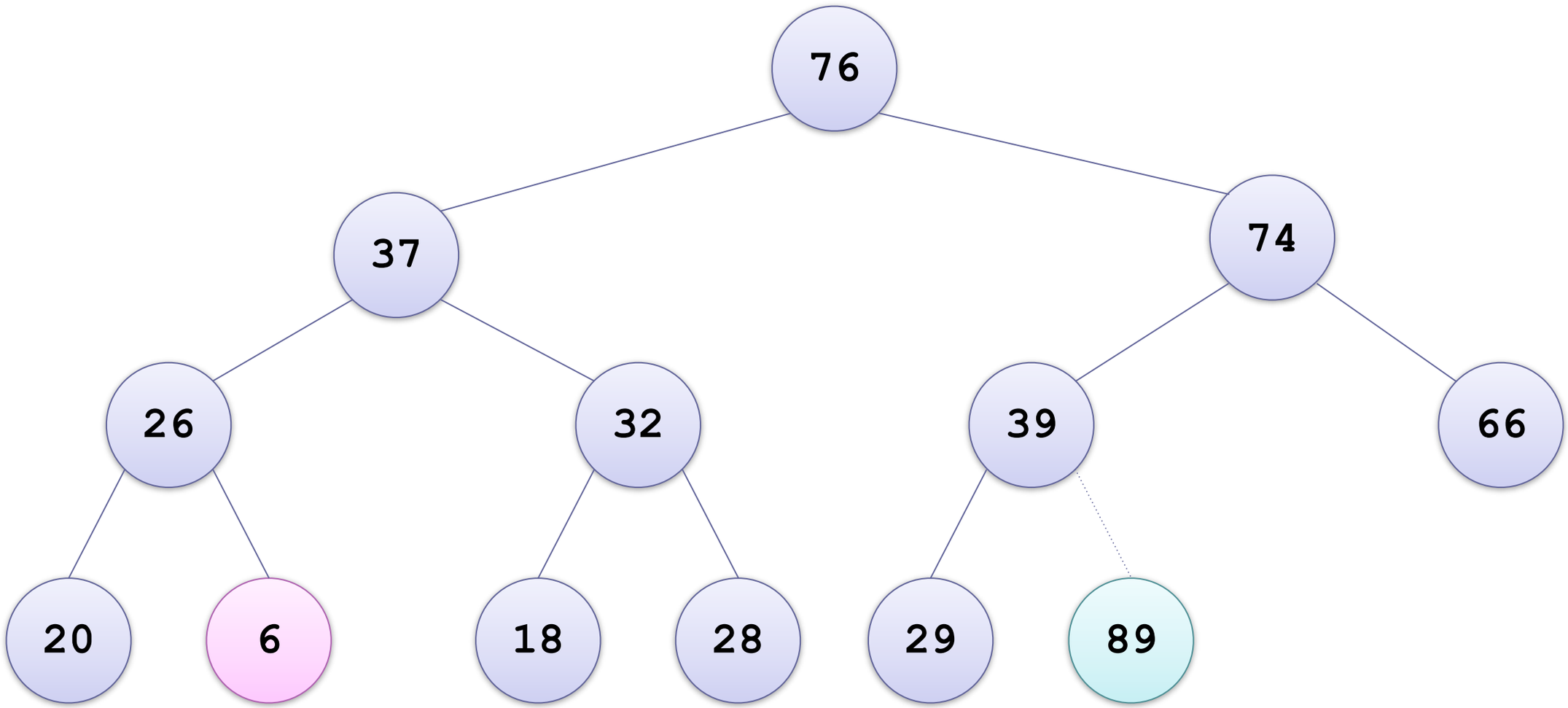

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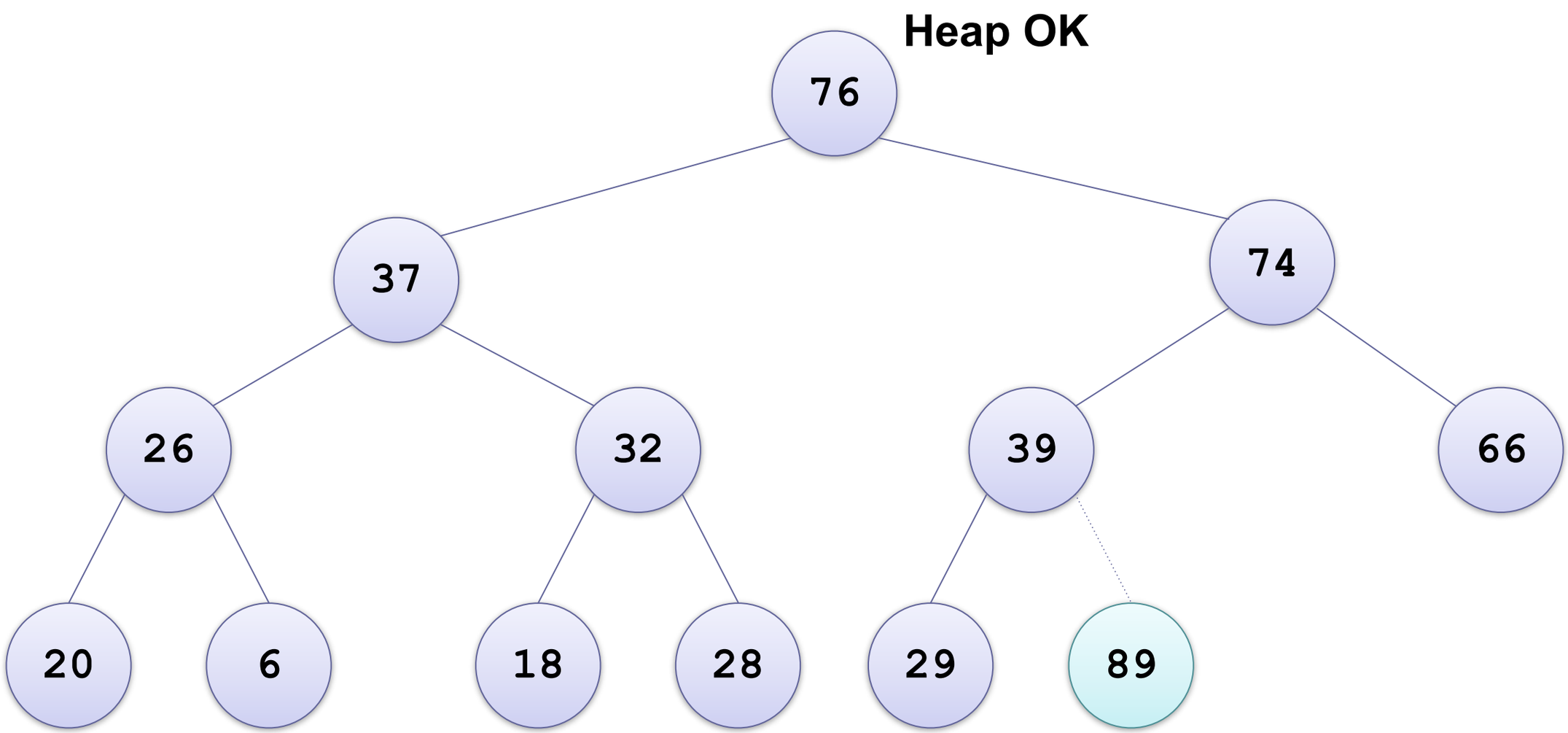

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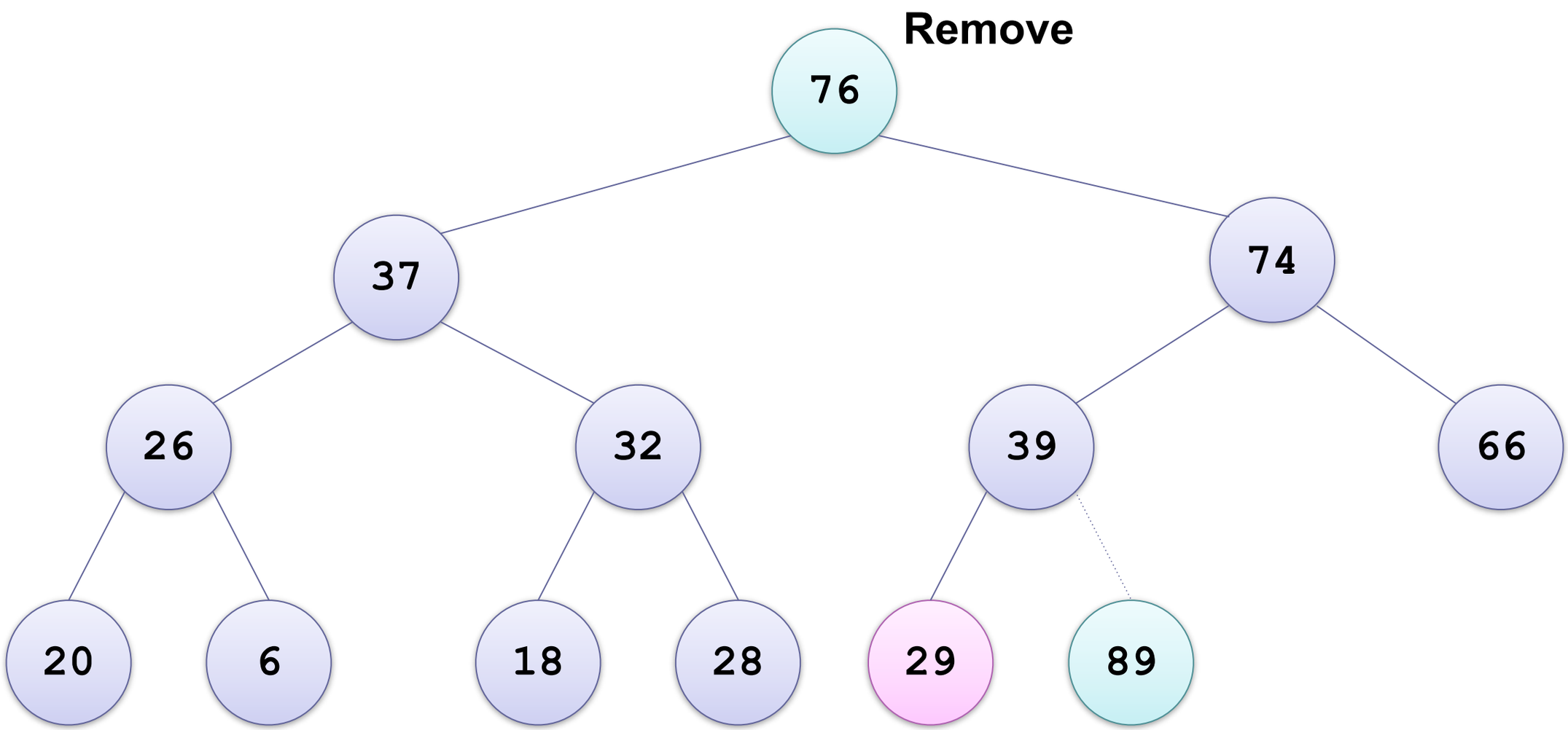

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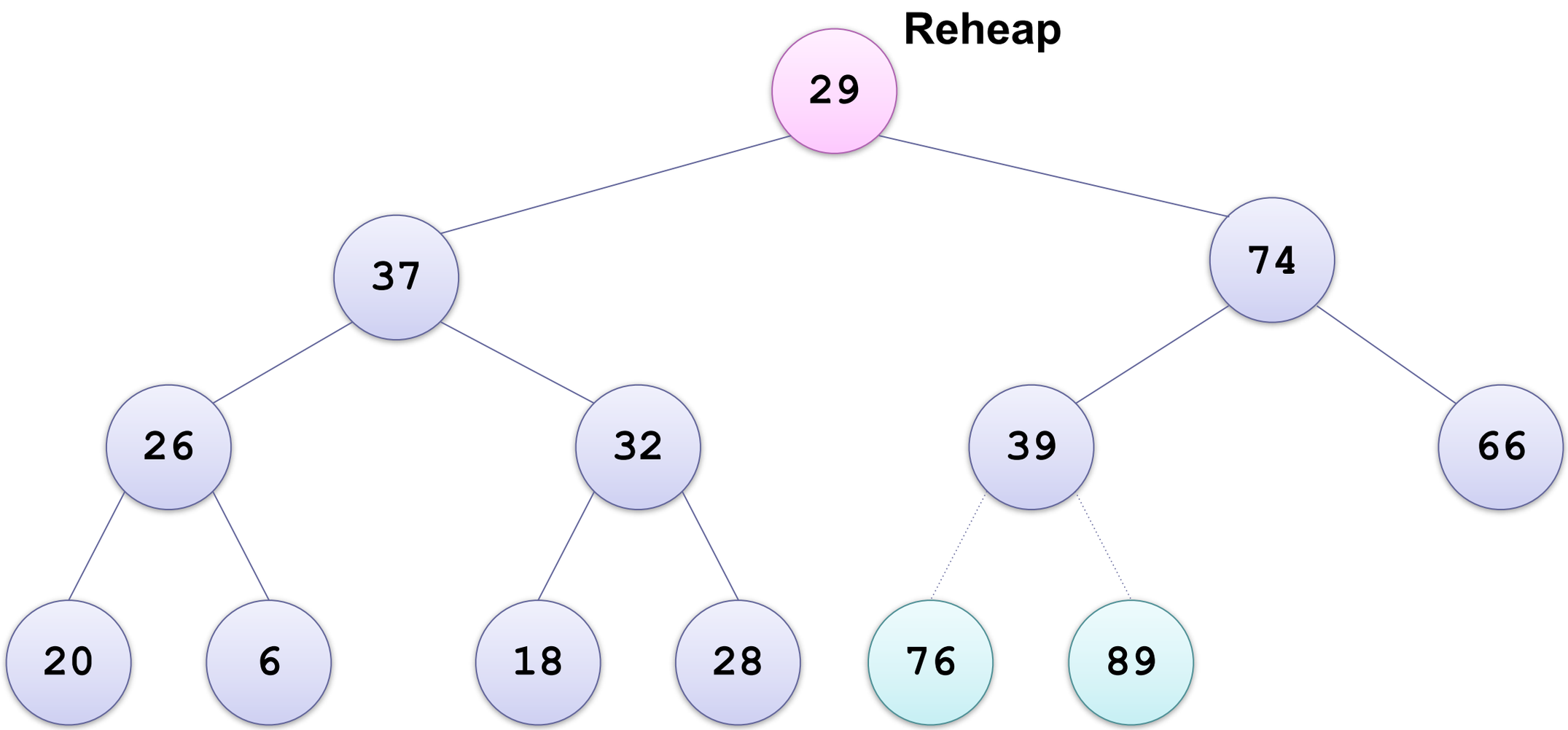

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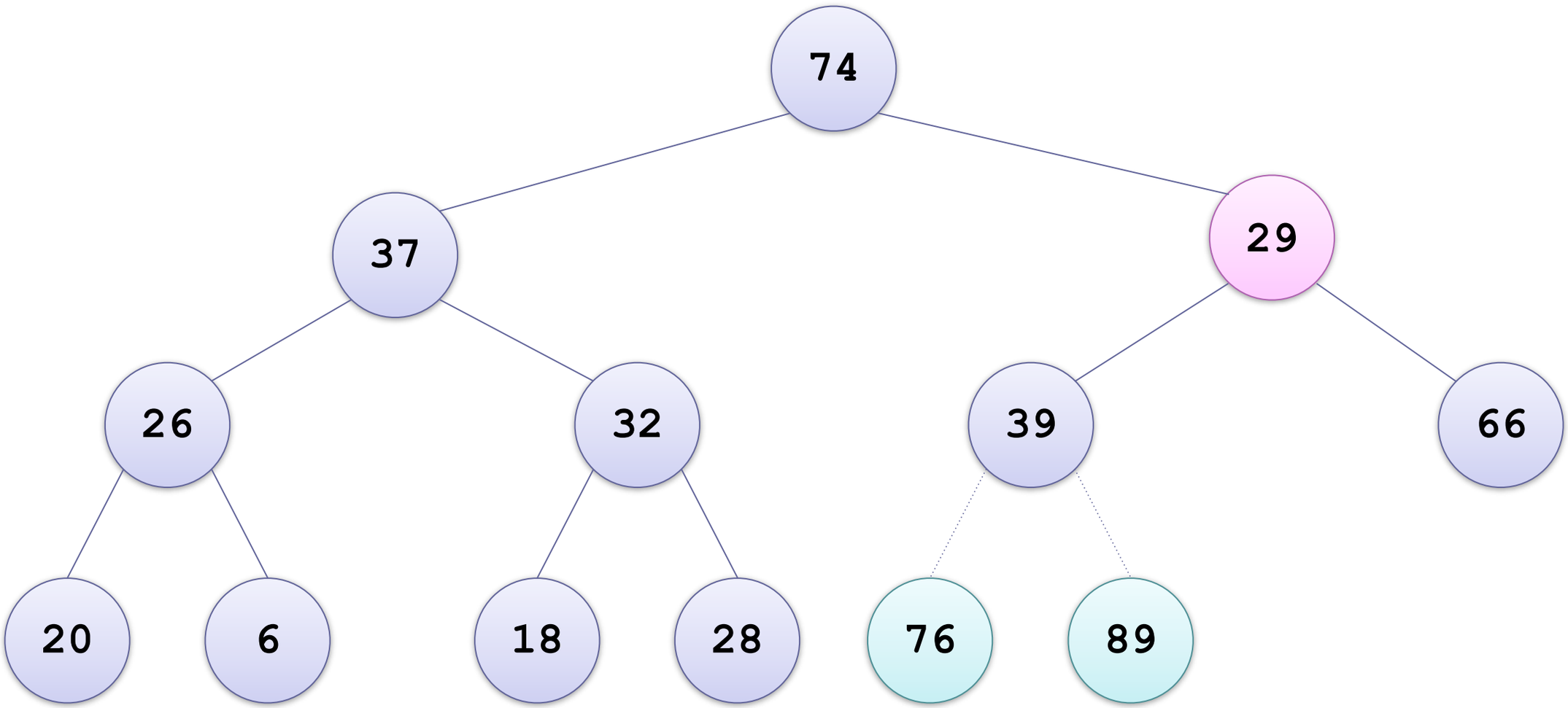

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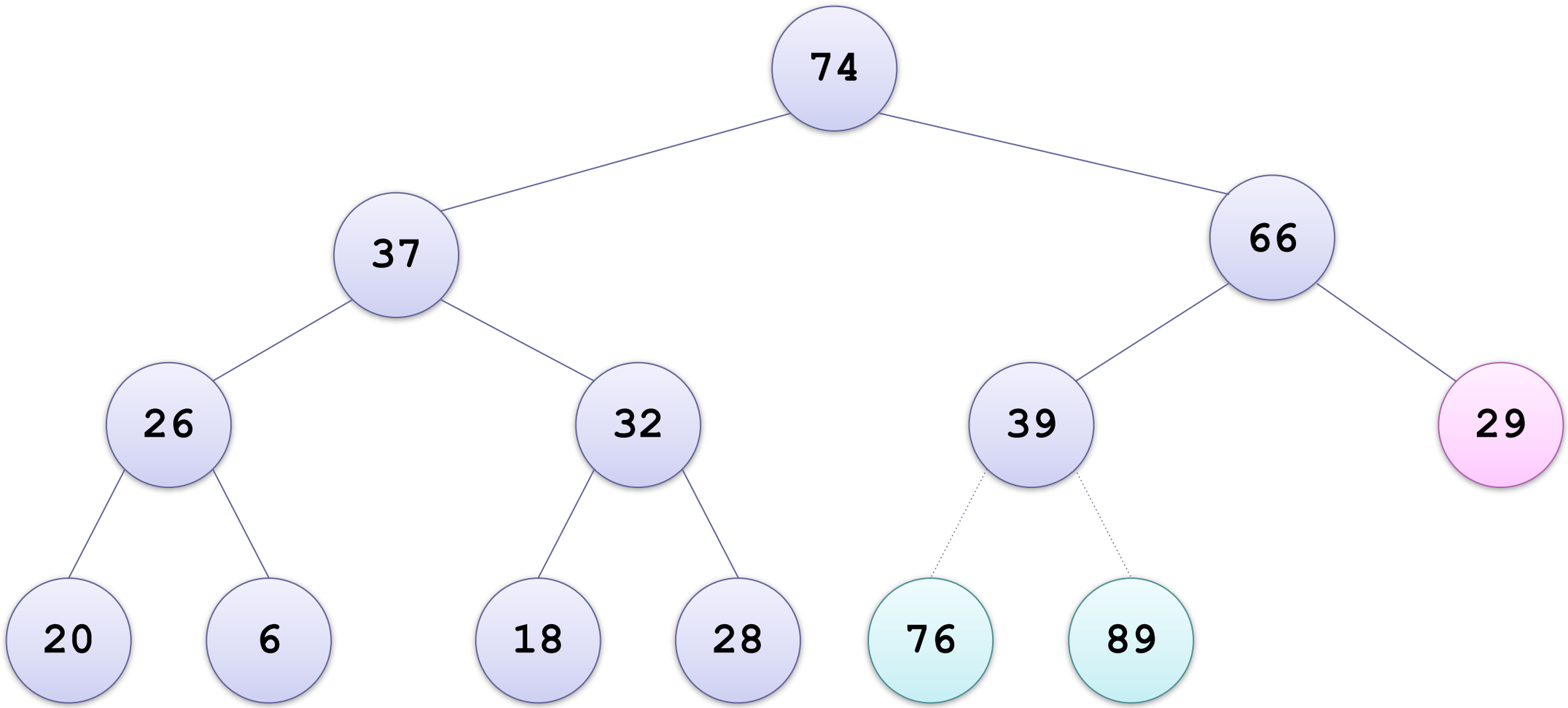

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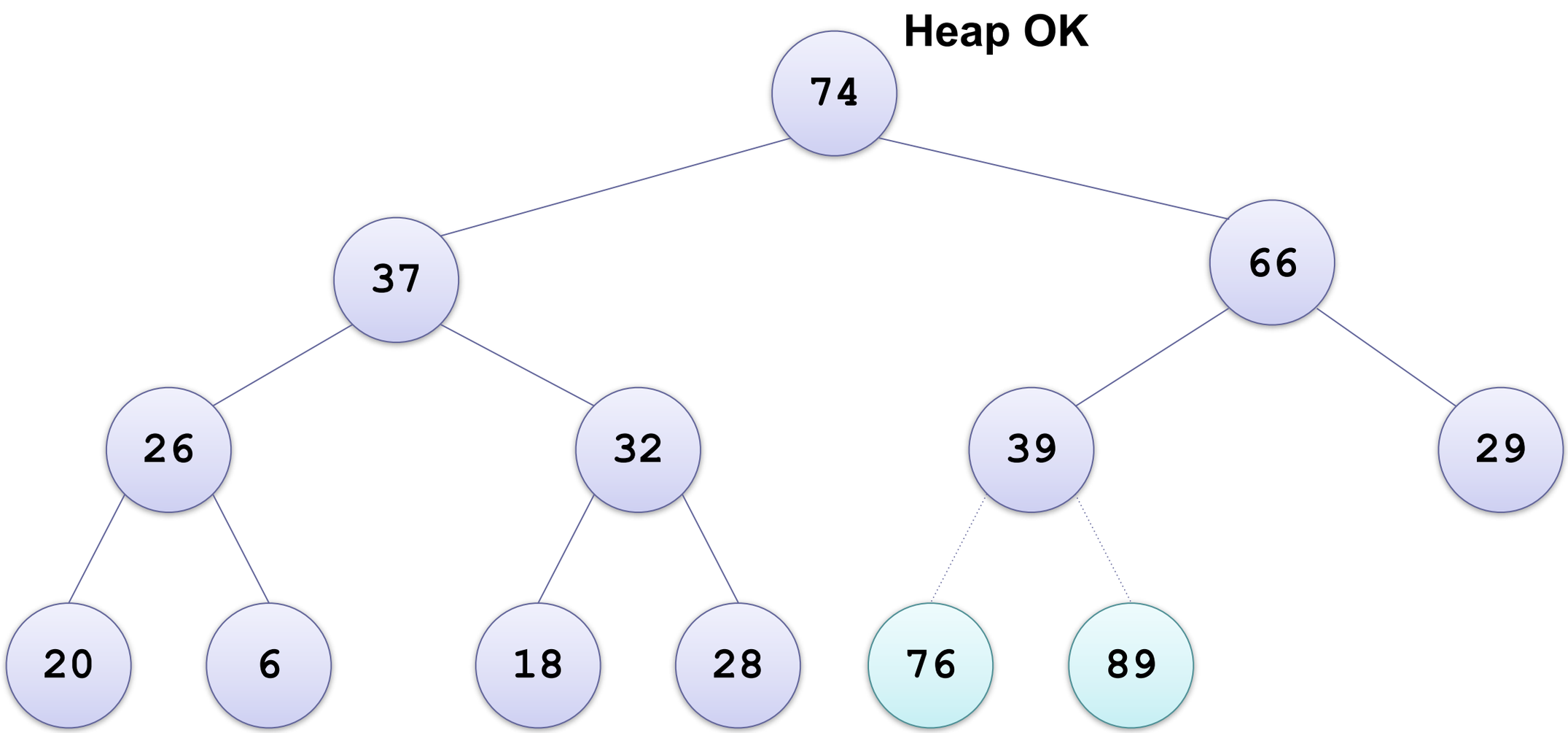

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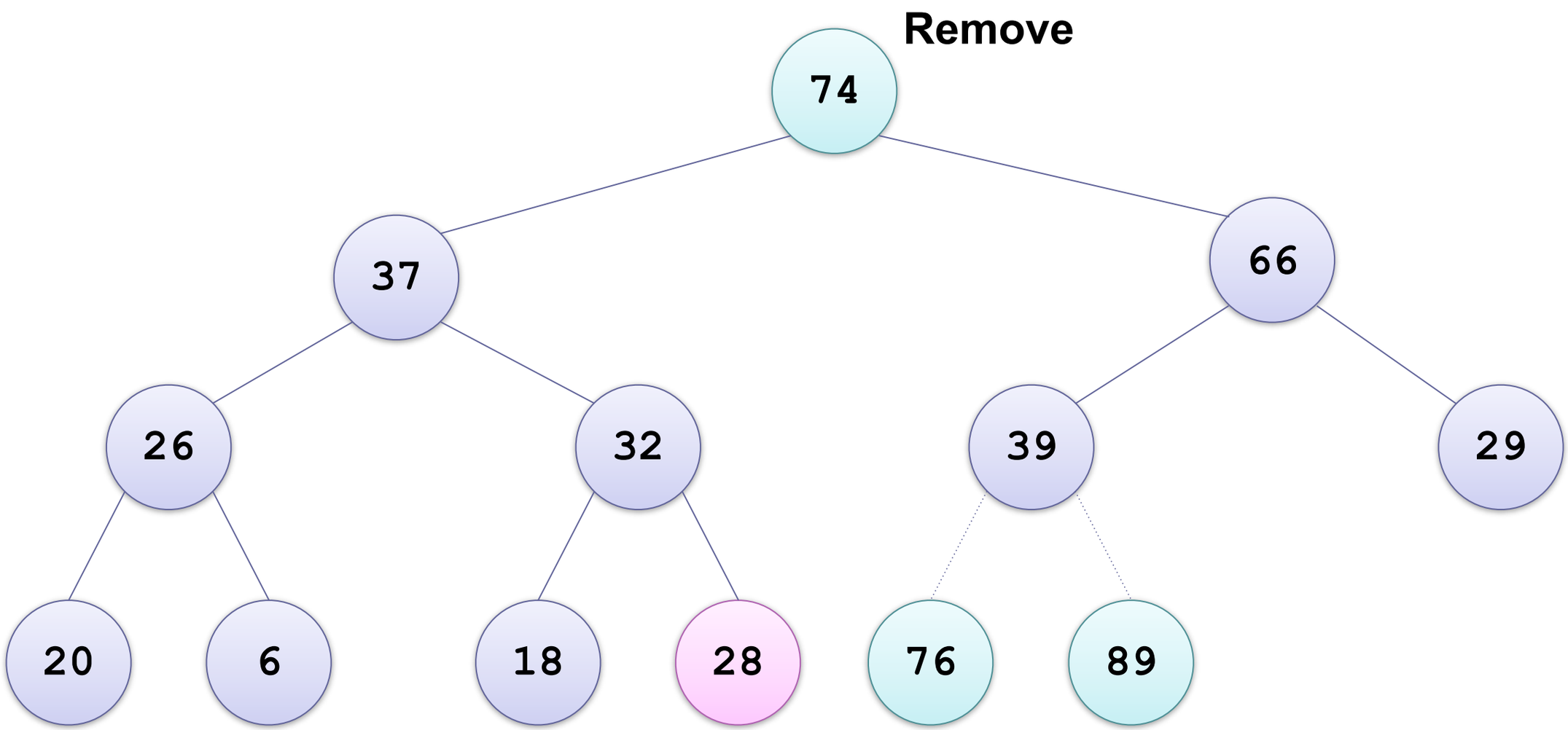

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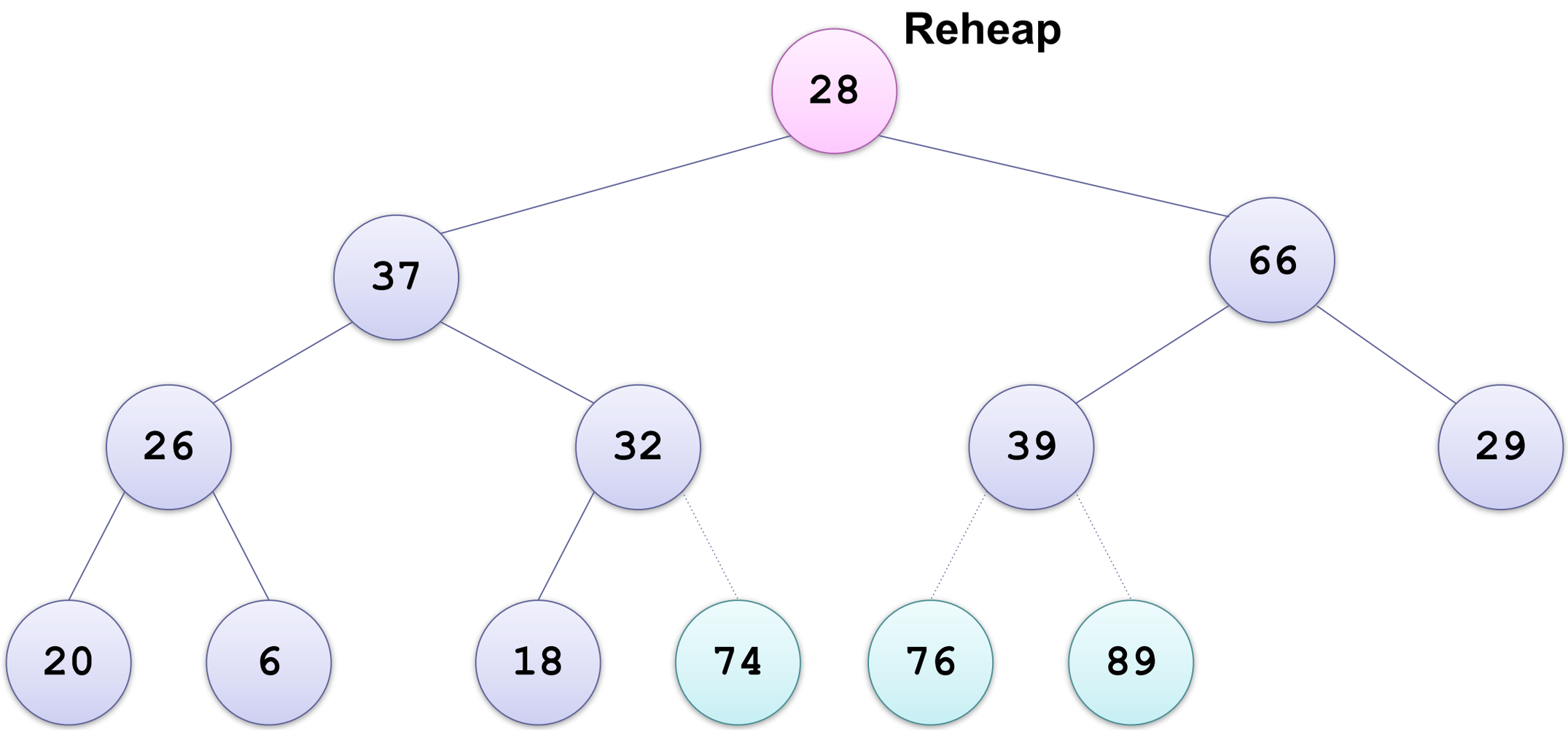

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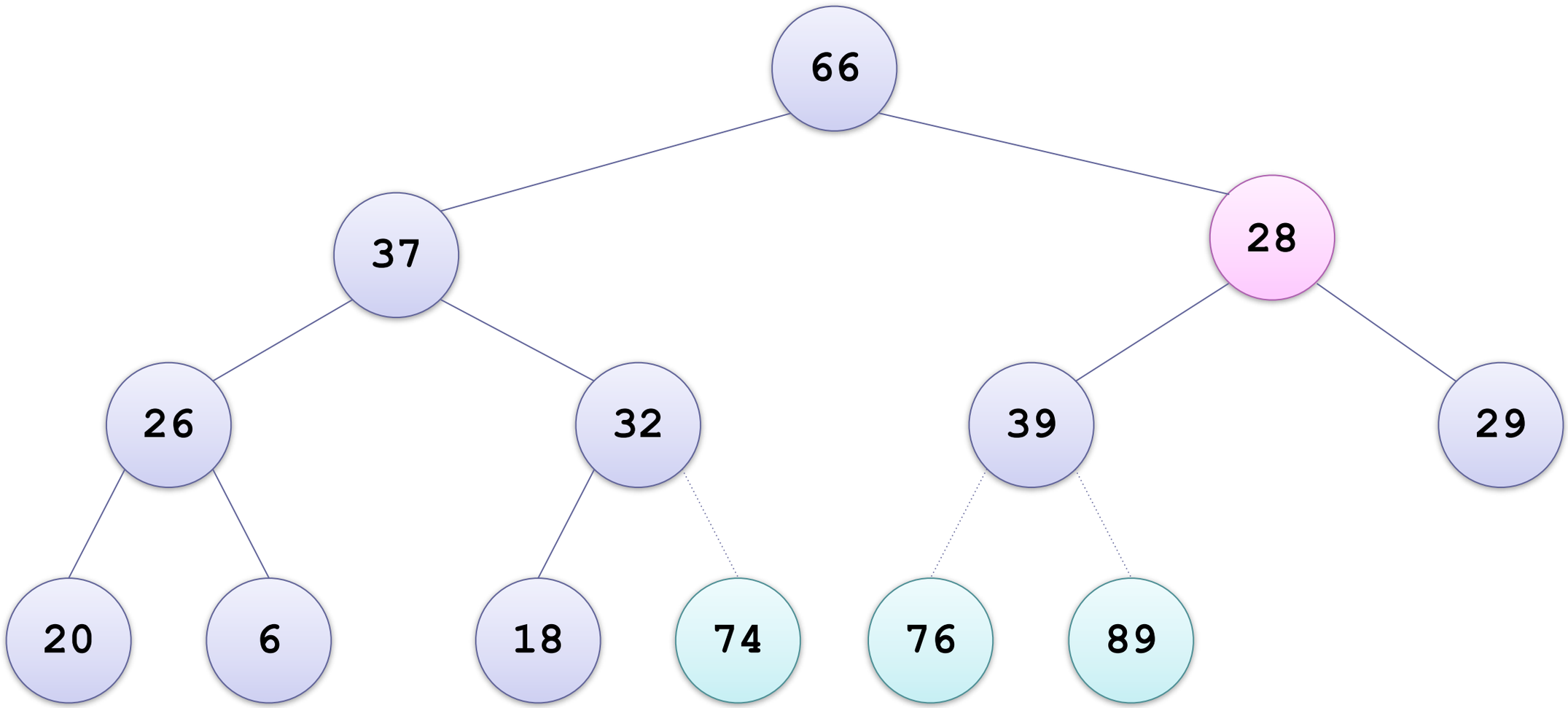

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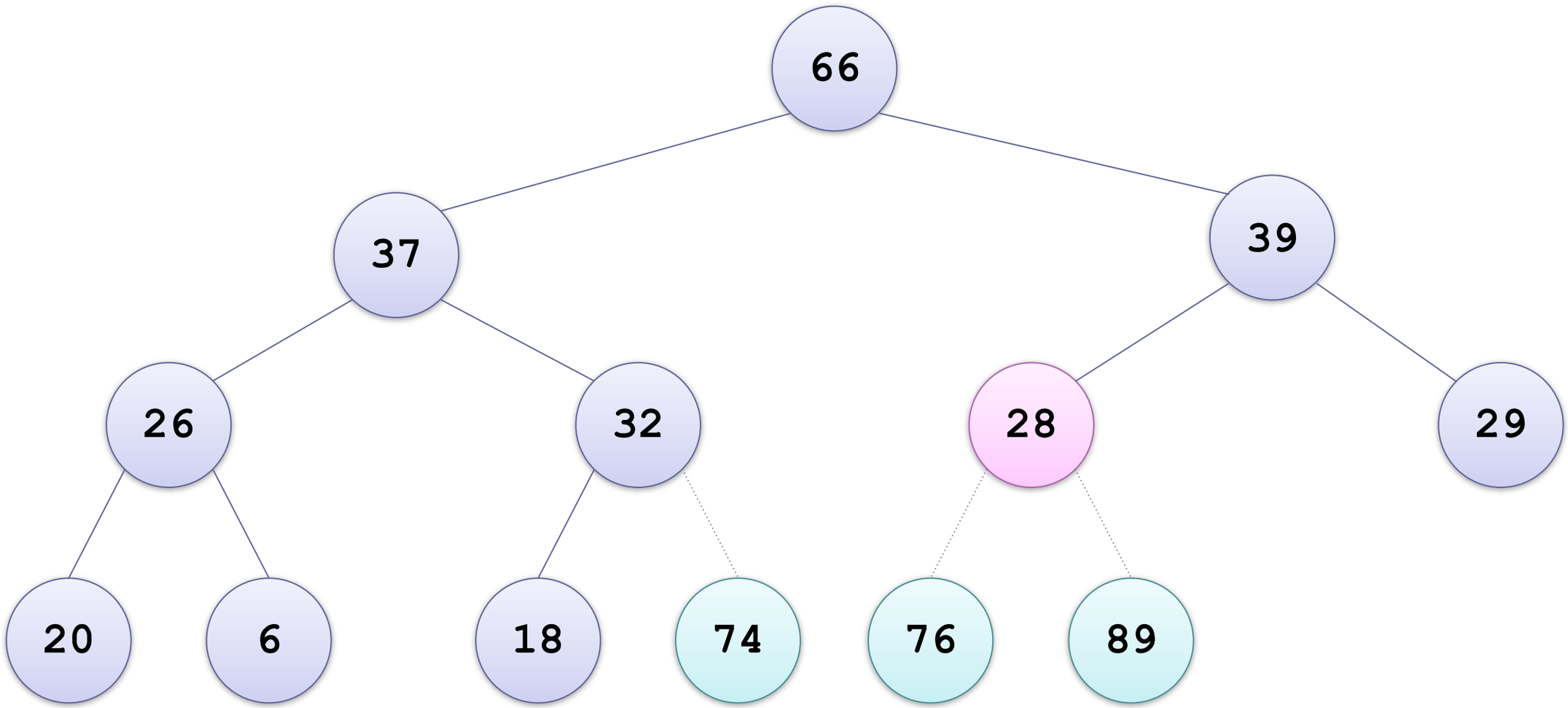

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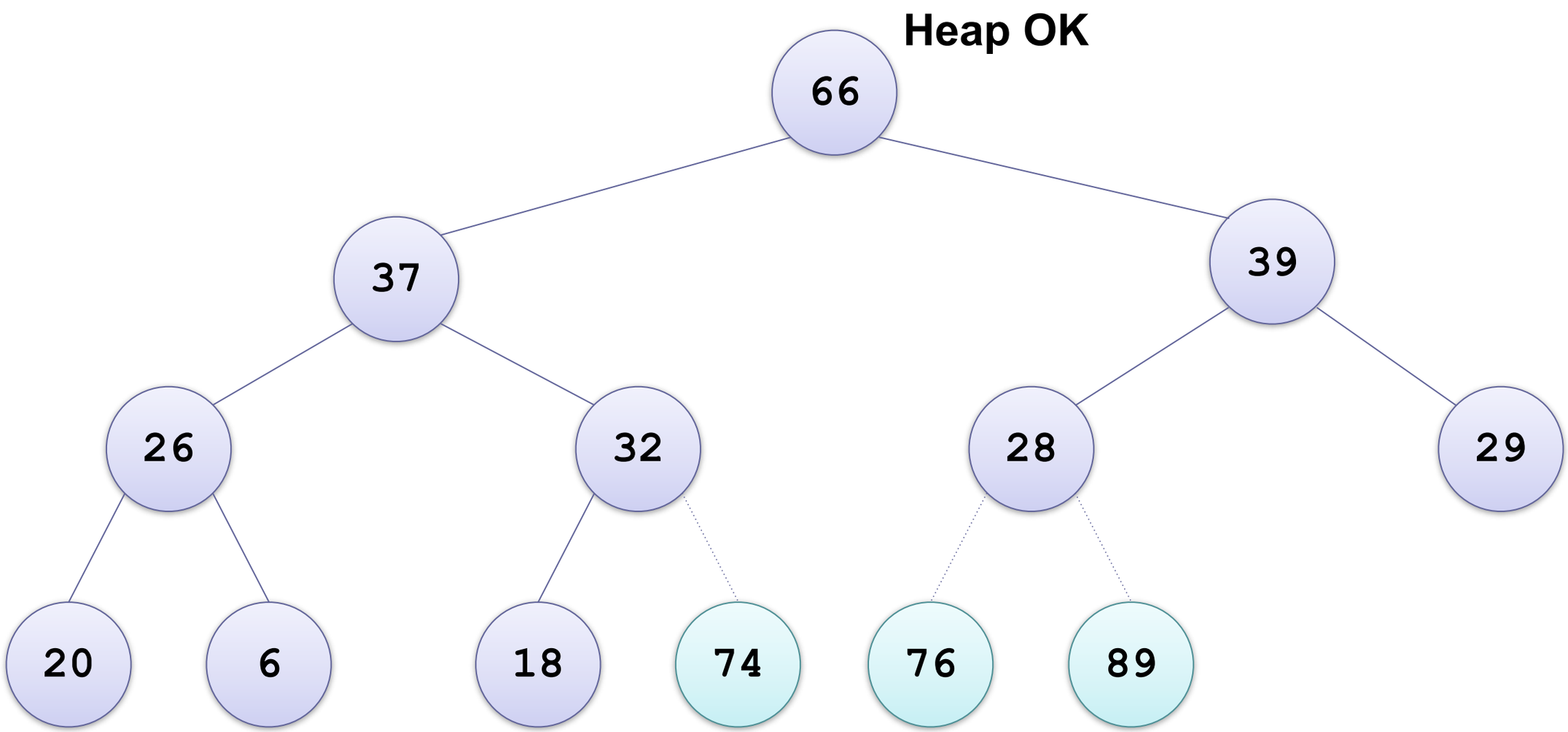

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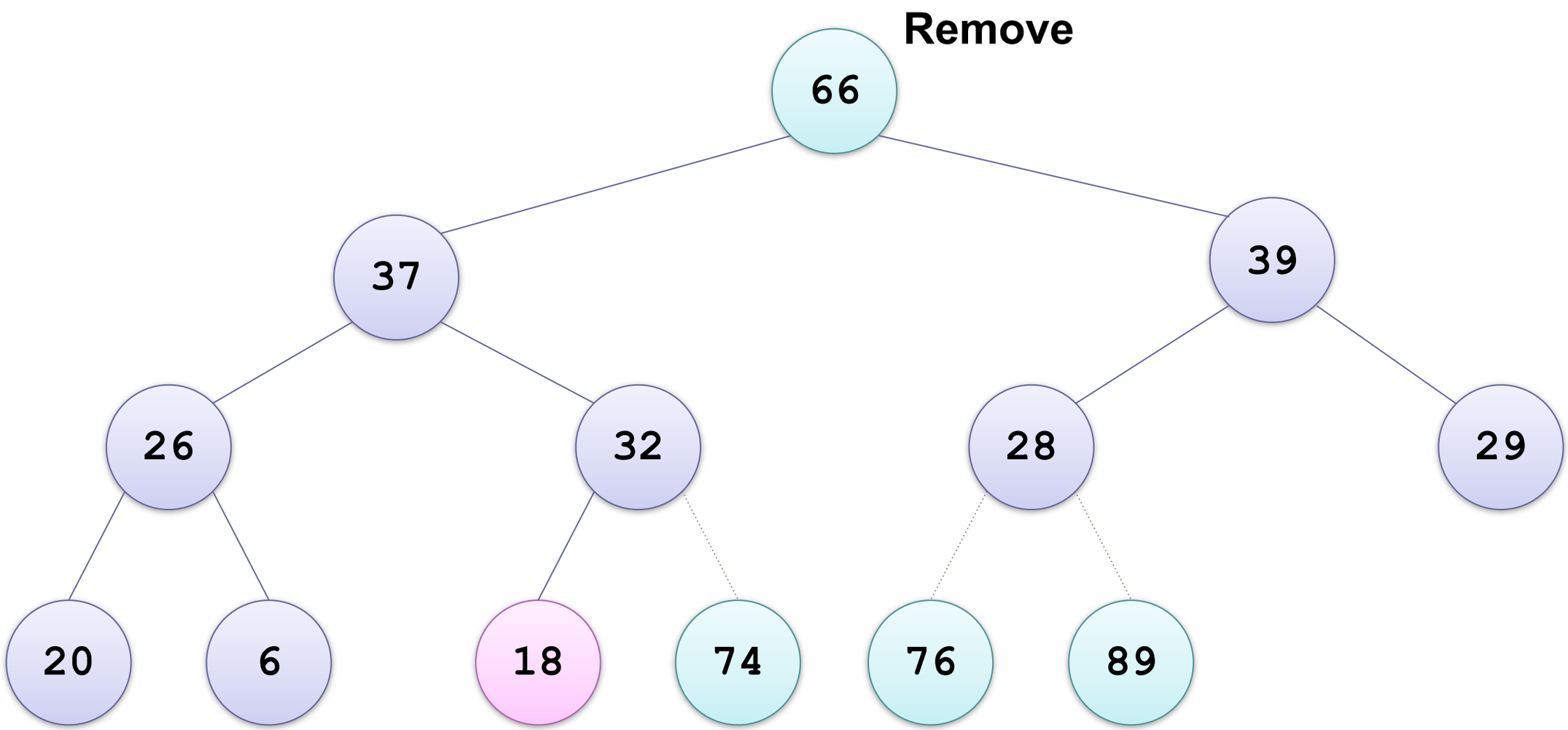

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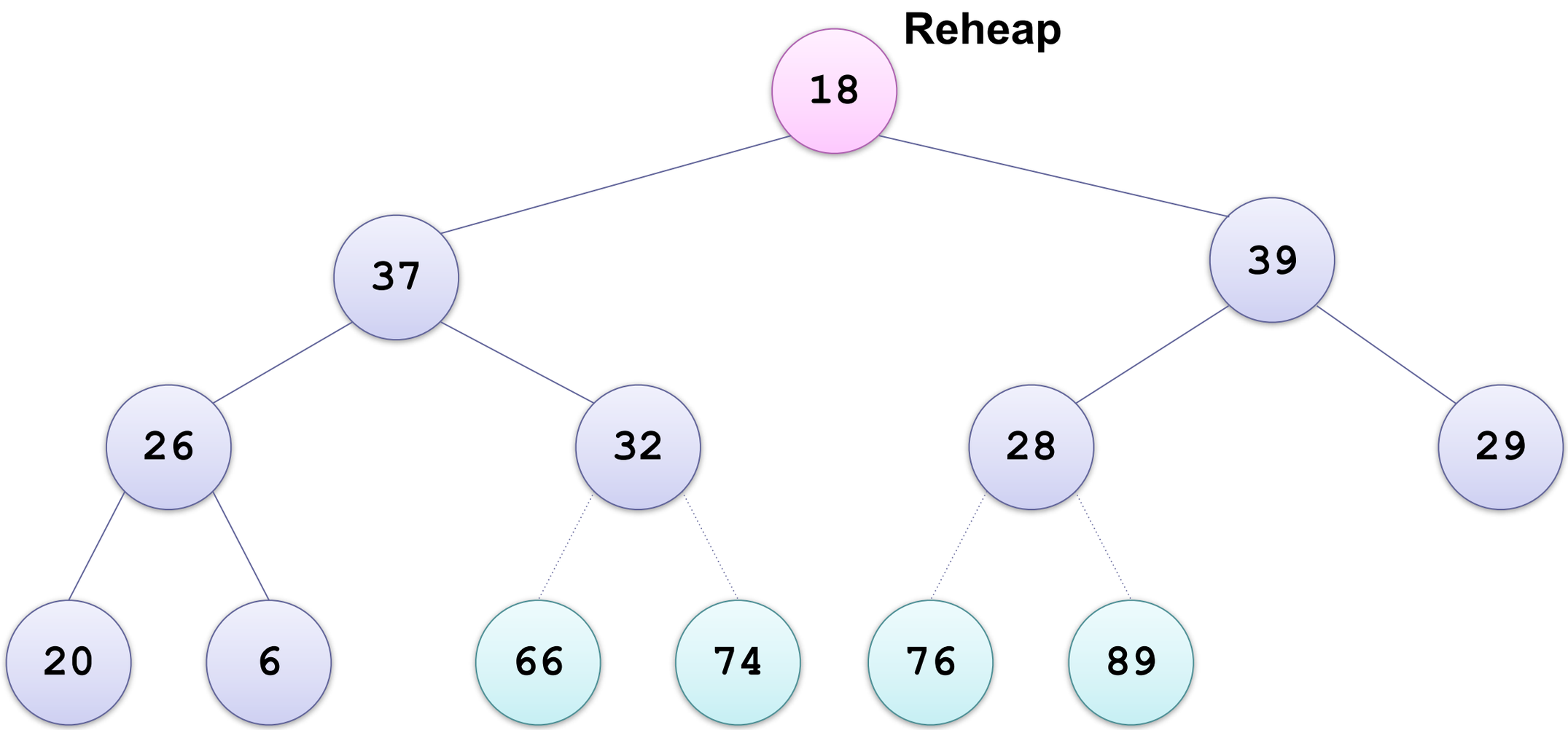

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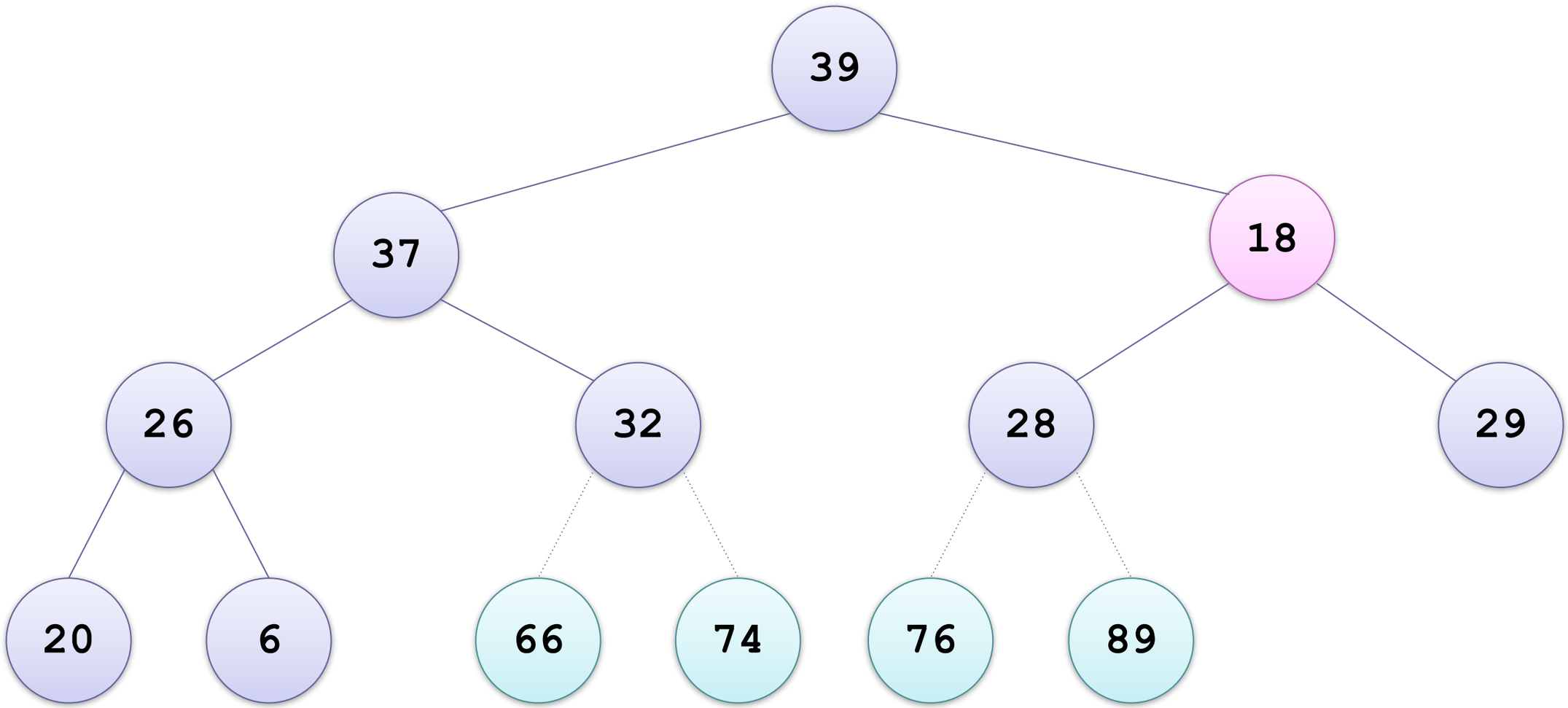

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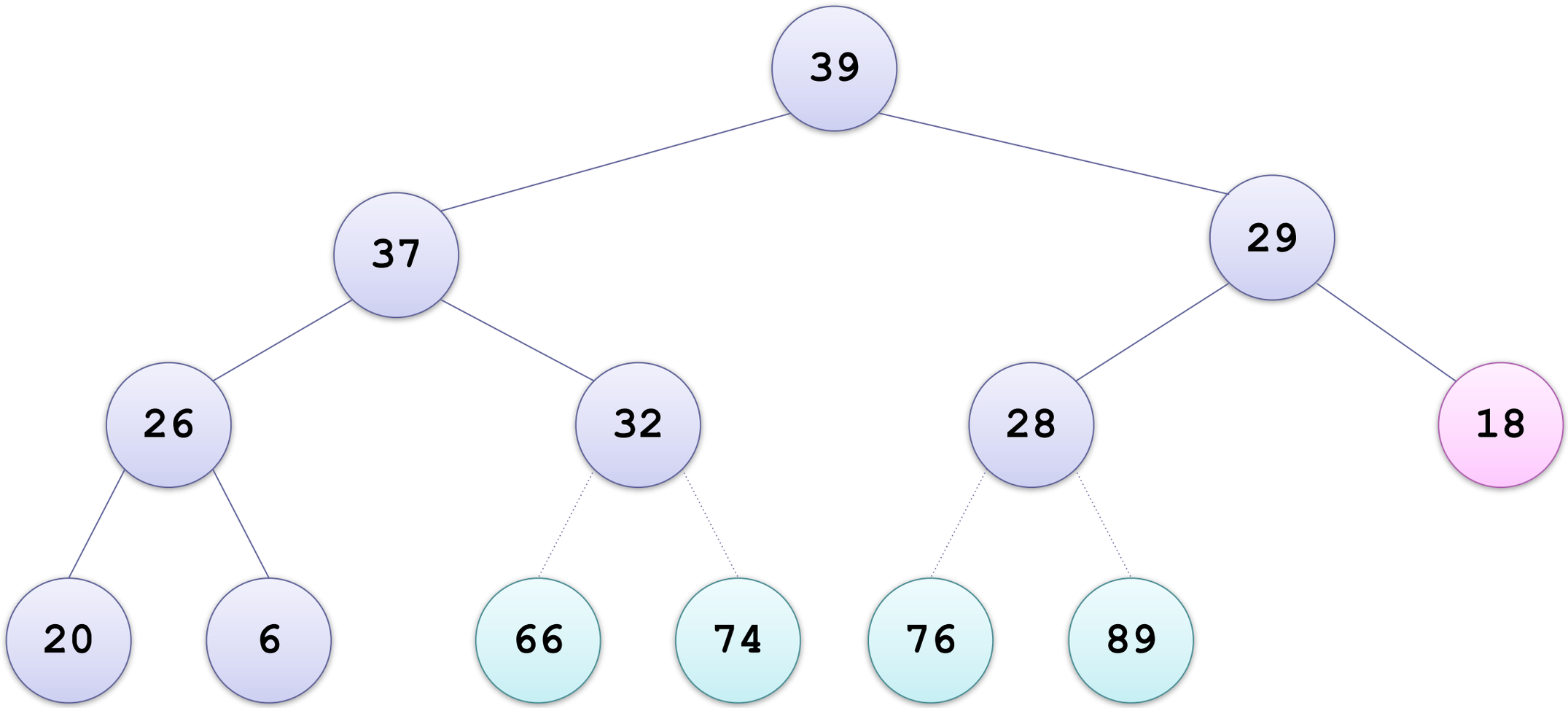

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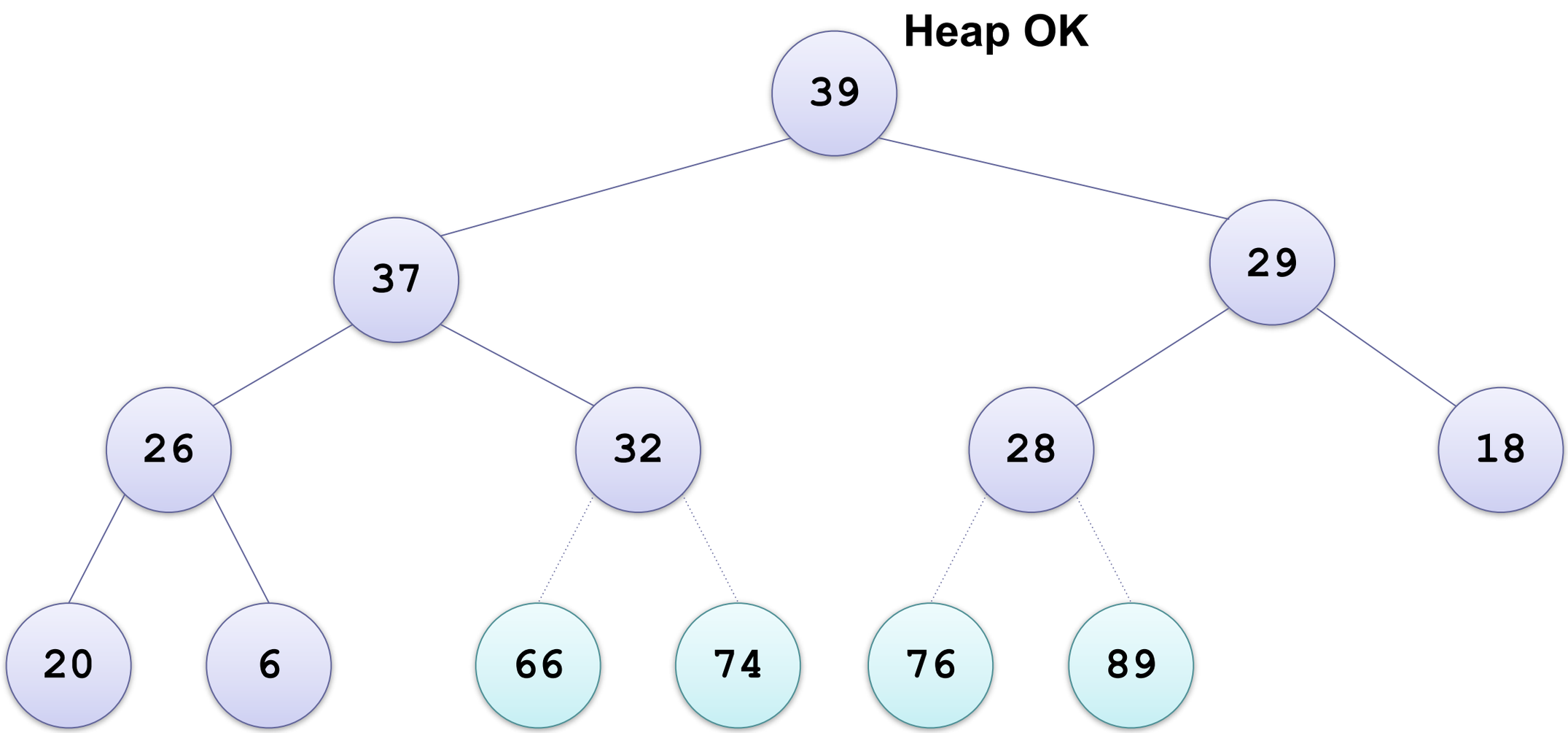

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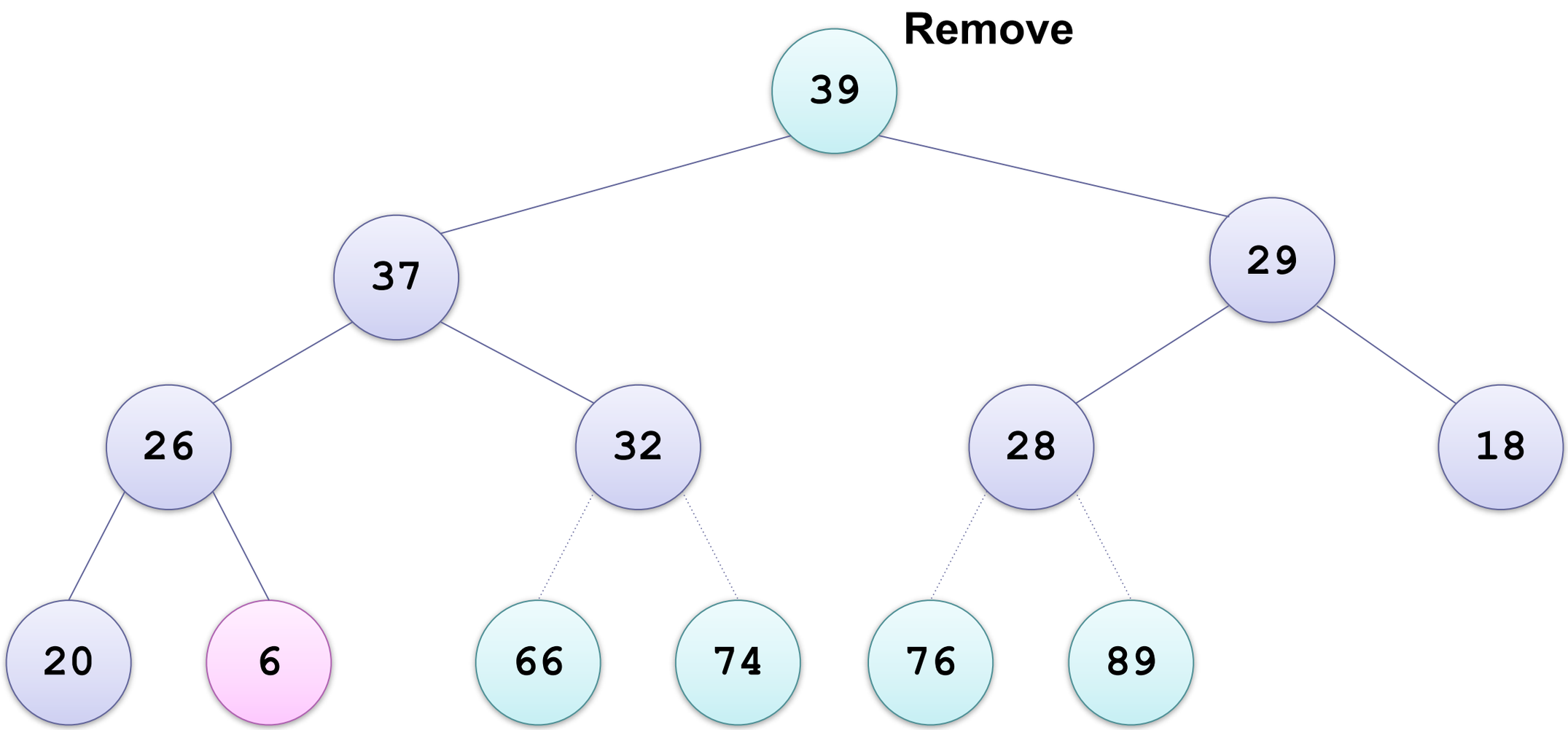

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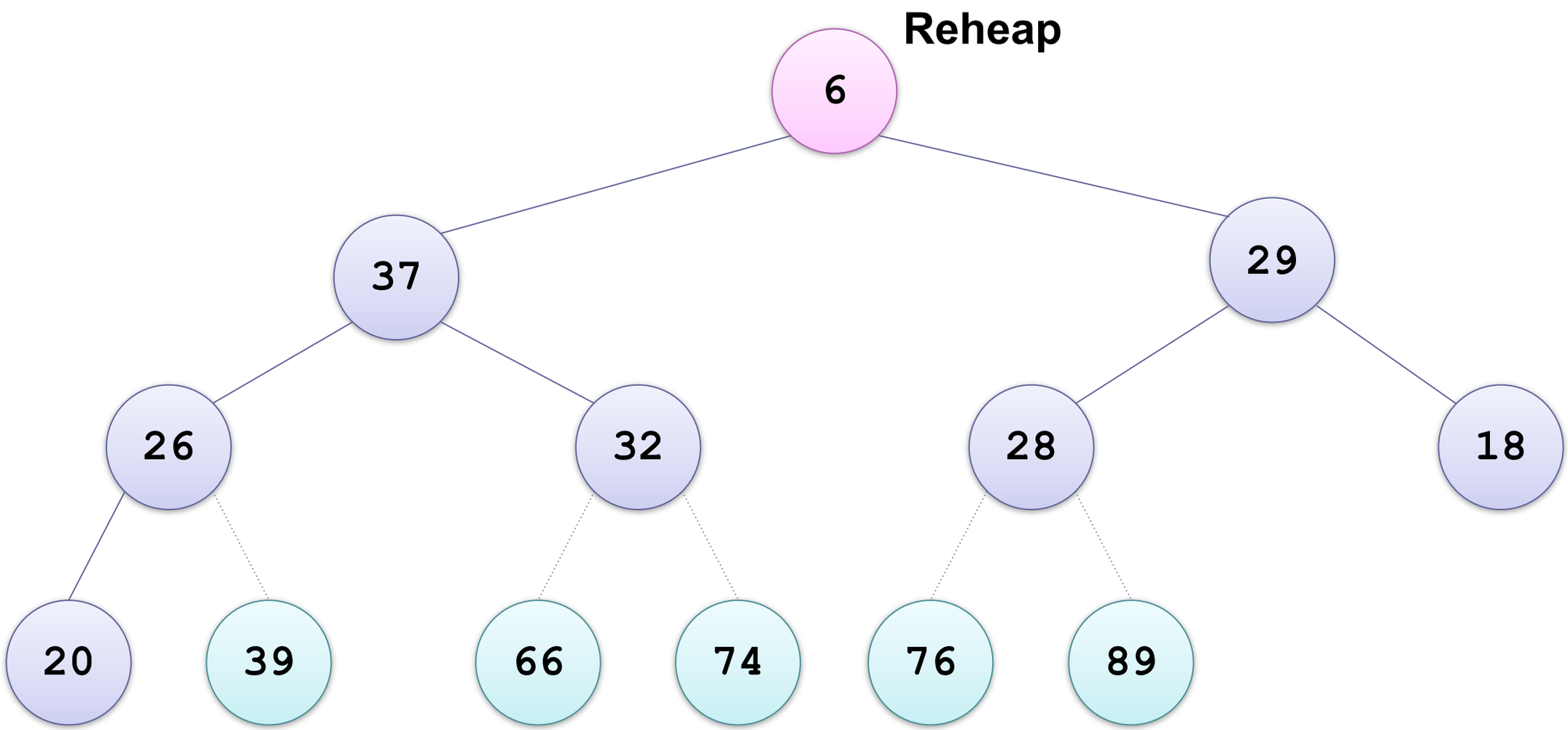

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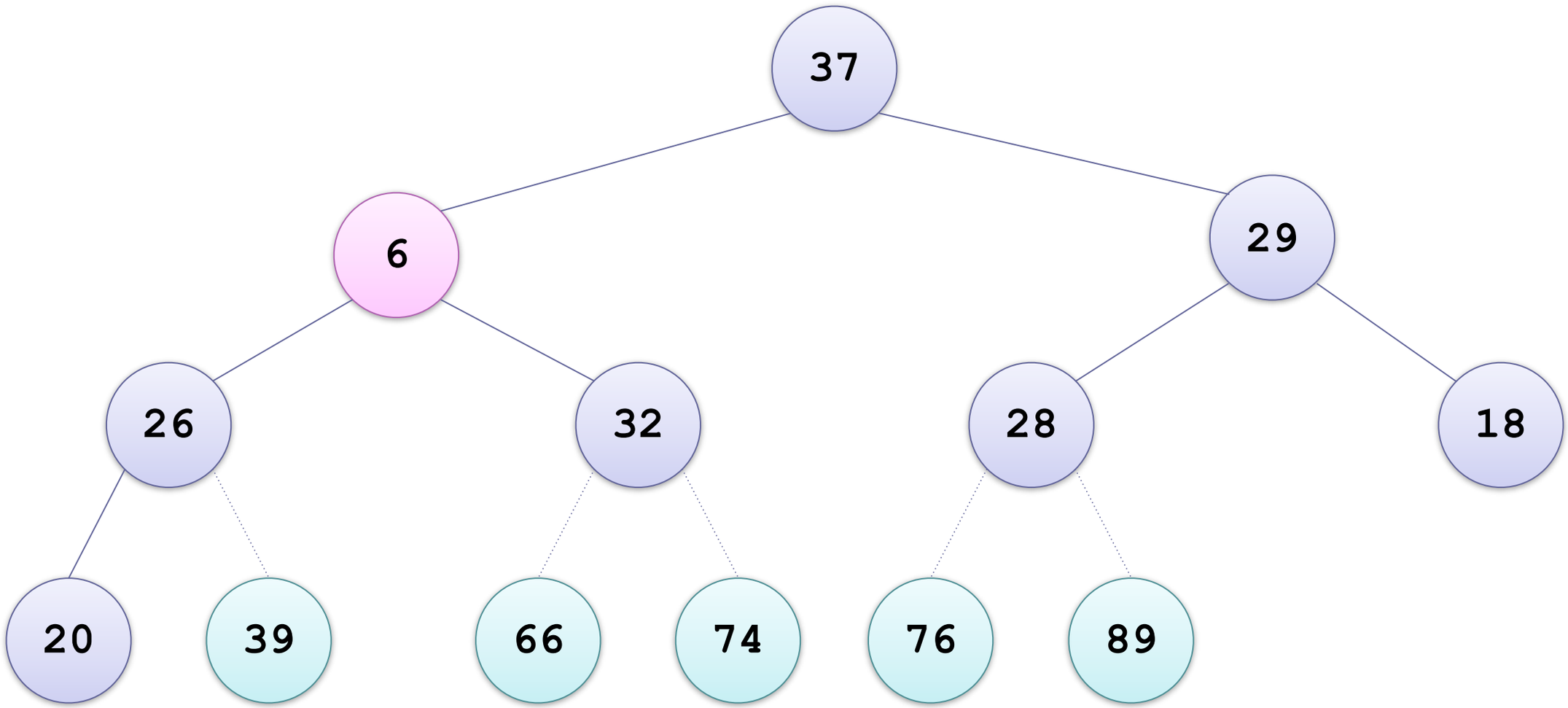

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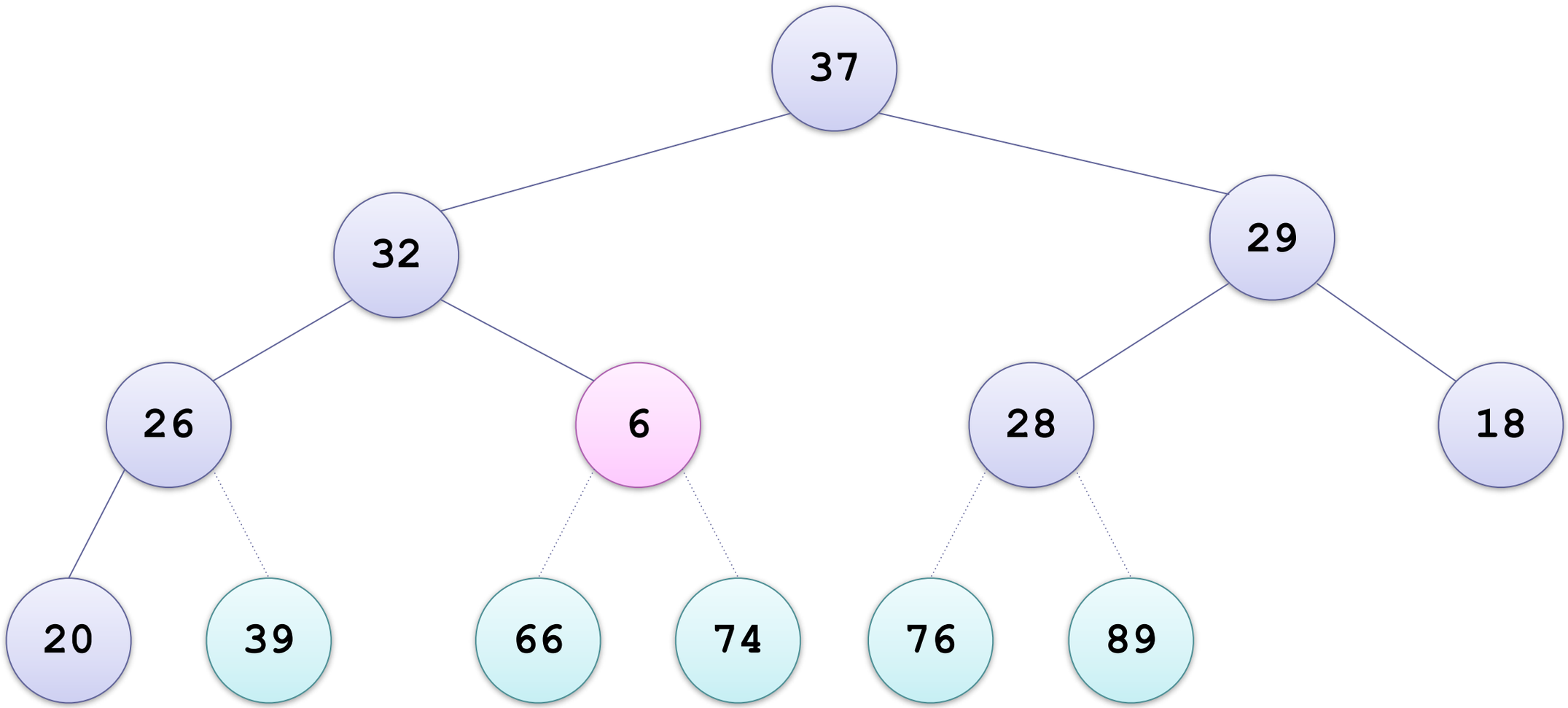

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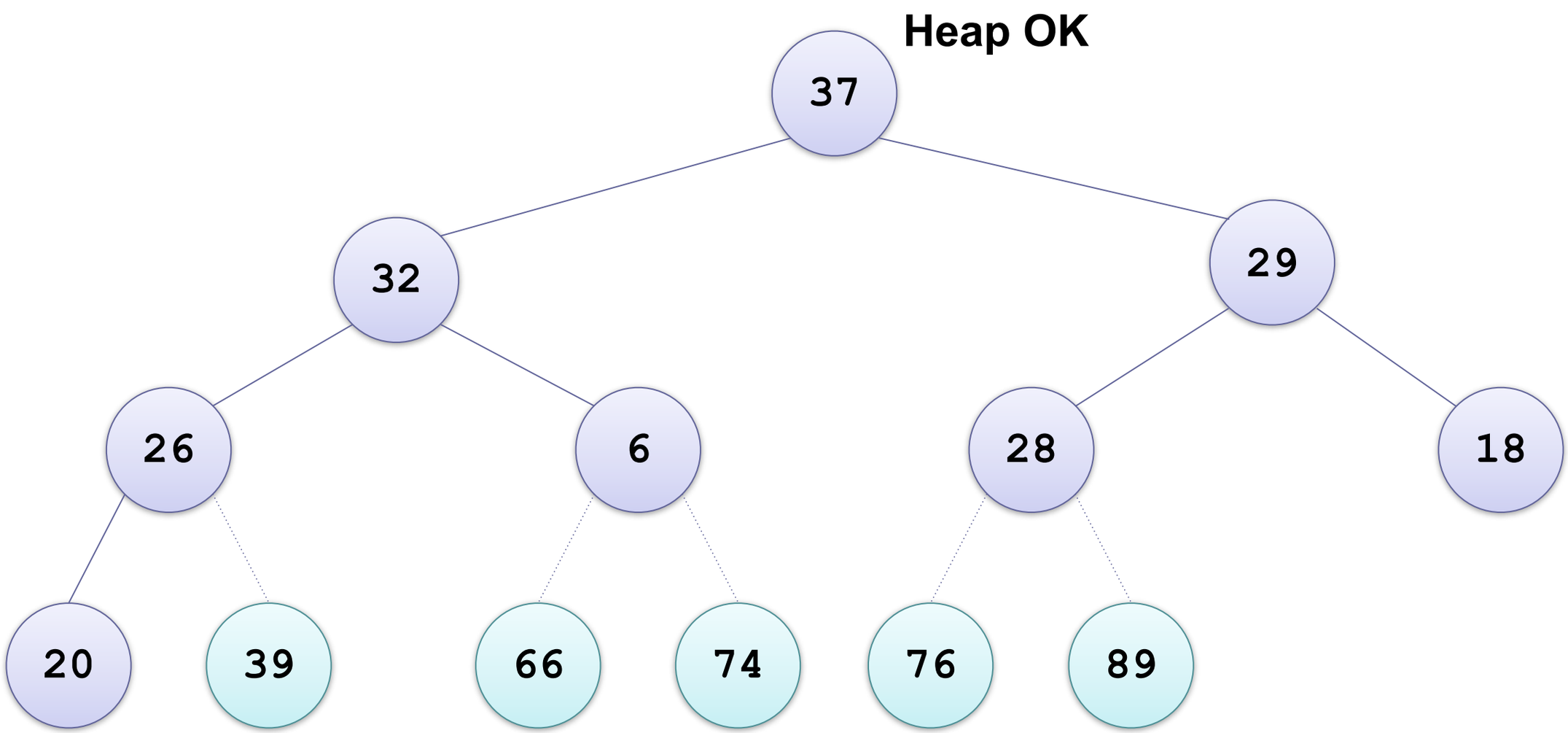

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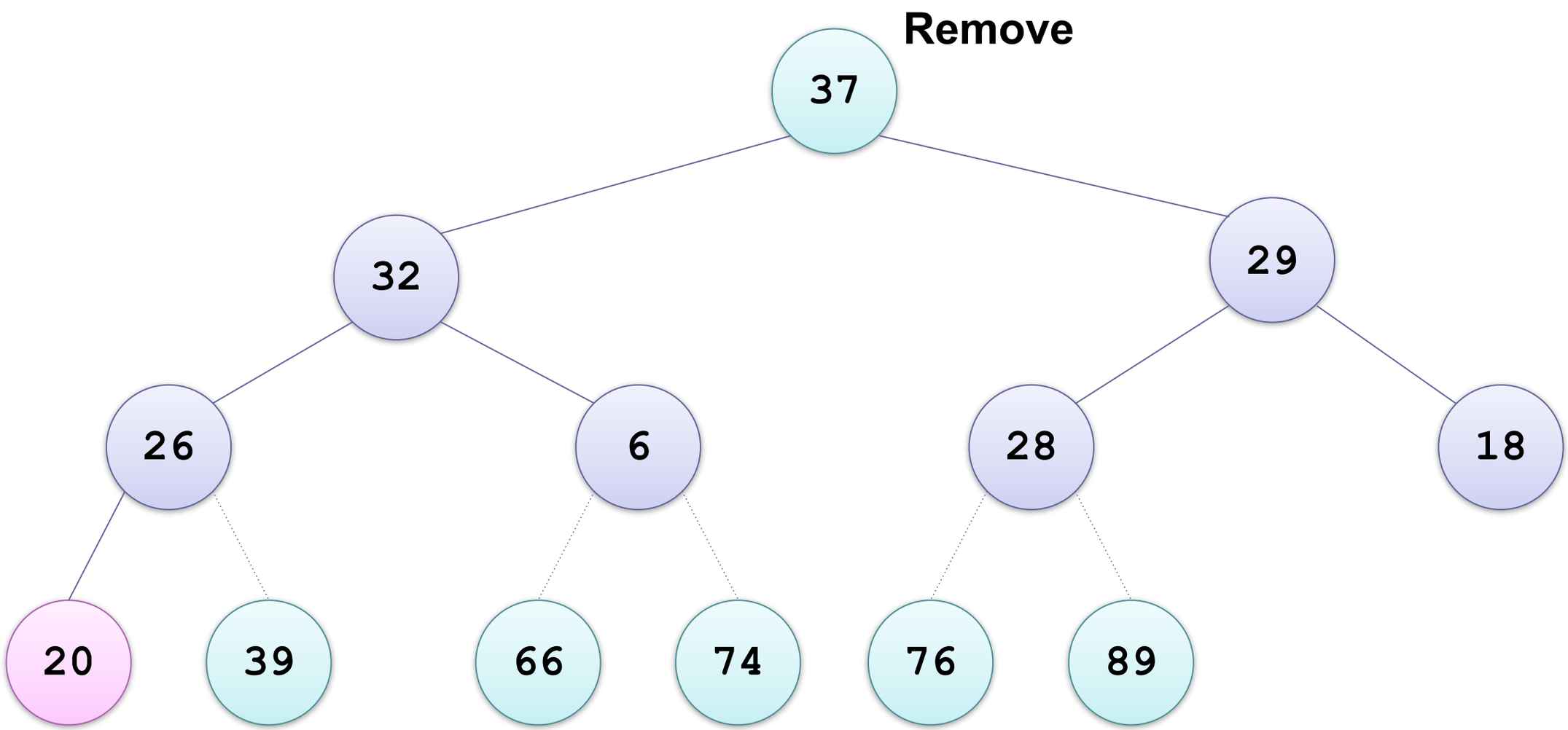

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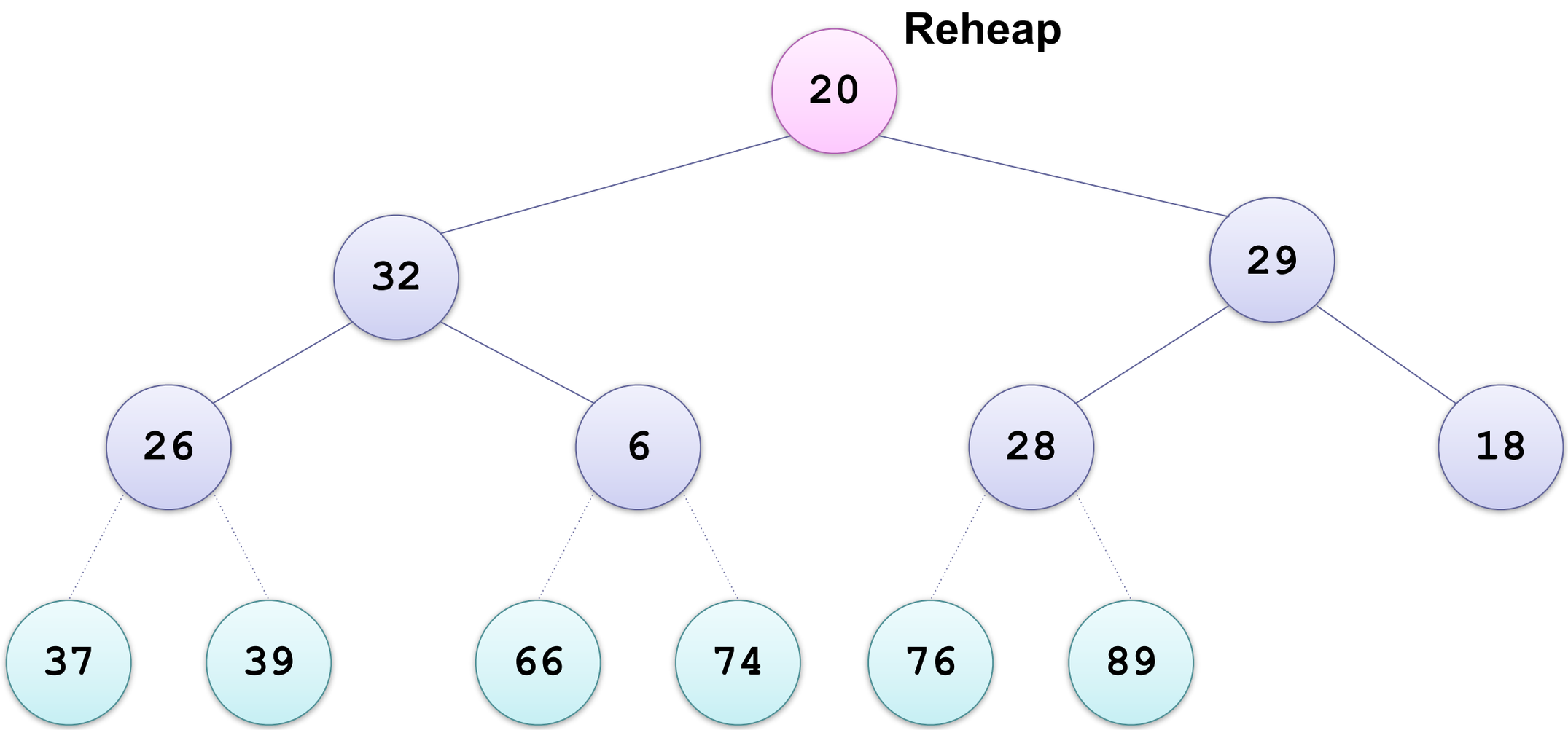

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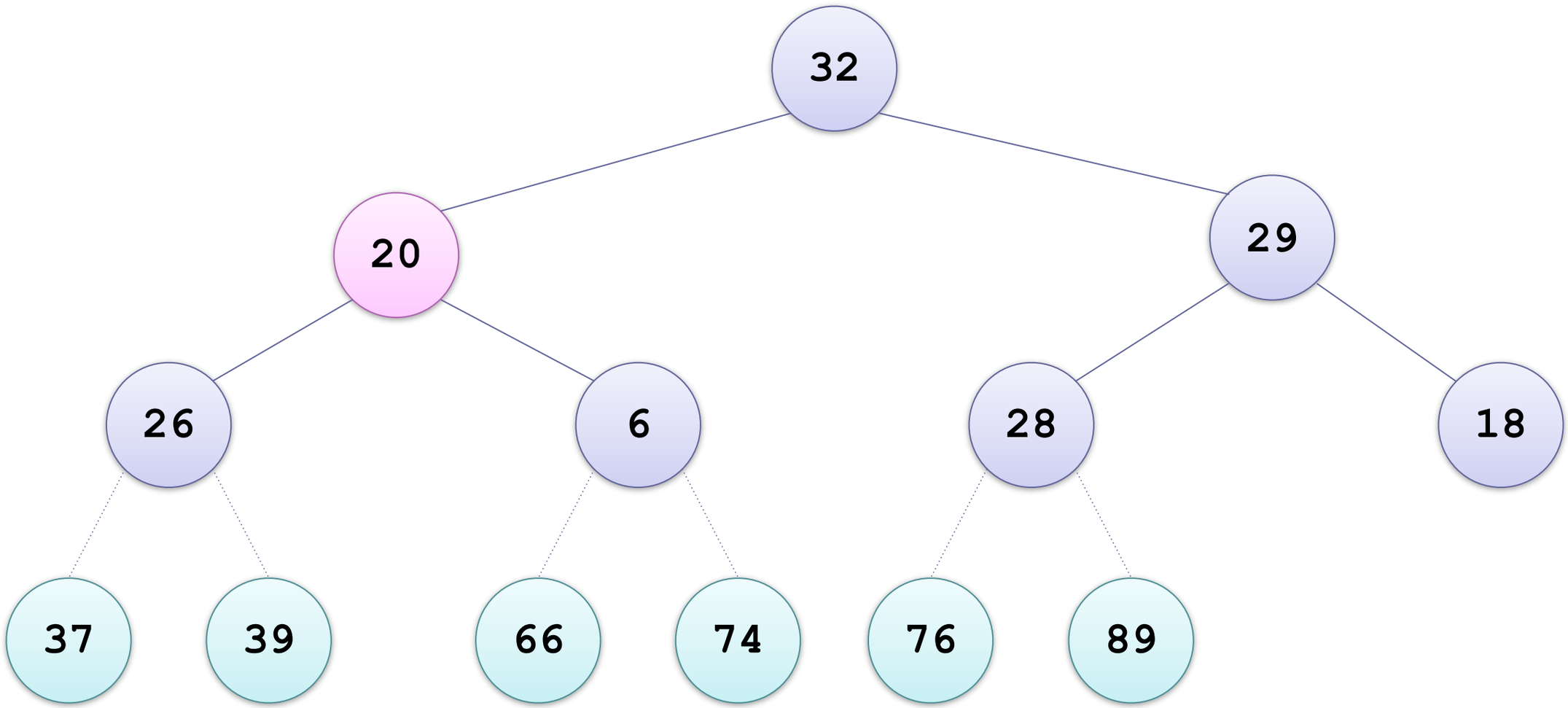

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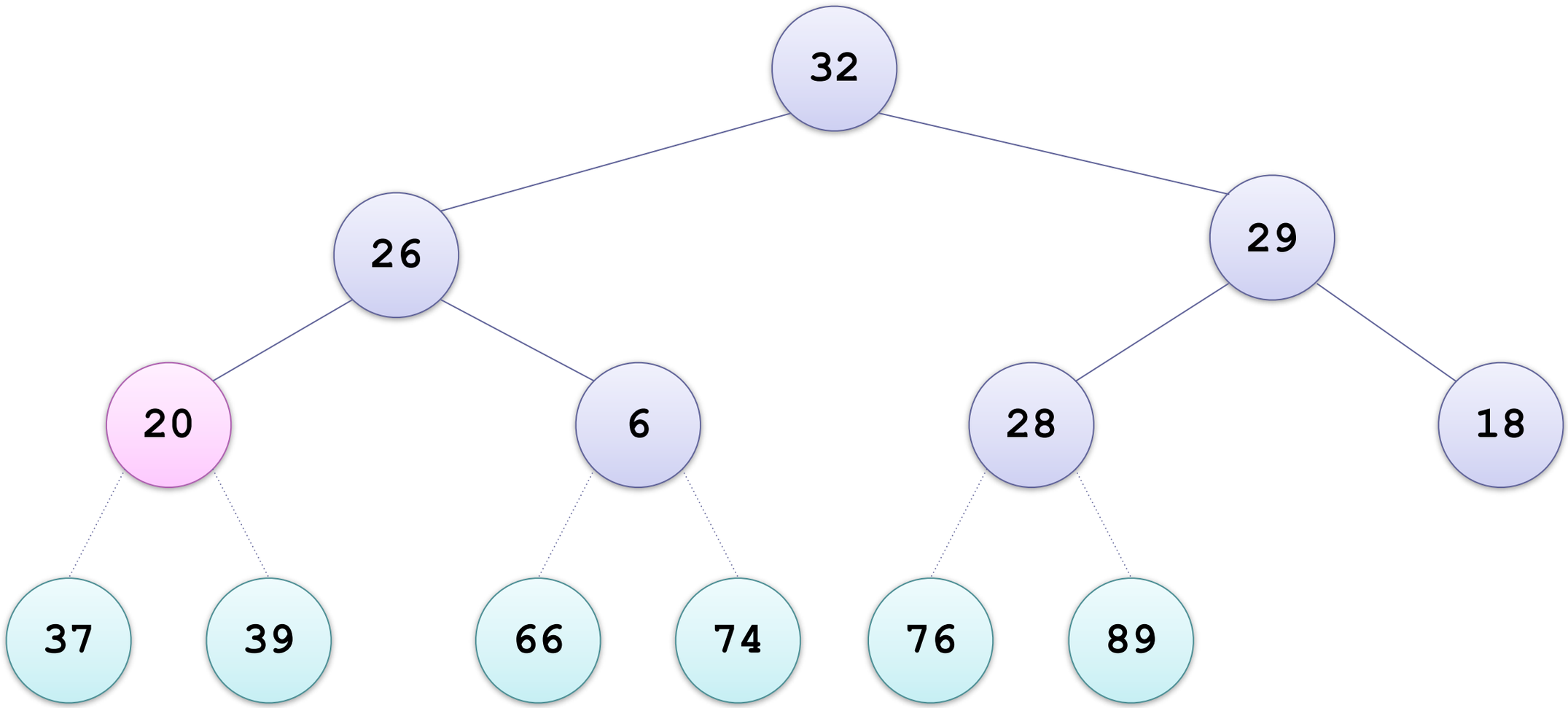

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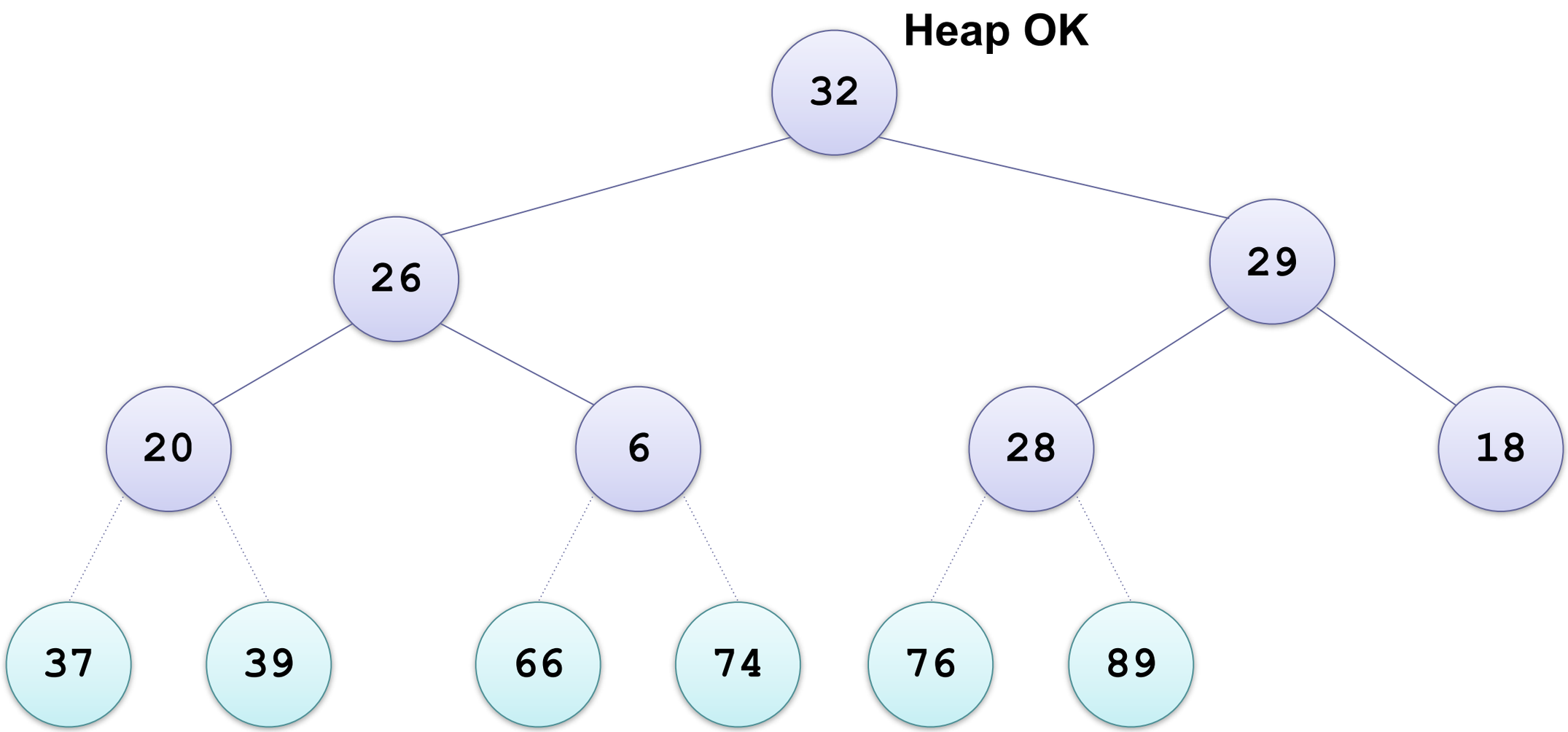

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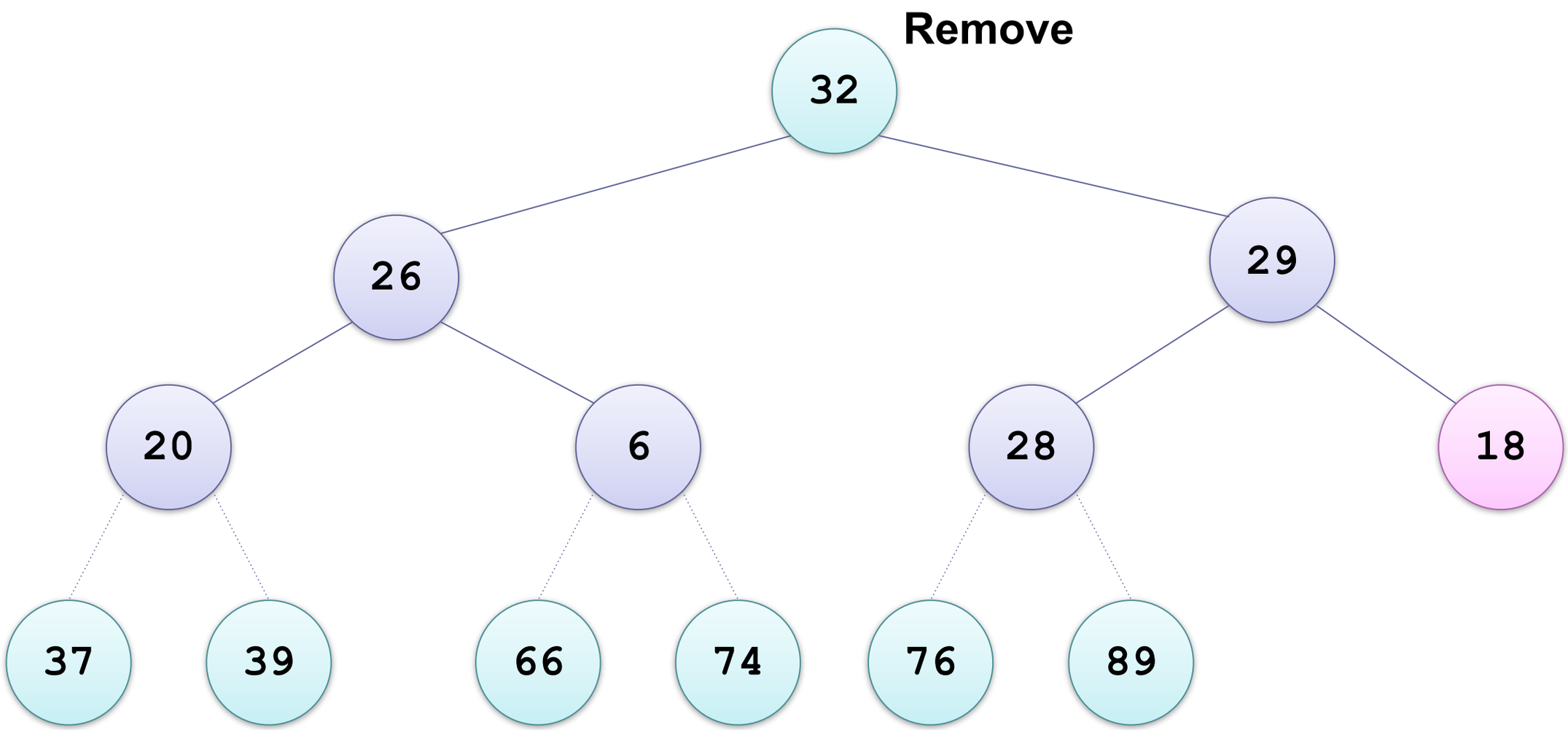

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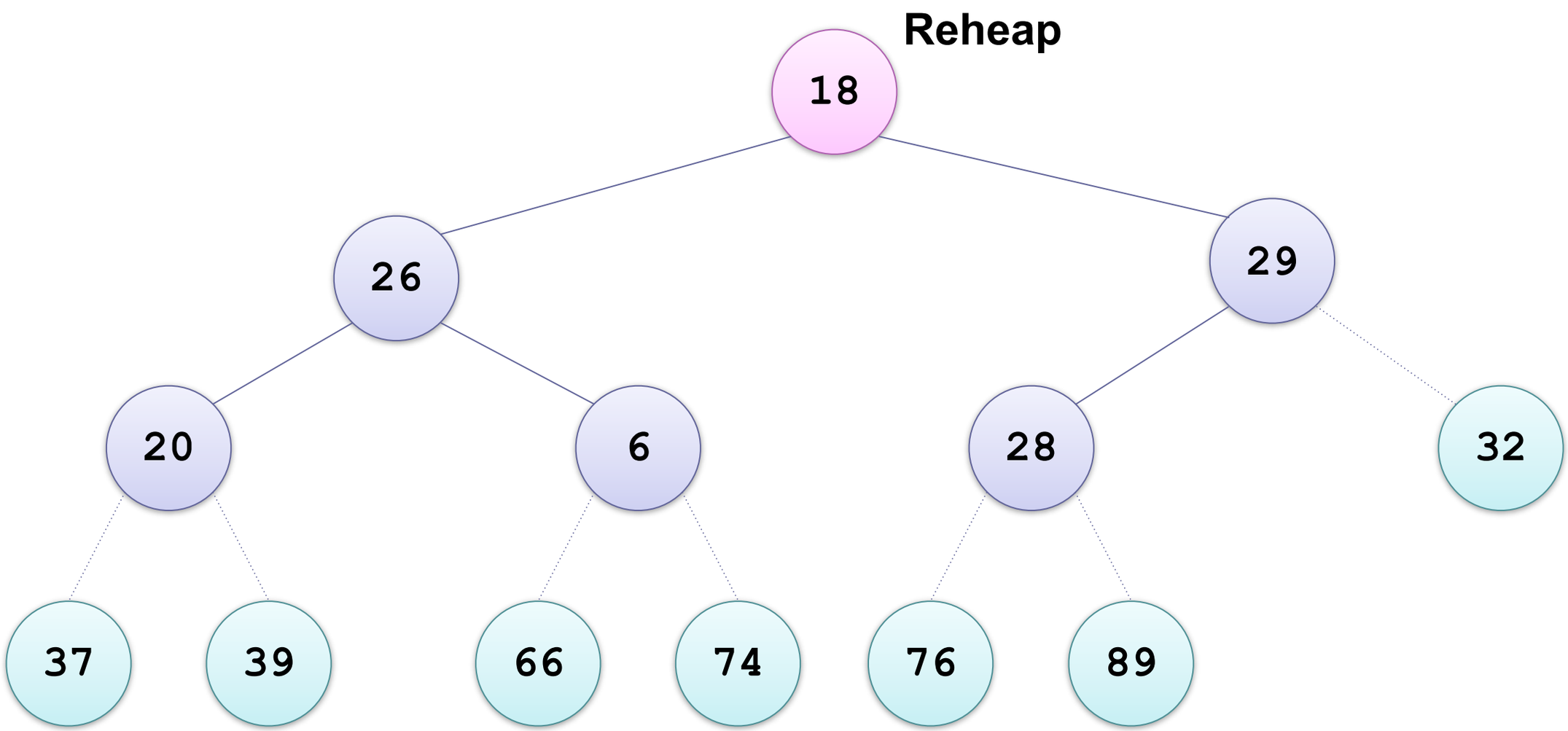

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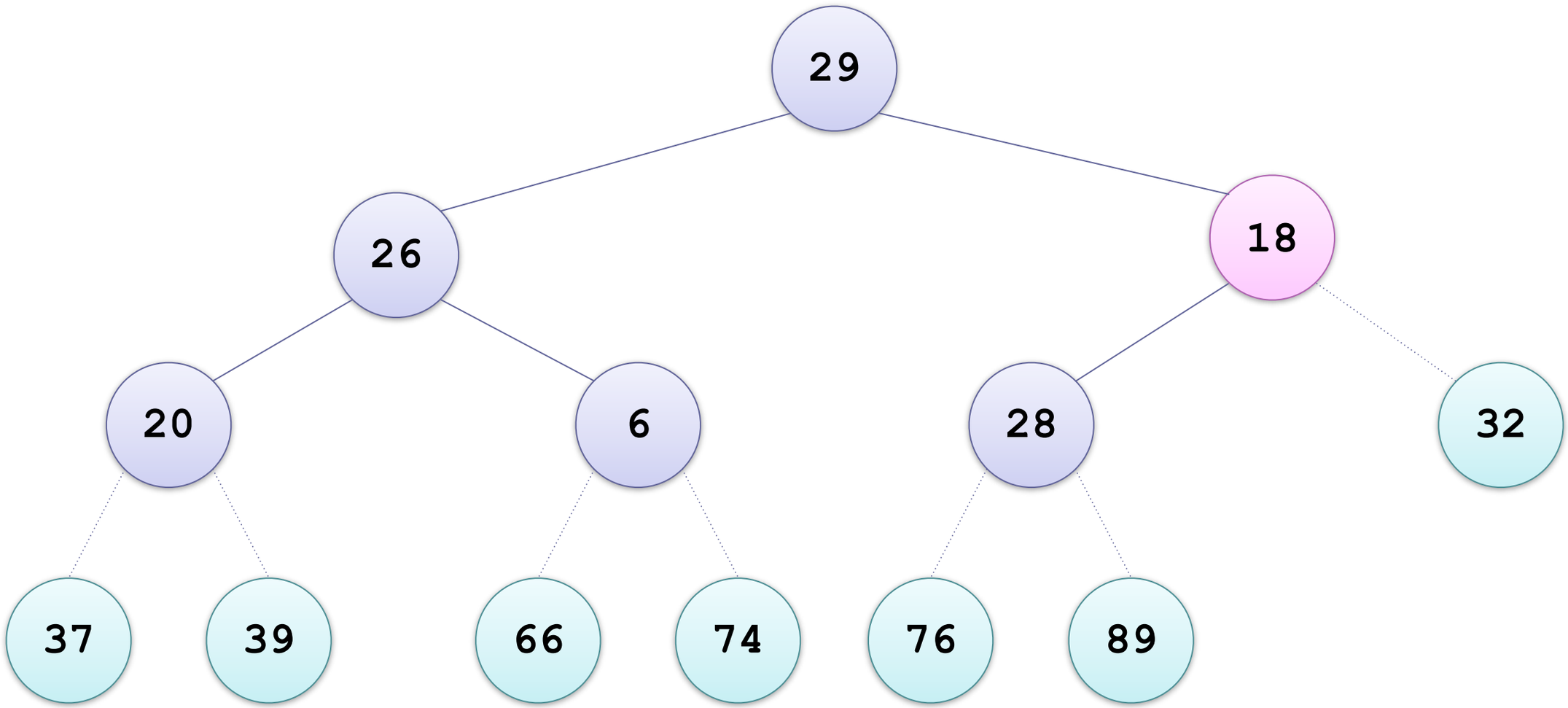

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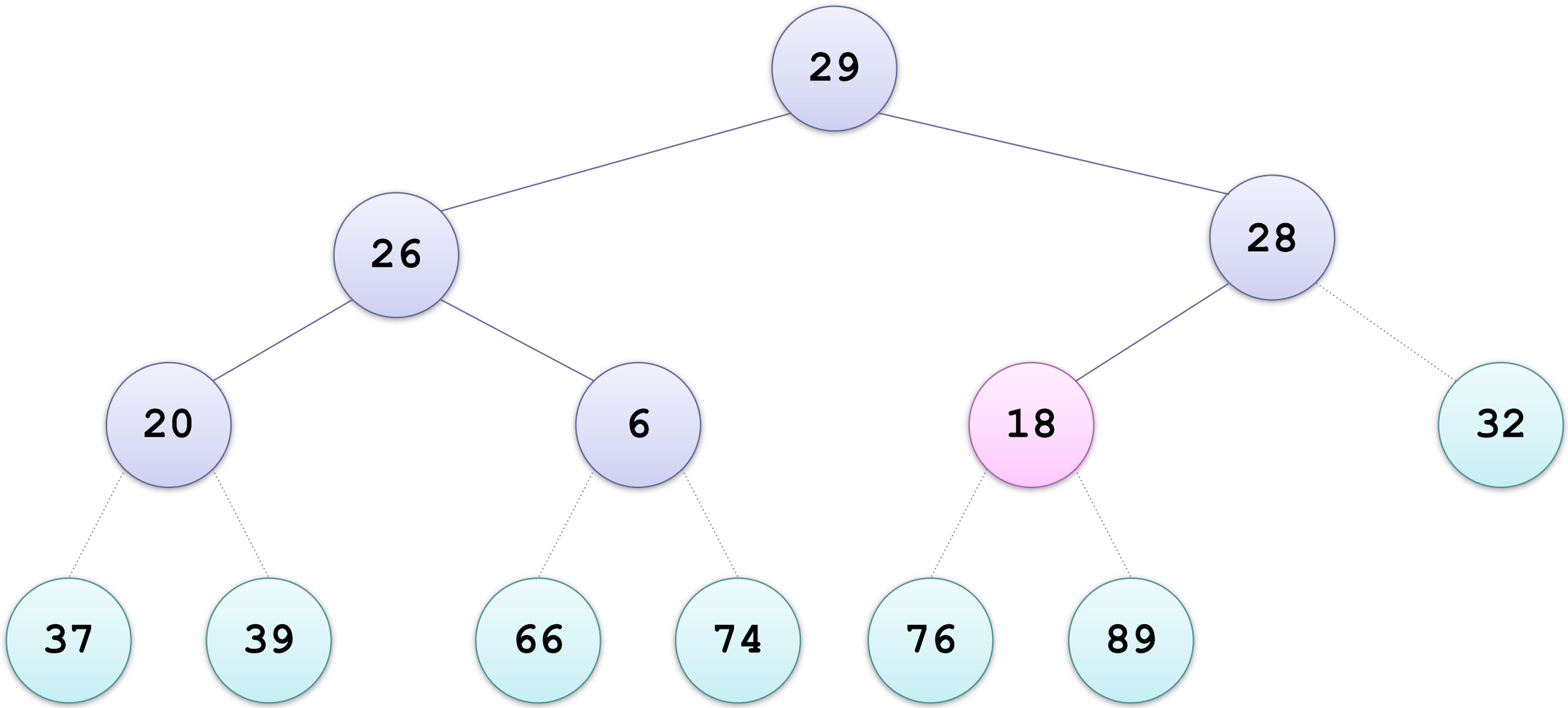

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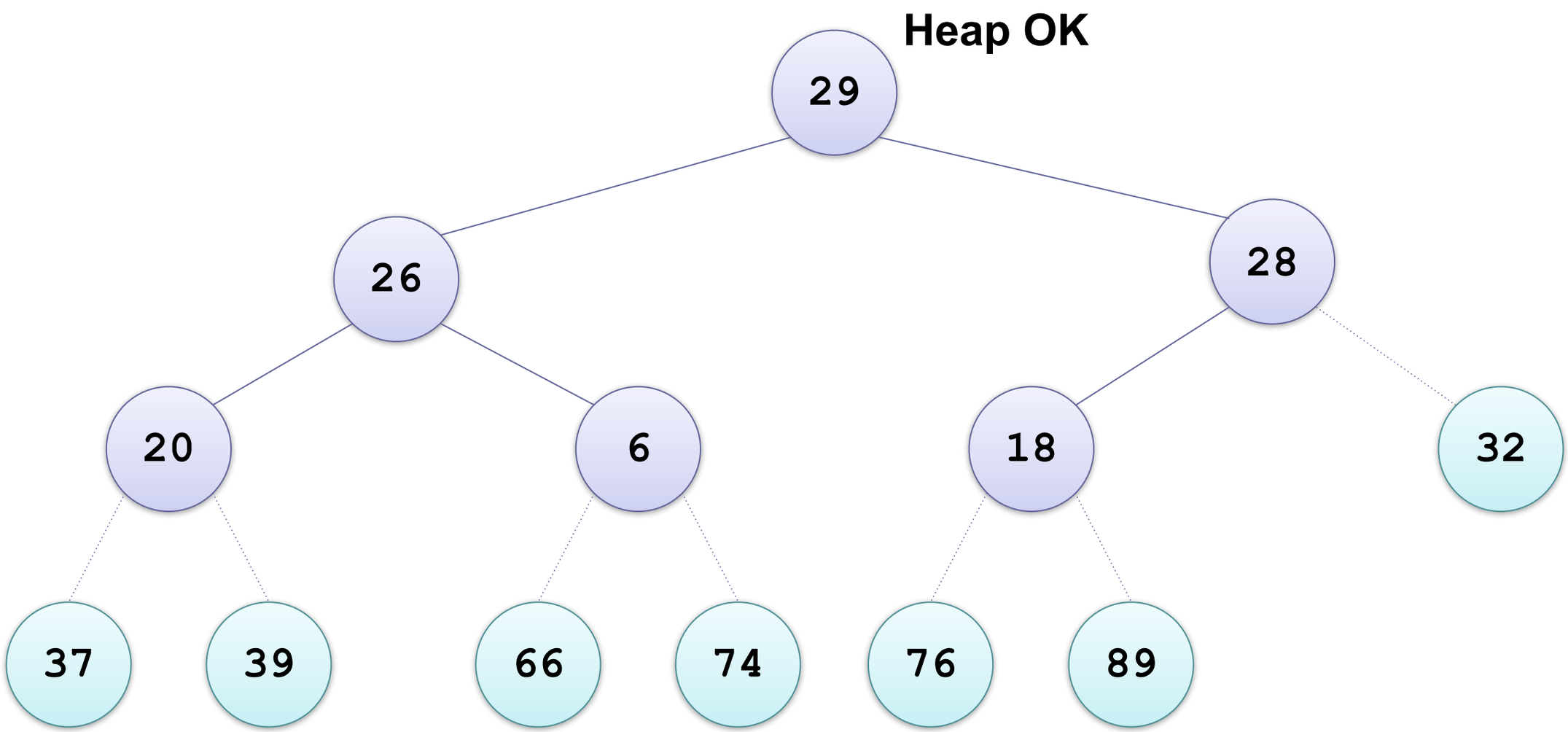

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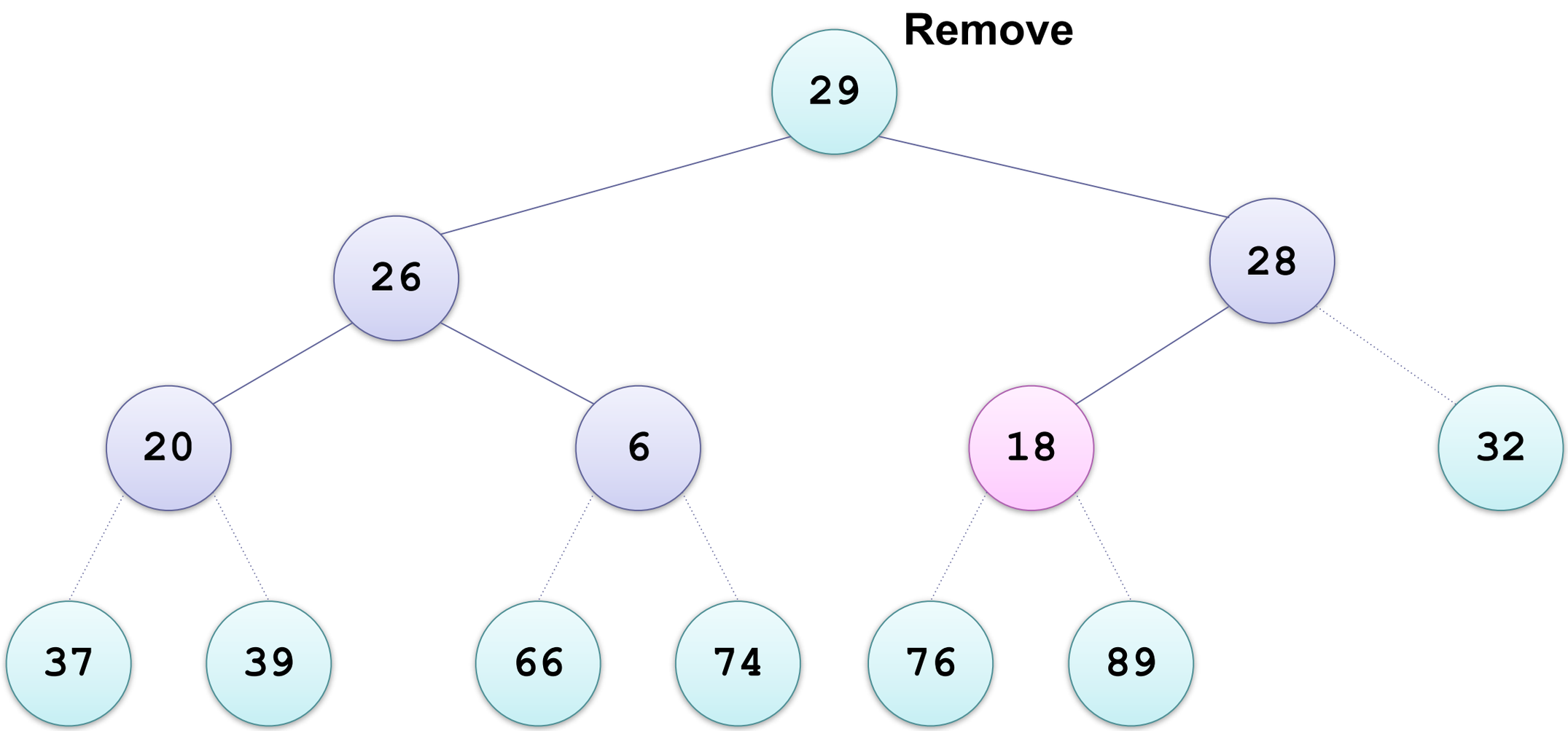

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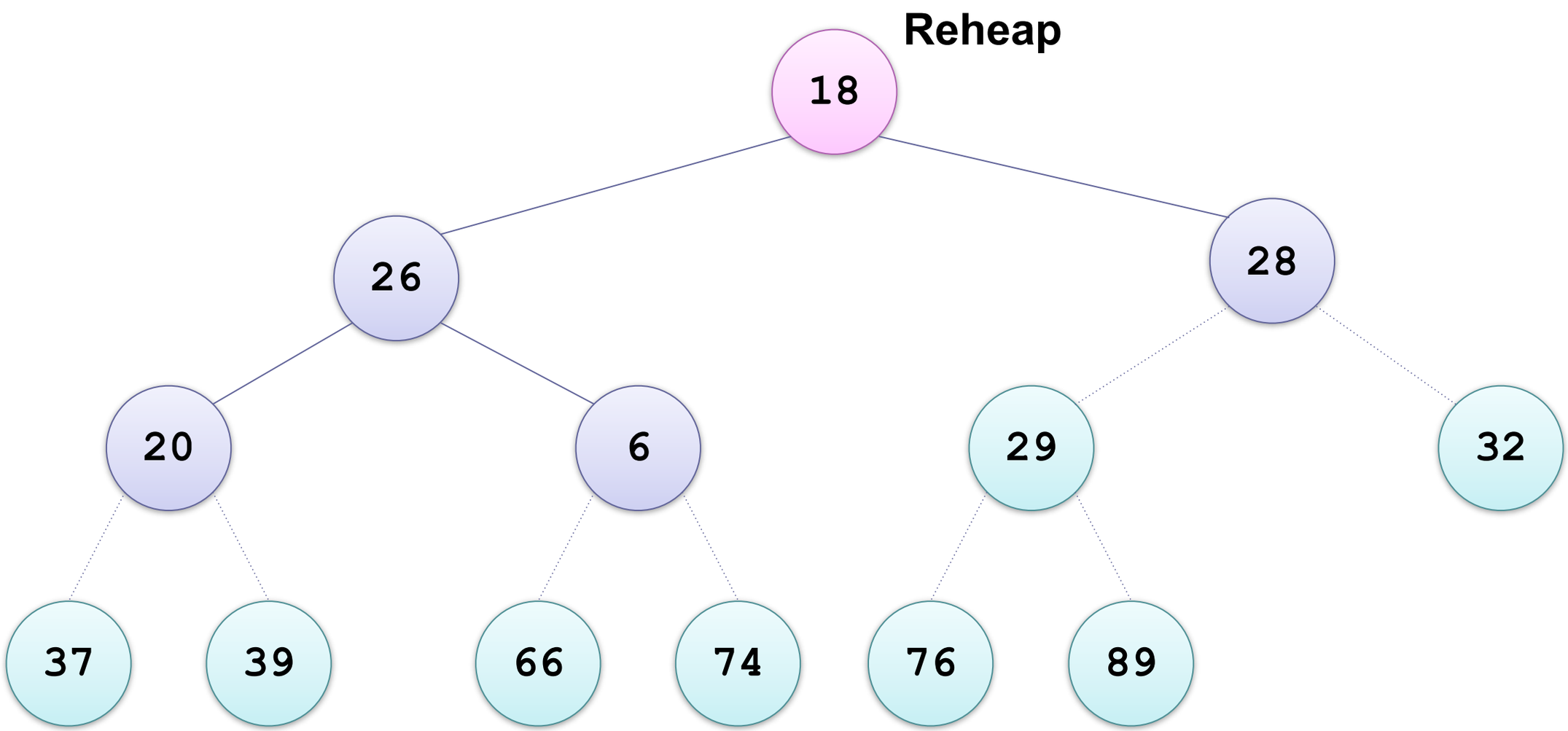

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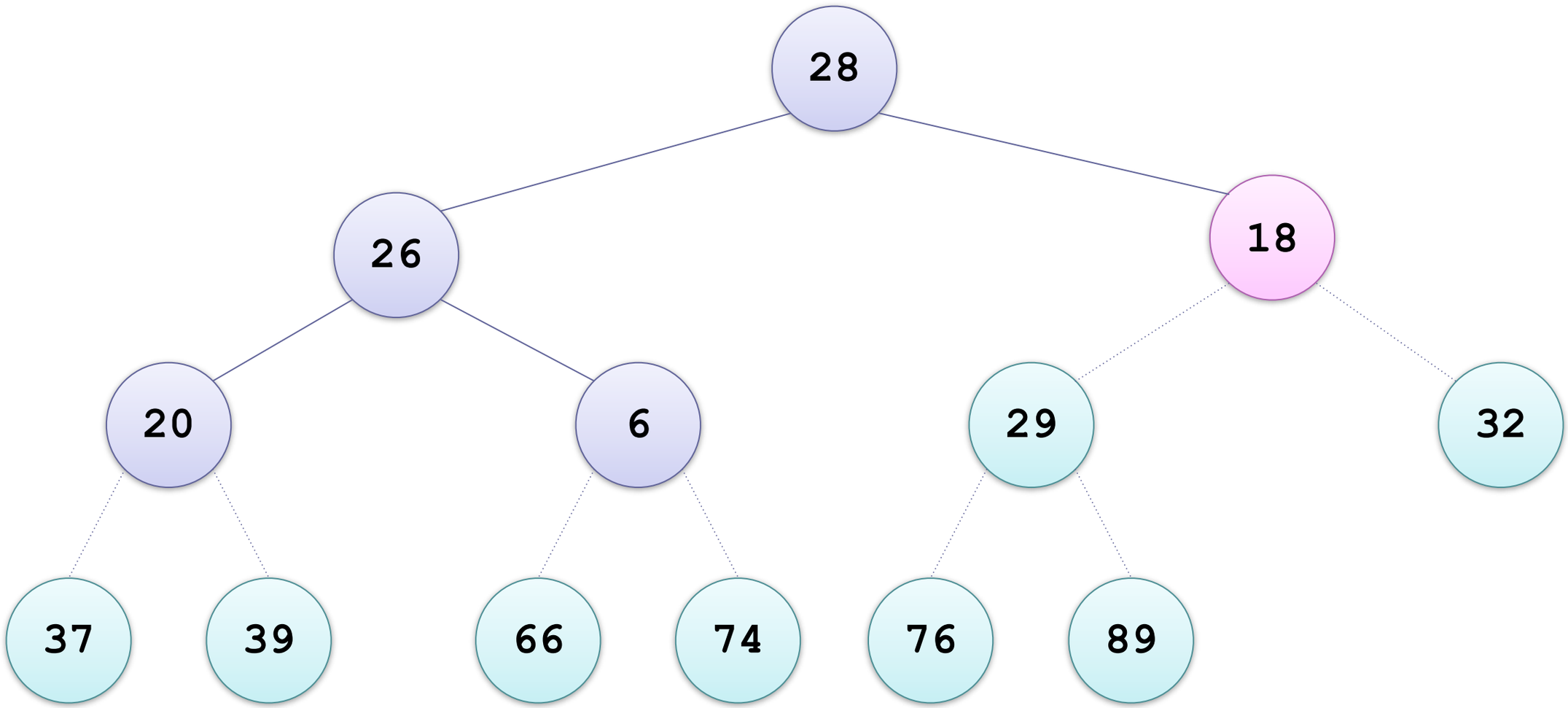

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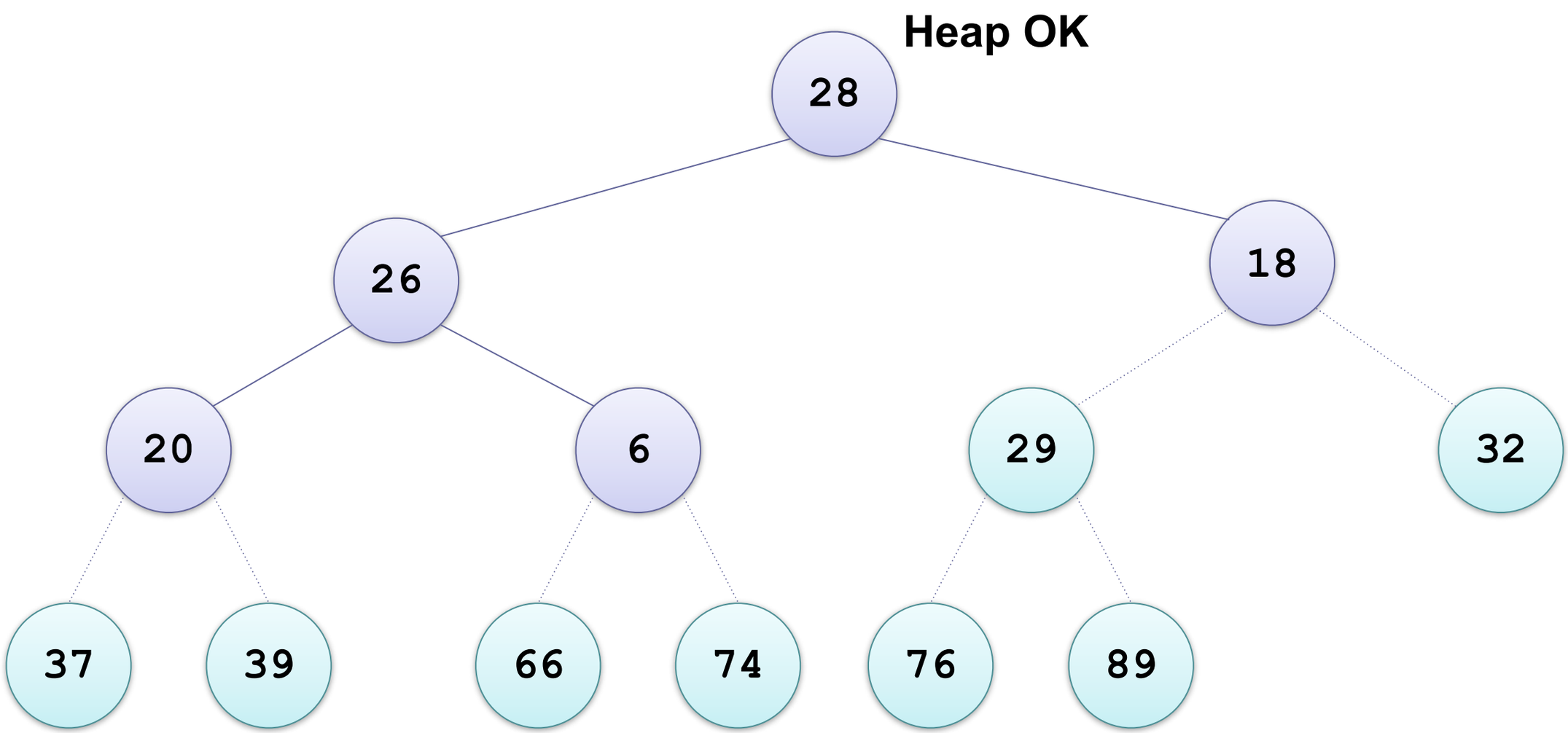

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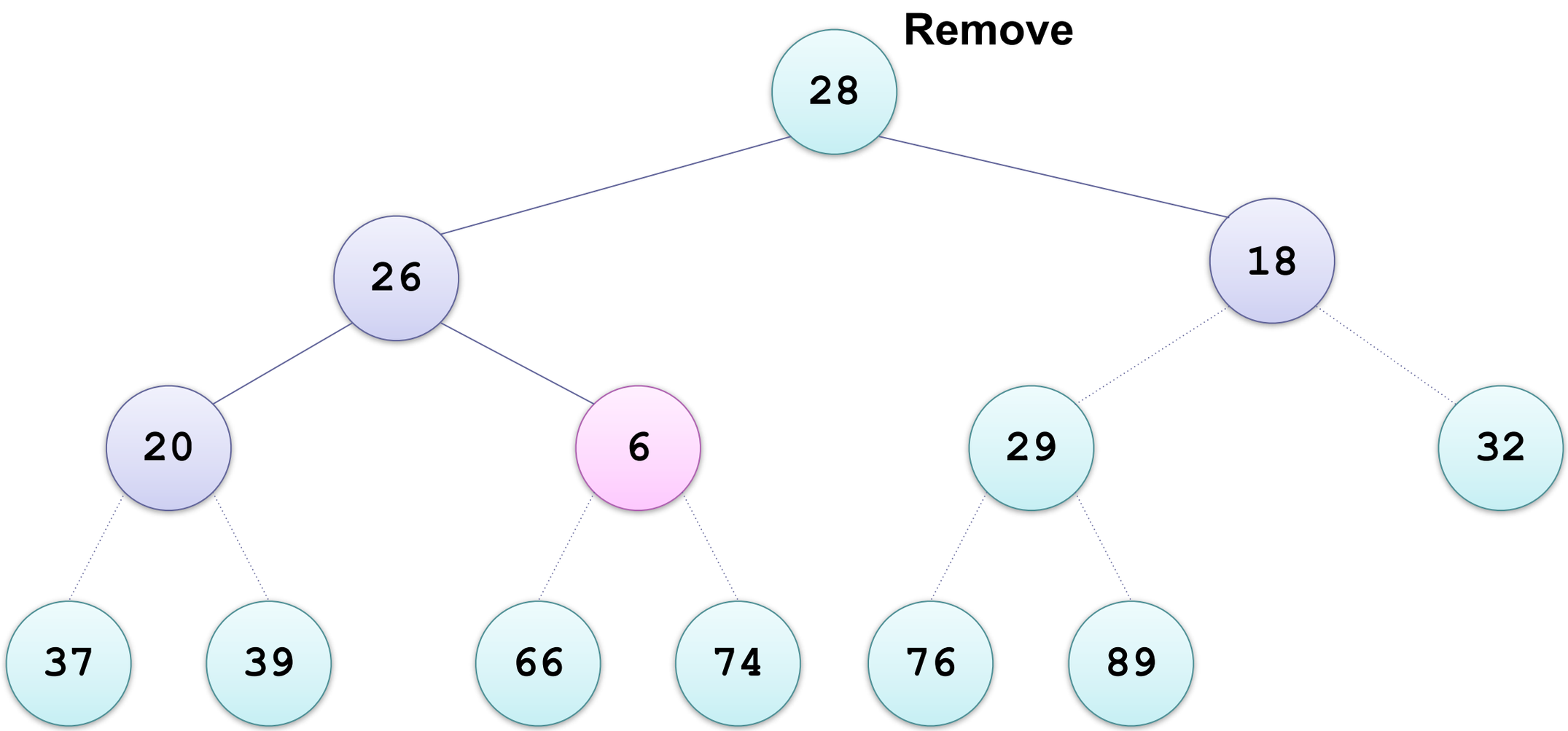

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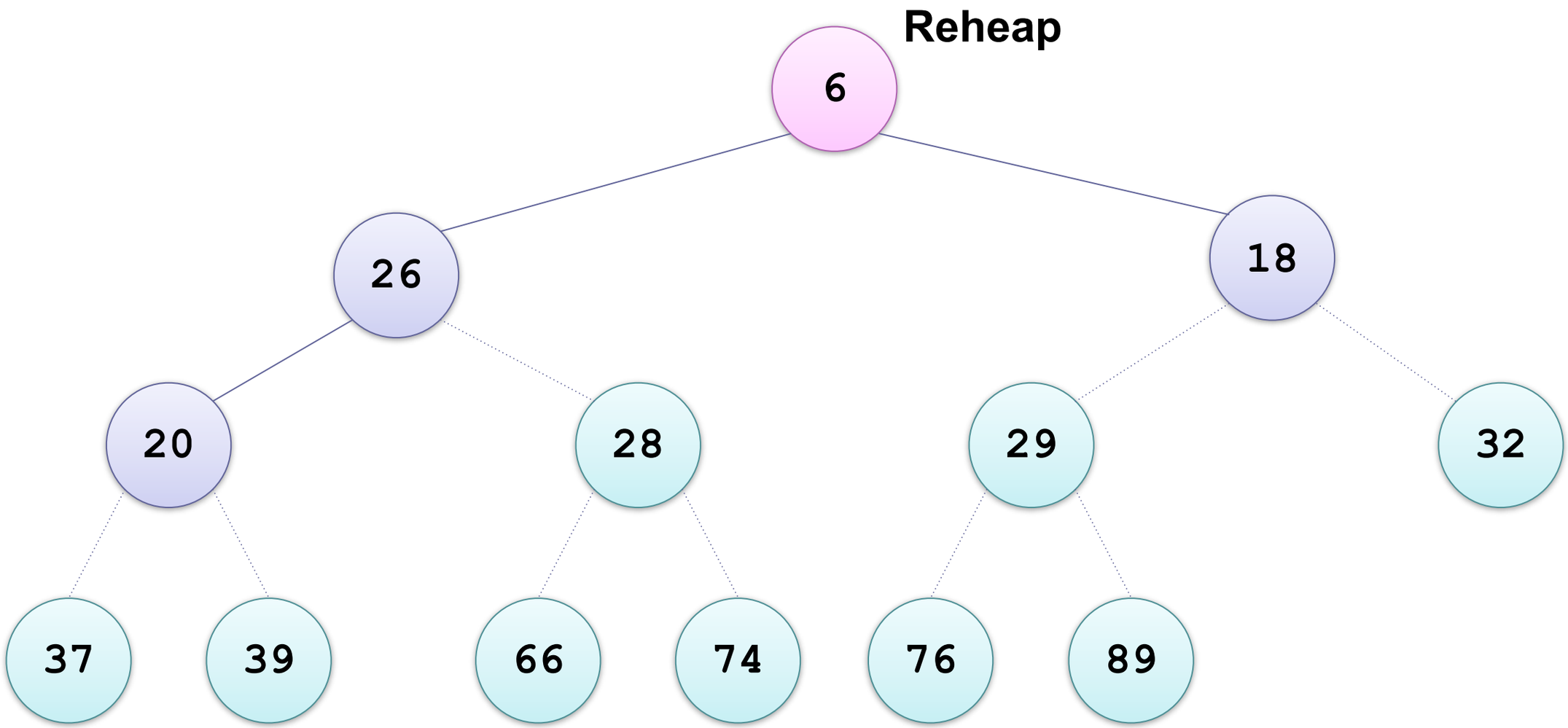

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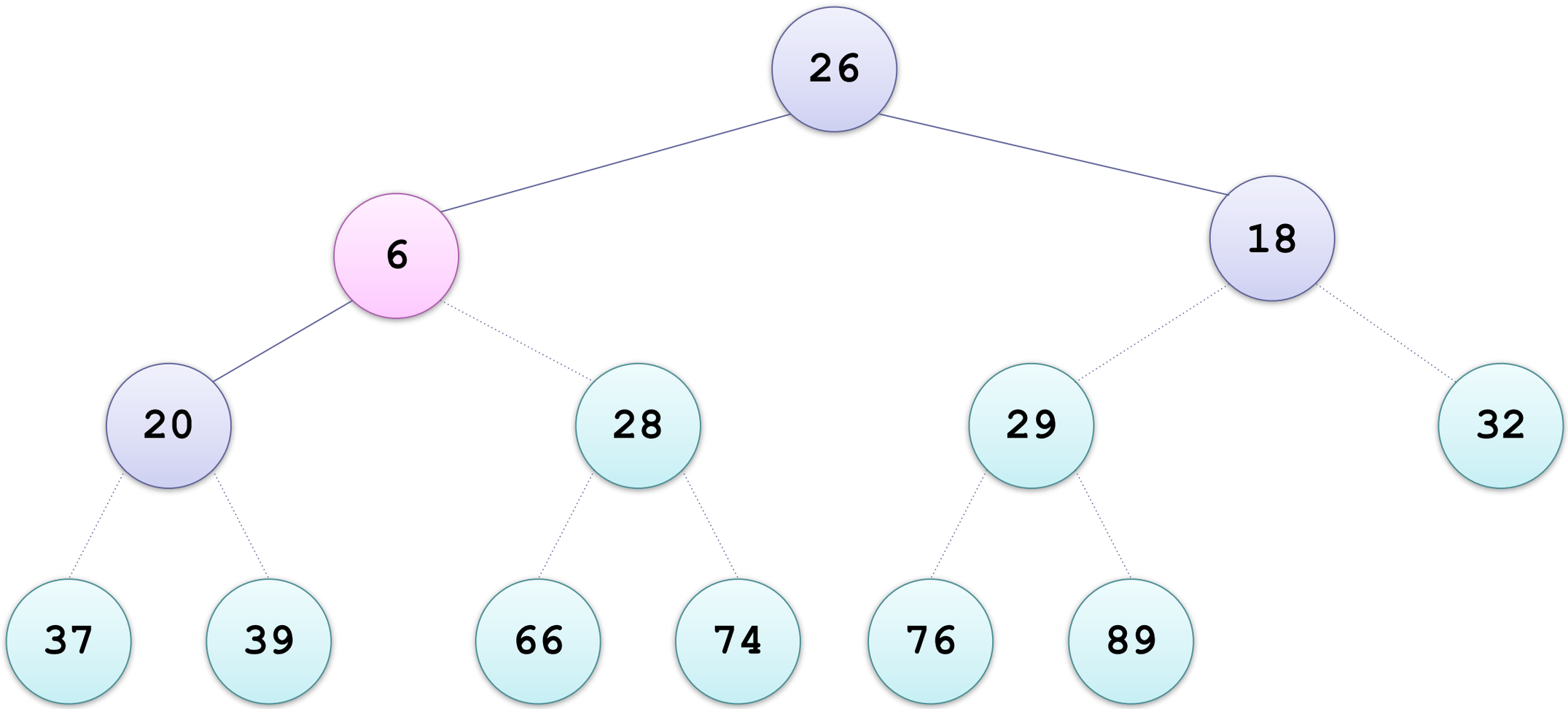

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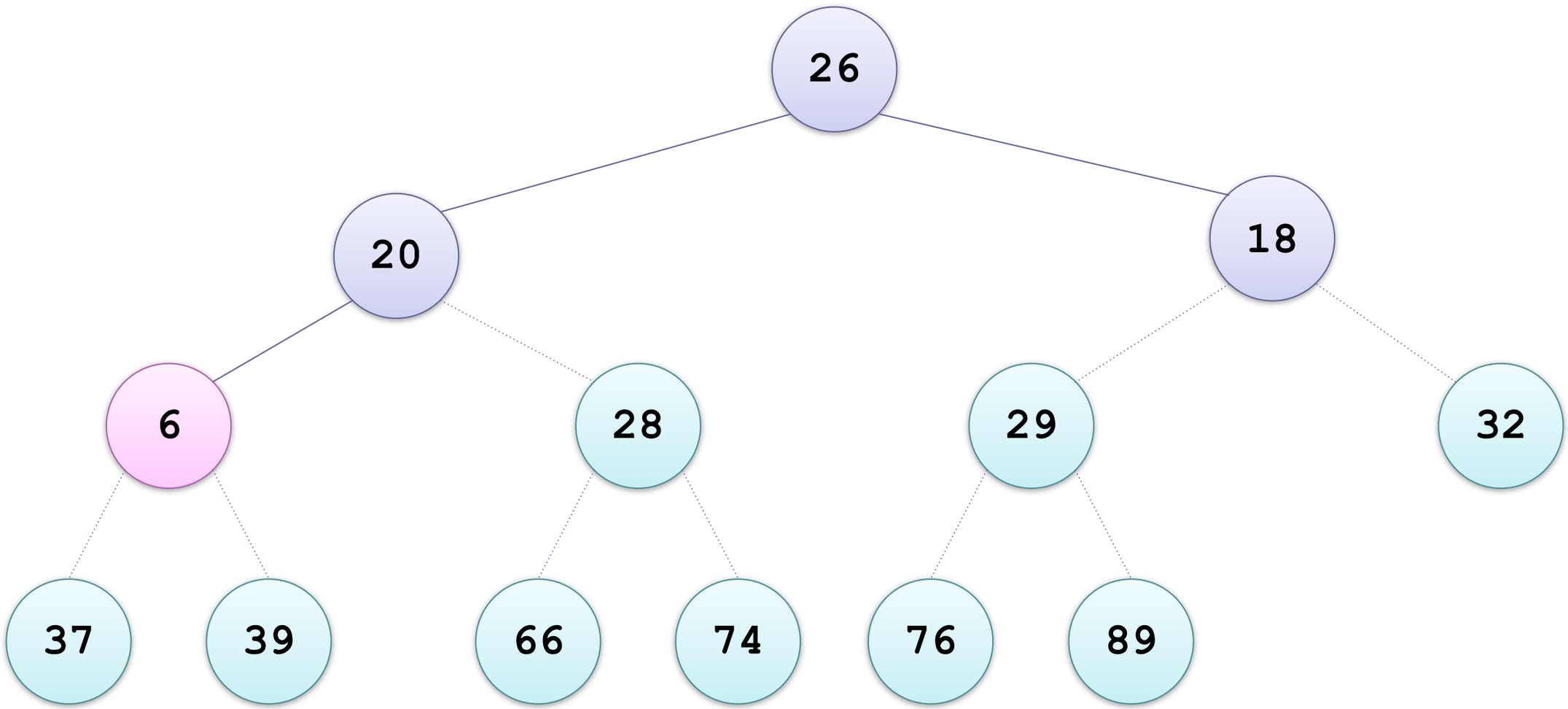

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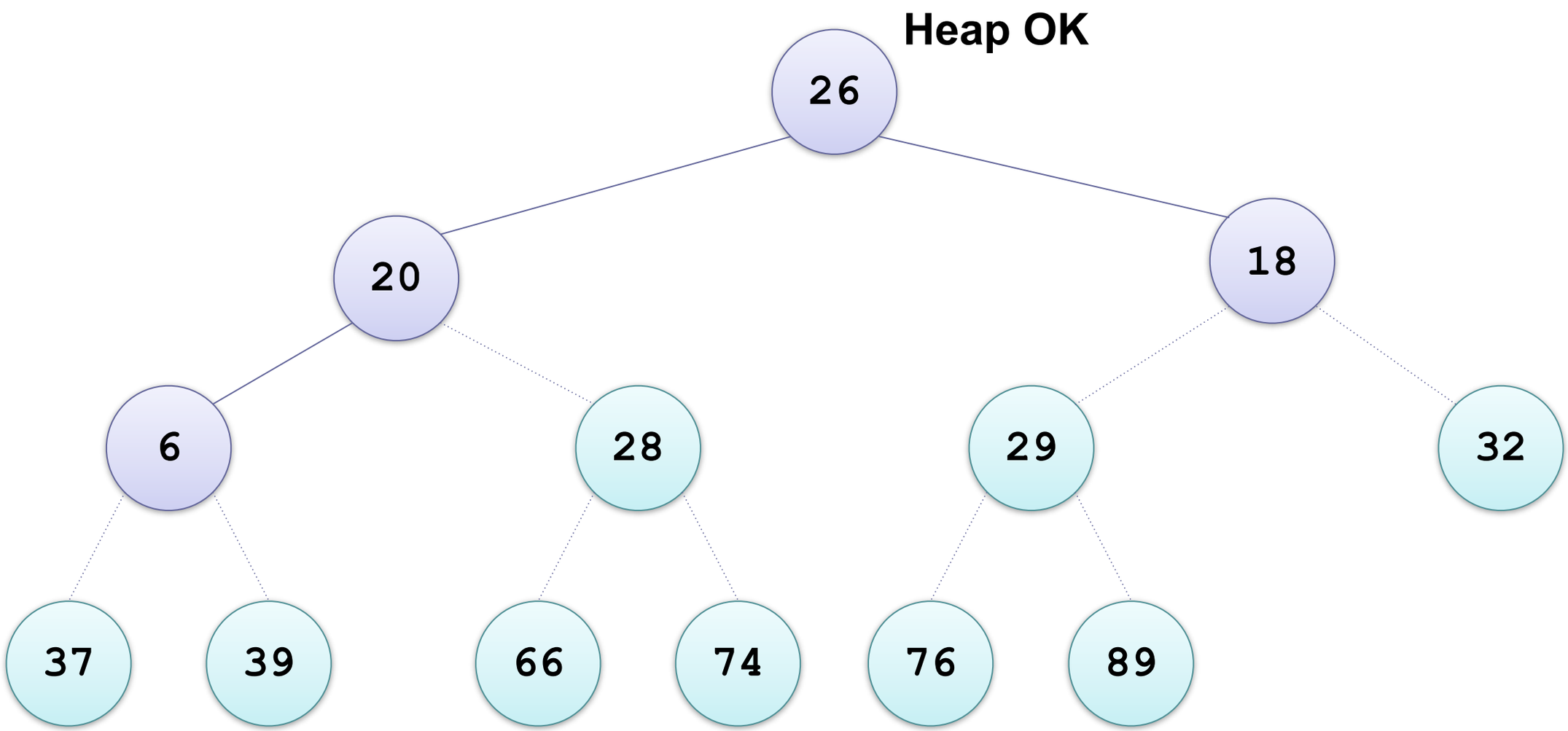

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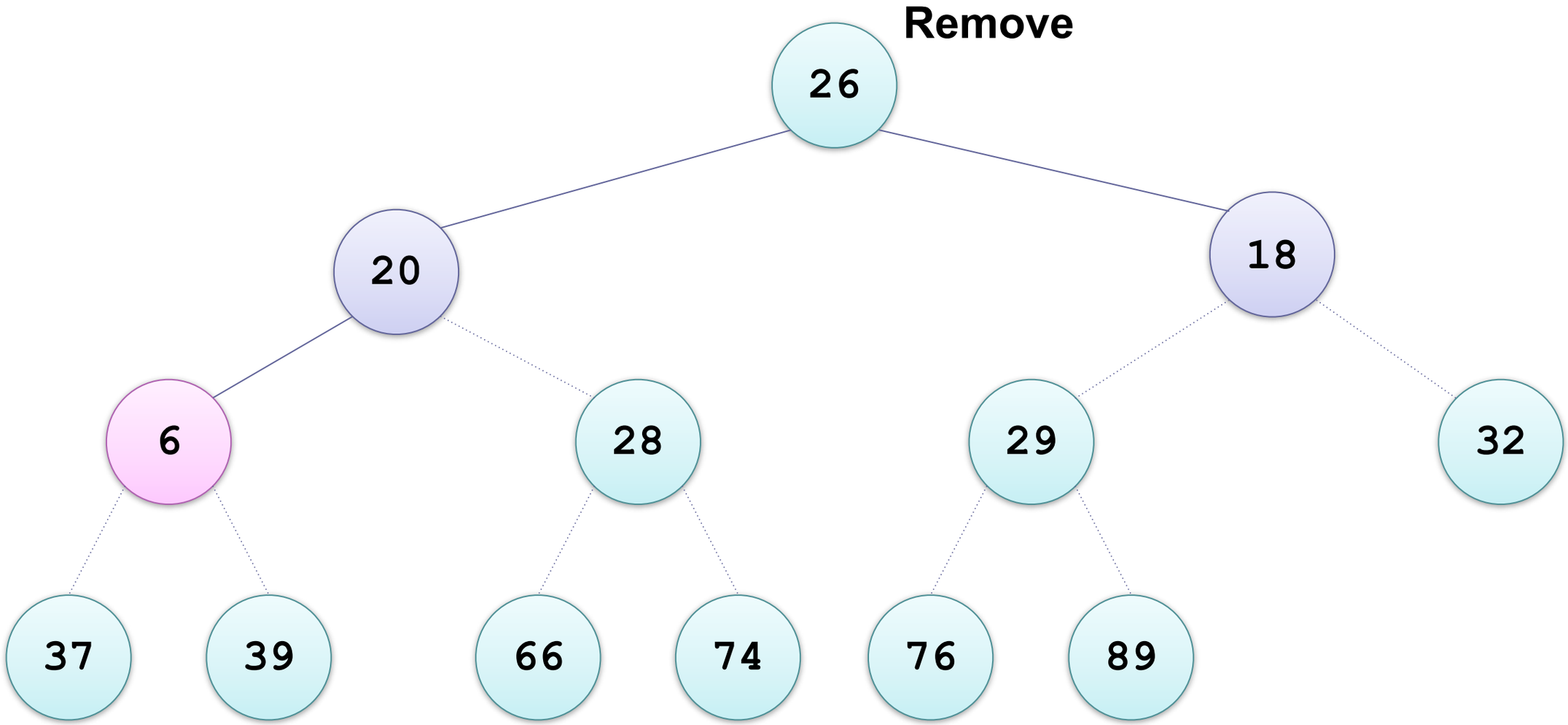

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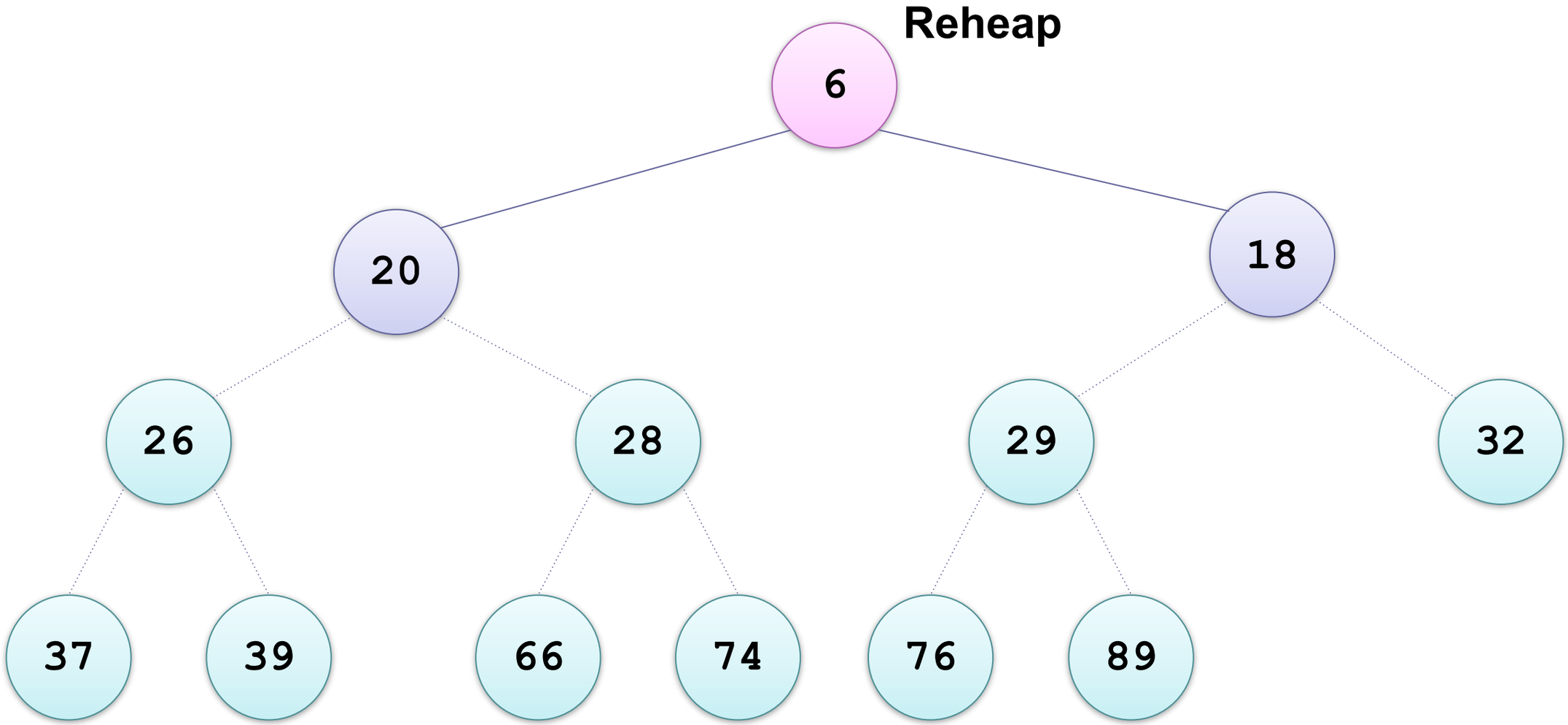

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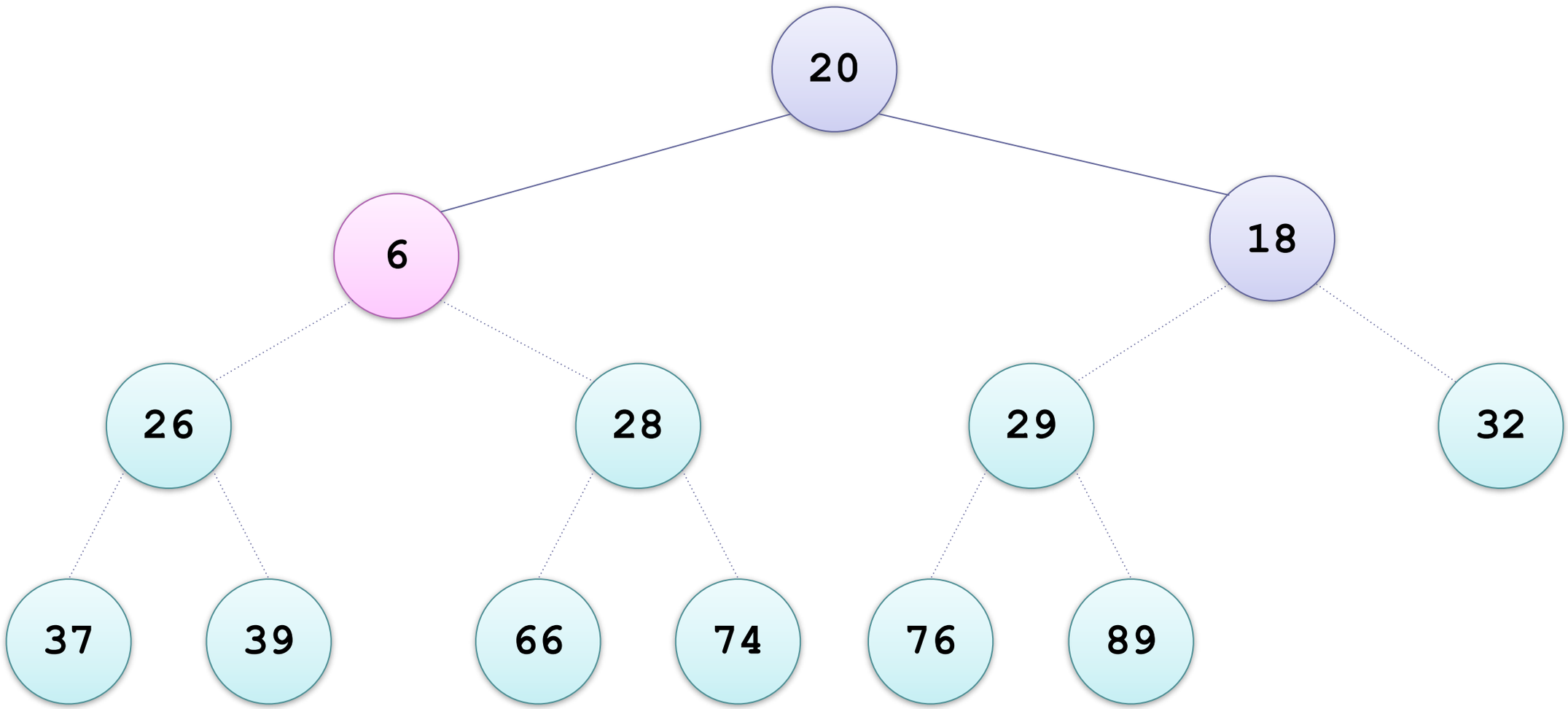

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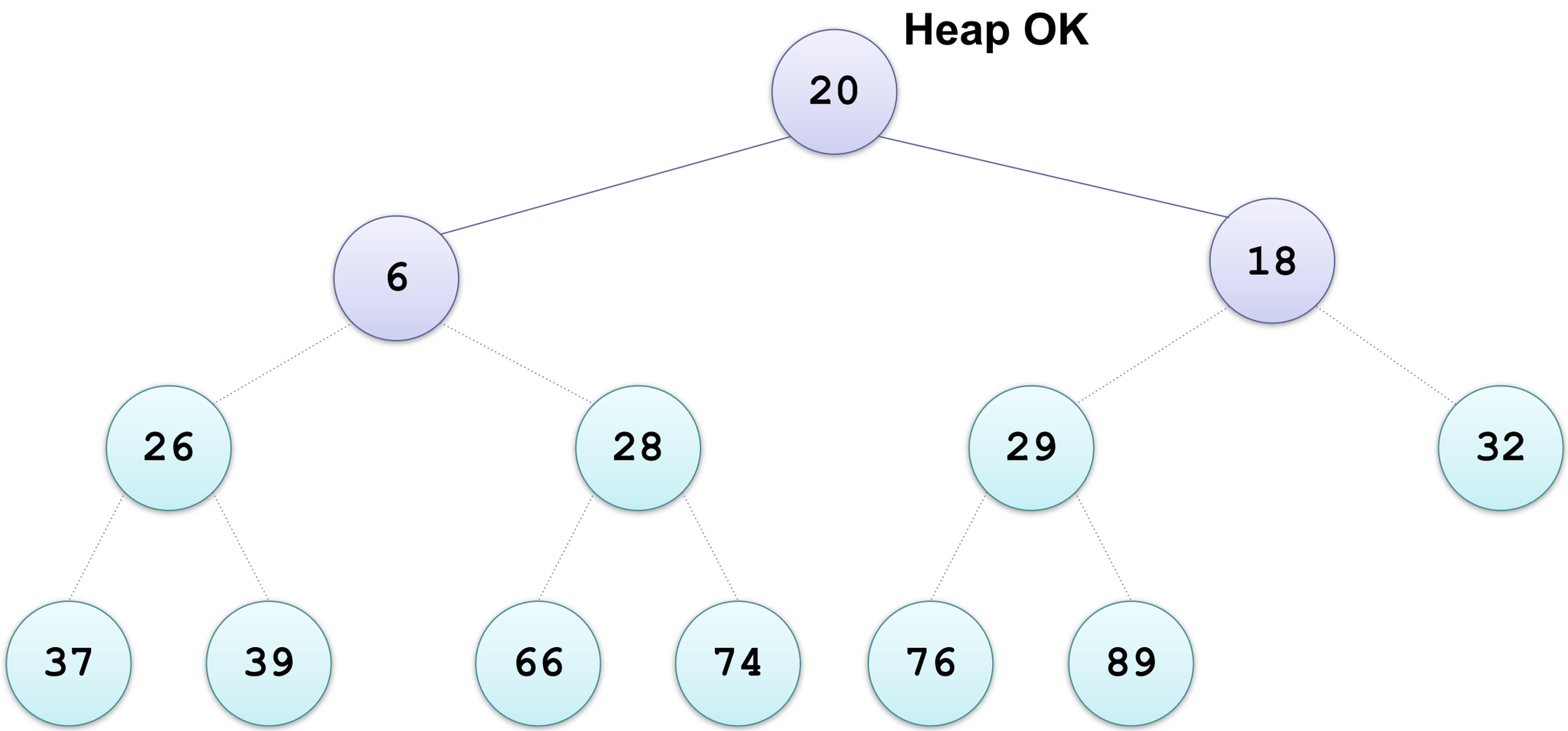

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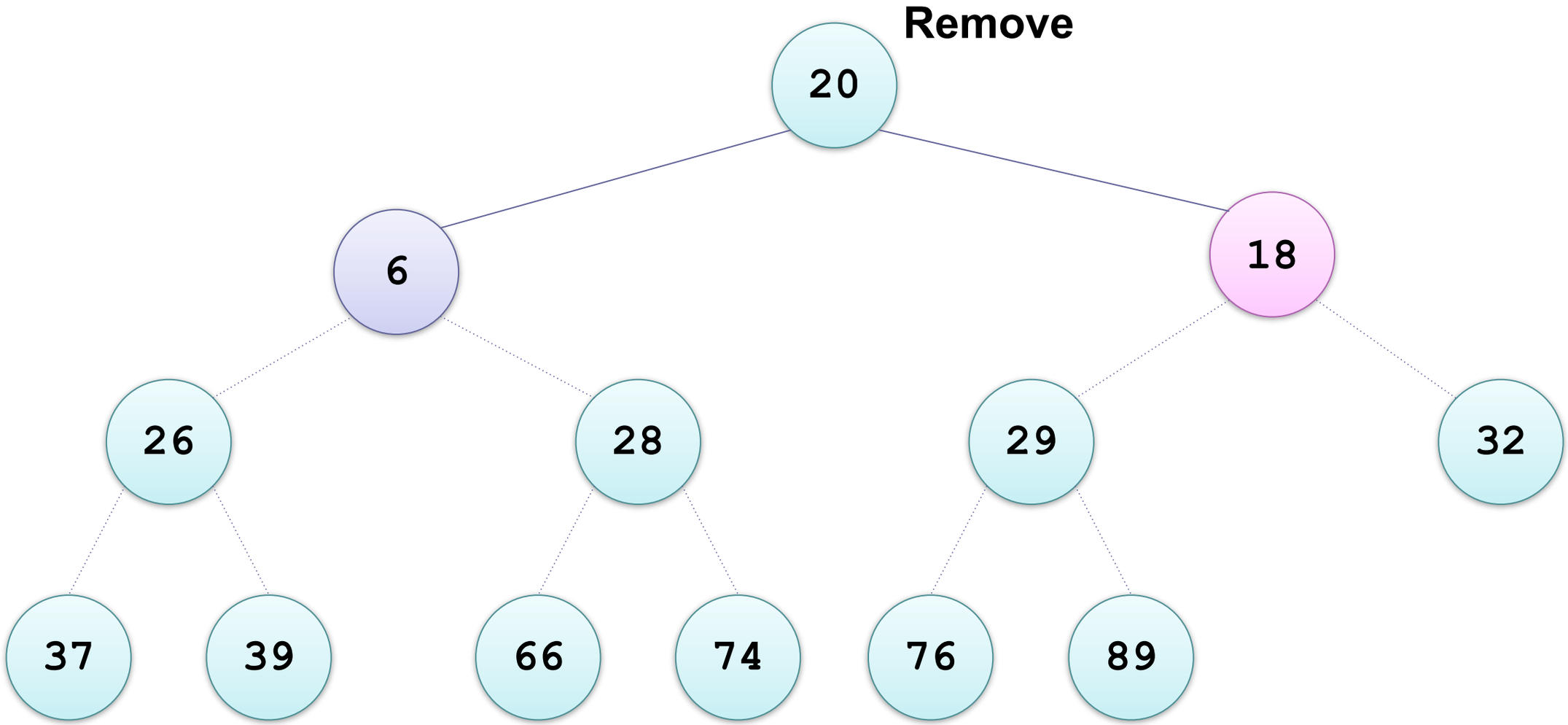

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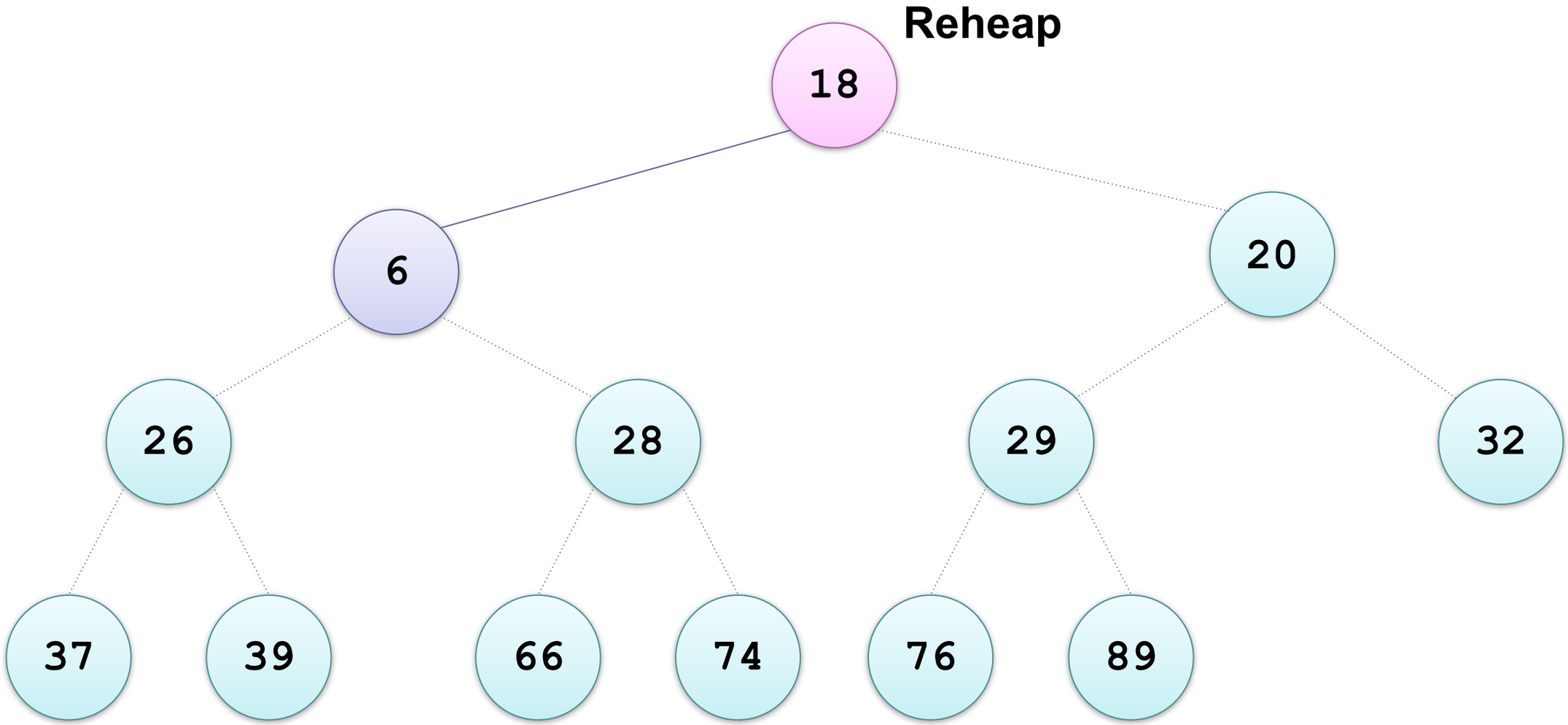

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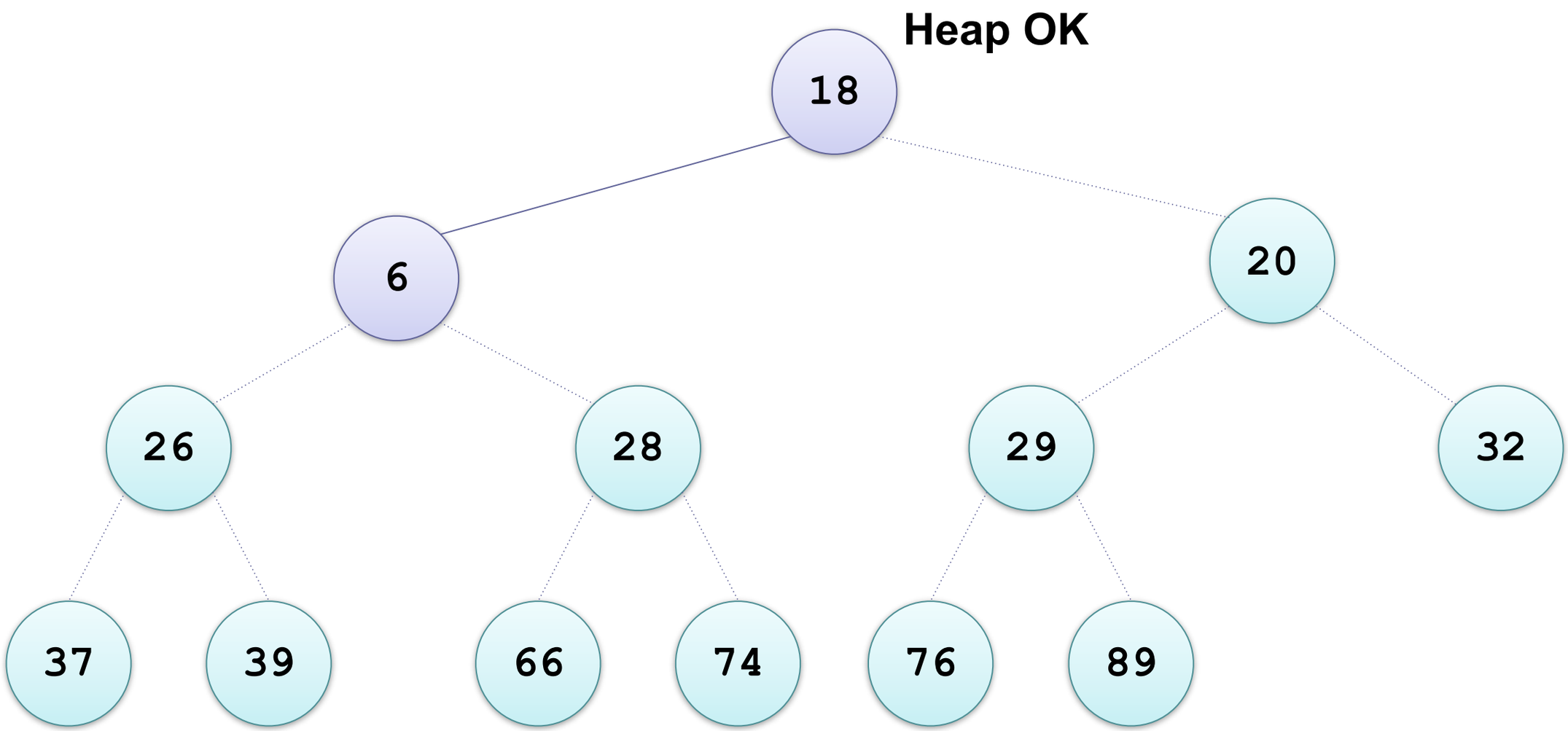

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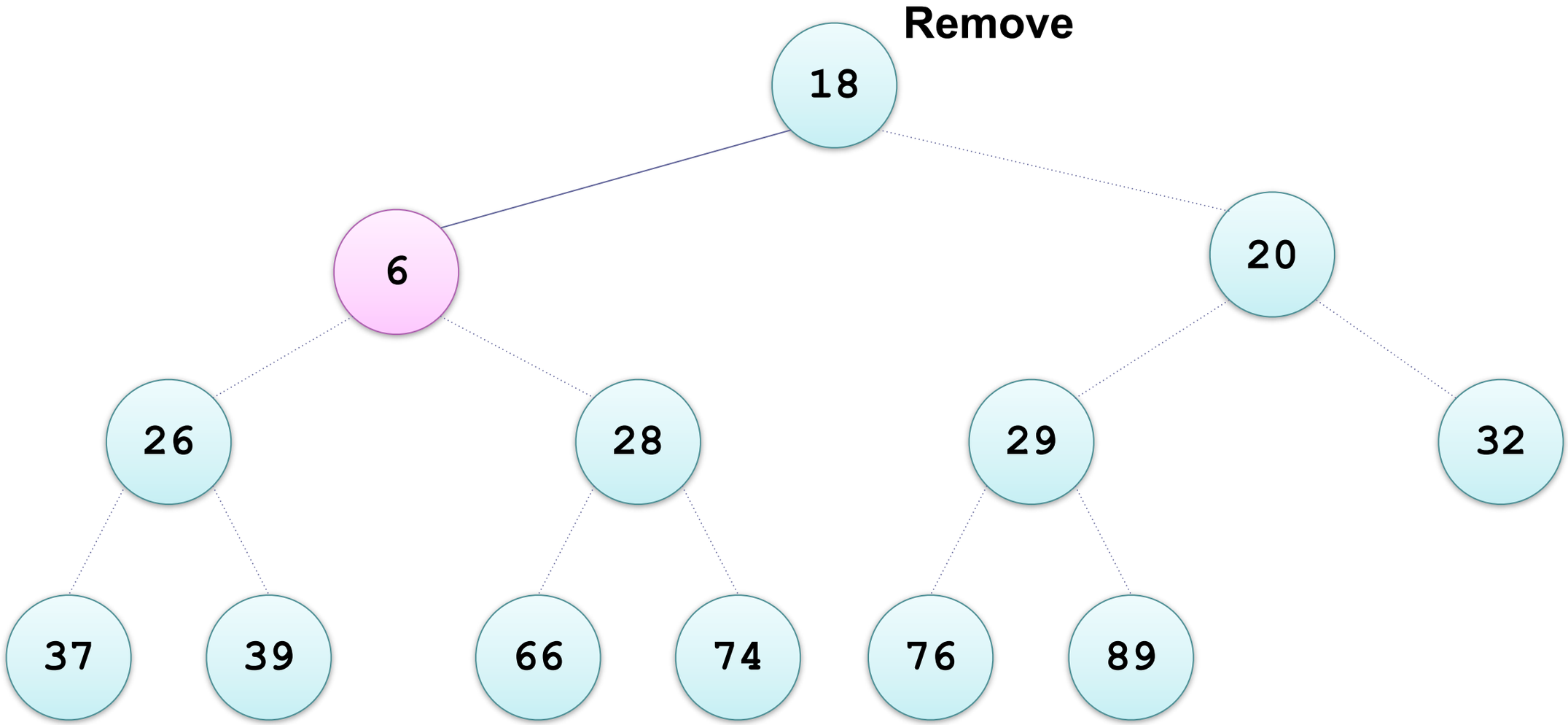

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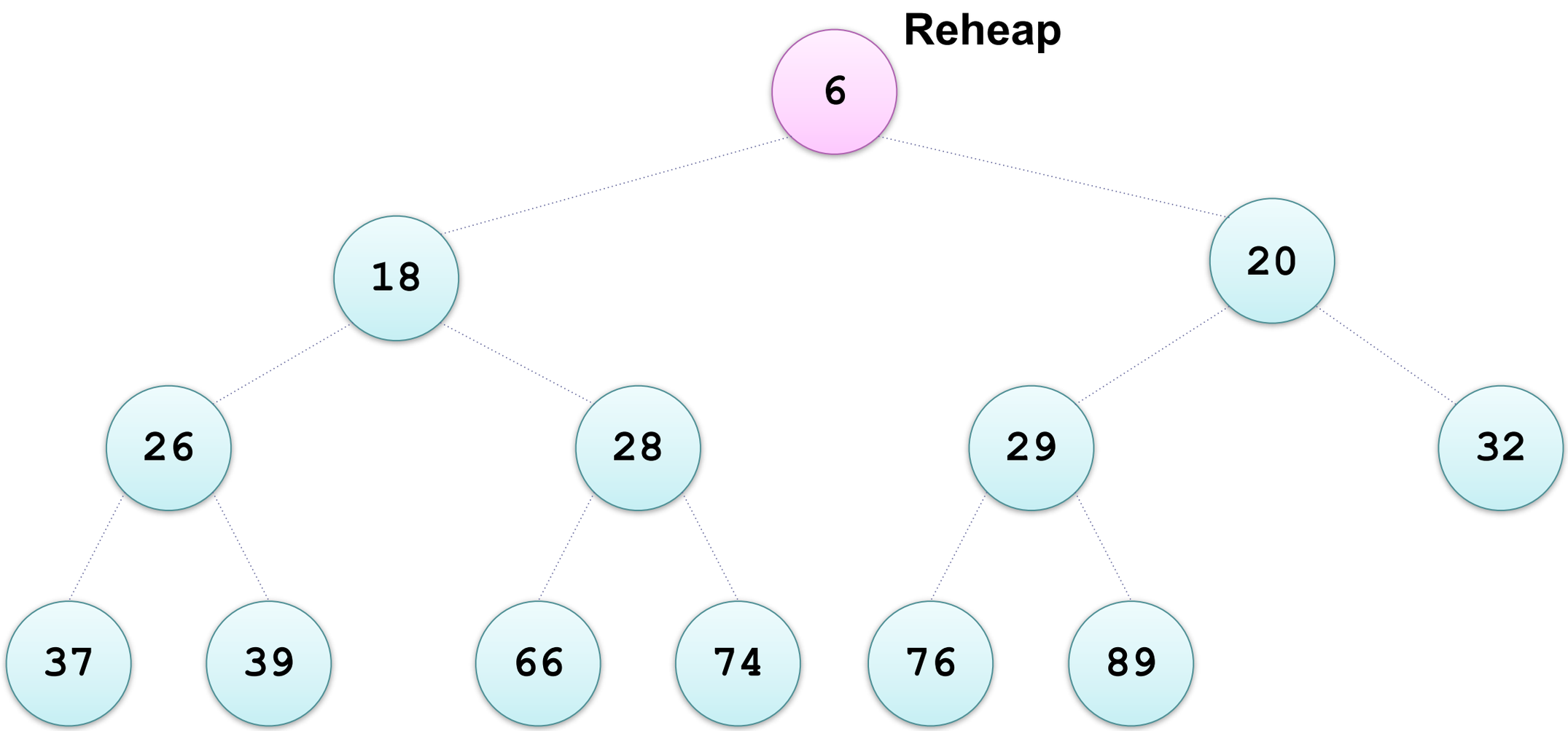
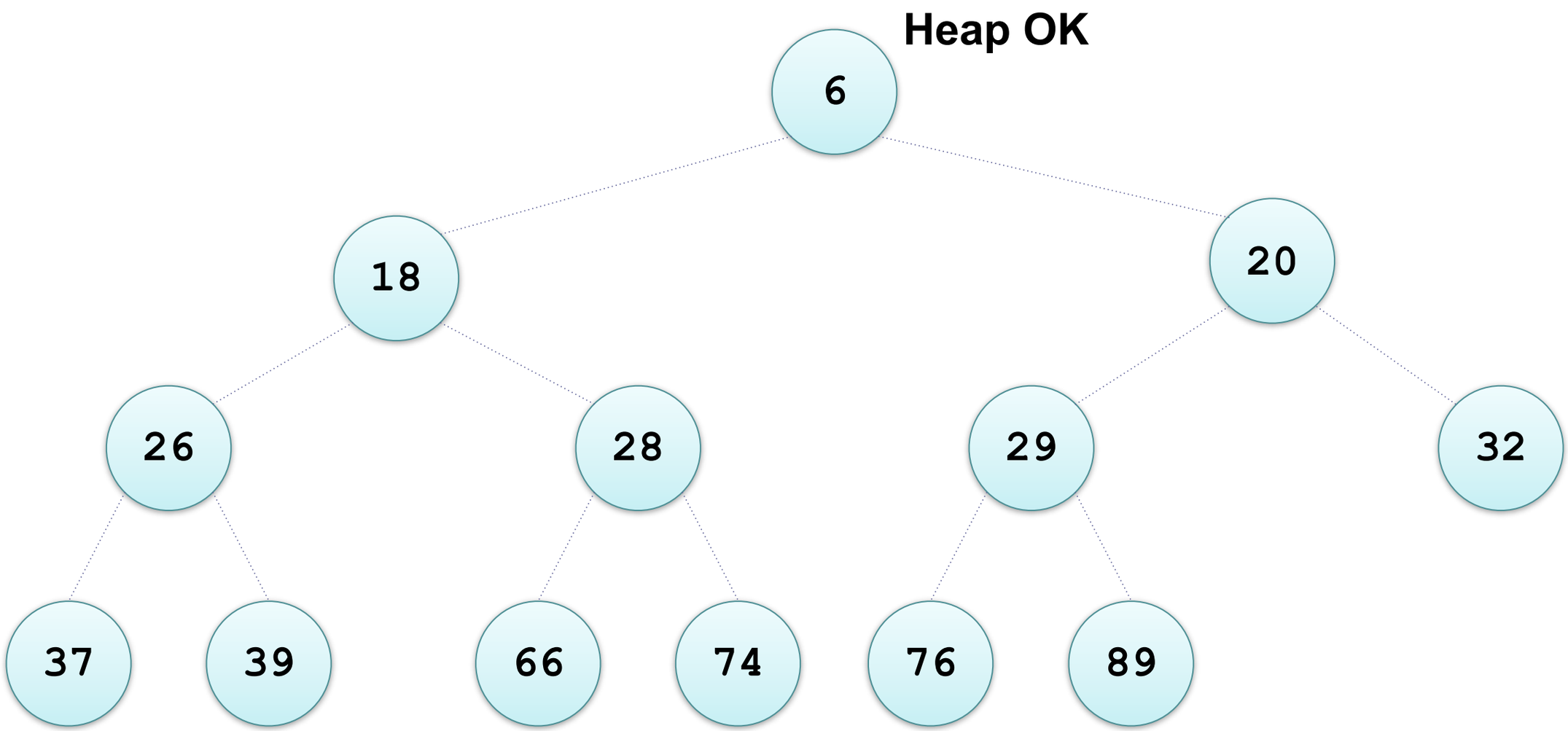


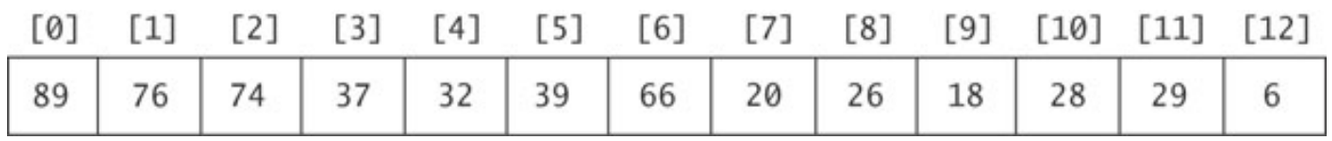
Trace of Heapsort (cont.)

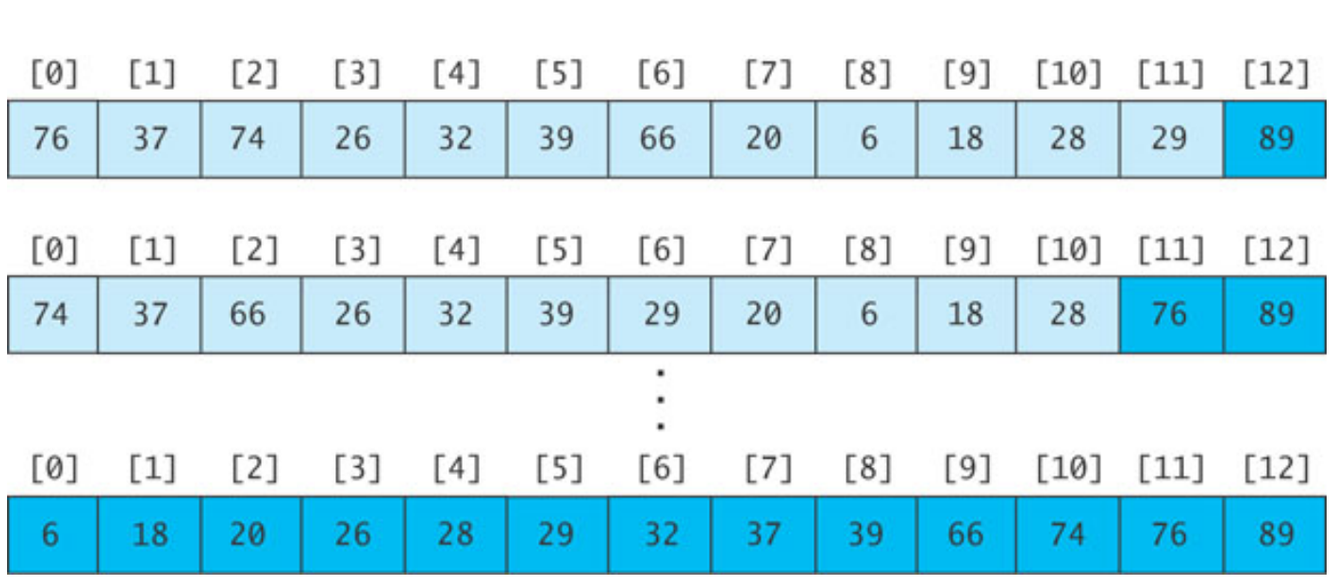


Heapsort, implementering

Vi implementerar heapen som ett fält:

- fältet är uppdelat i en heap-del och en sorterad lista
- varje element vi tar bort flyttas till slutet av fältet
- heap-delen av fältet minskar successivt





Heapsort, algoritm

Algoritm för In-Place Heapsort

1. while n is less than table.length:
2. increment n by 1
   (this inserts a new item into the heap)
3. restore the heap property
4. while the heap is not empty:
5. remove the first item from the heap by
   swapping it with the last item in the heap
6. restore the heap property

Analys av Heapsort

Heapar är logaritmiska:

- stoppa in/ta bort element är O(log n)
- att stoppa in n element är O(n log n)
- att ta bort n element är också O(n log n)
- O(n log n) + O(n log n) = O(n log n)
- algoritmen kräver inget extra minne