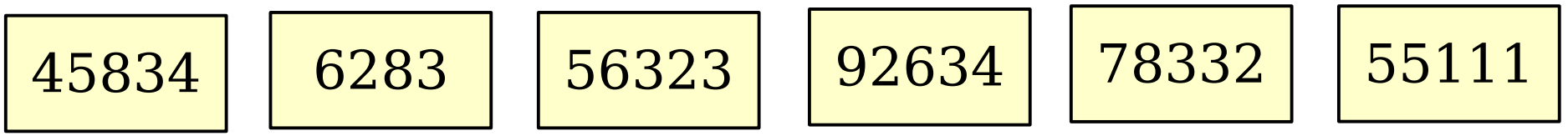
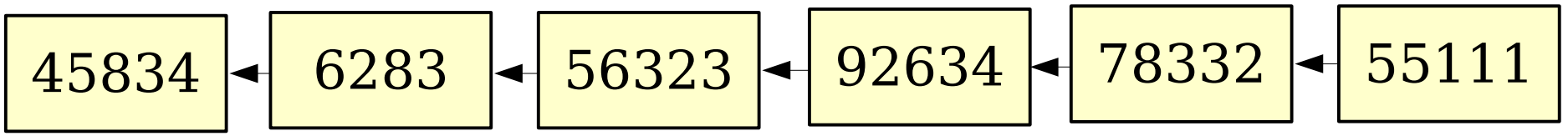
Radix Sort

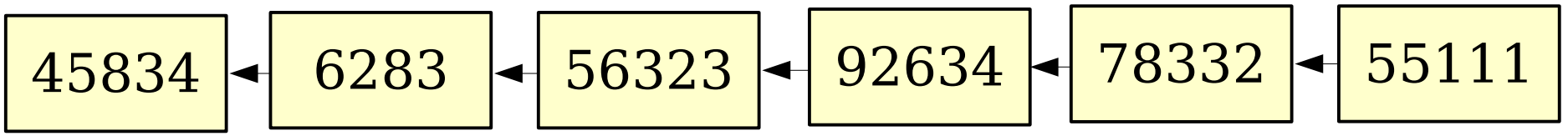
Radix Sort



Radix Sort



Radix Sort



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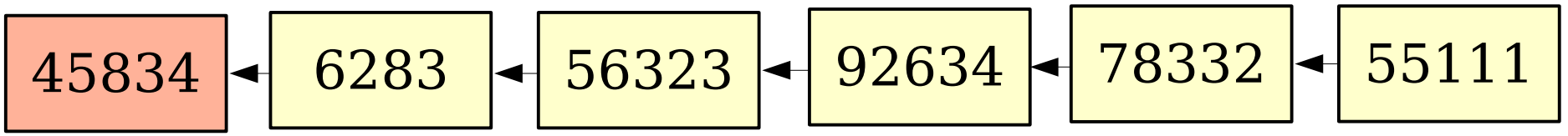

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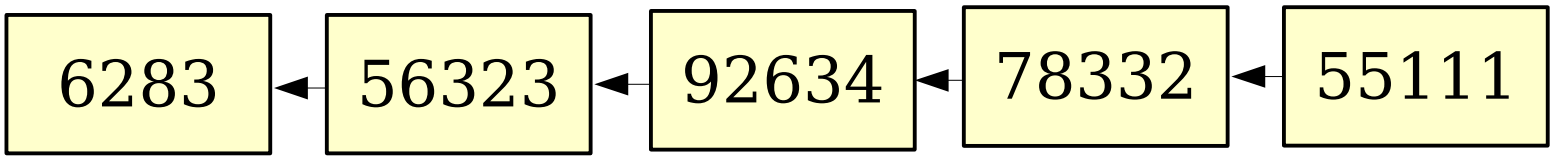

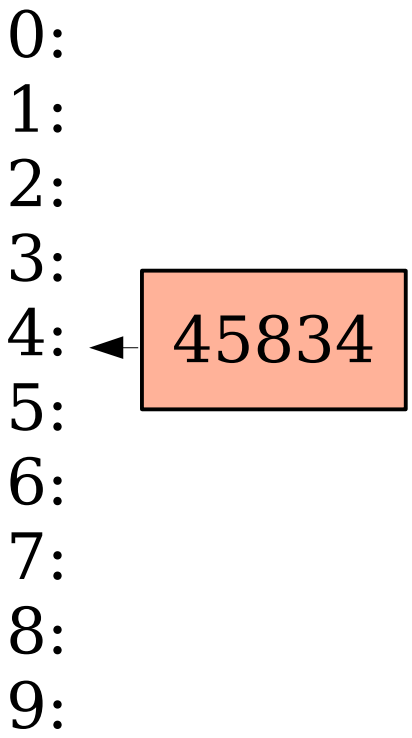

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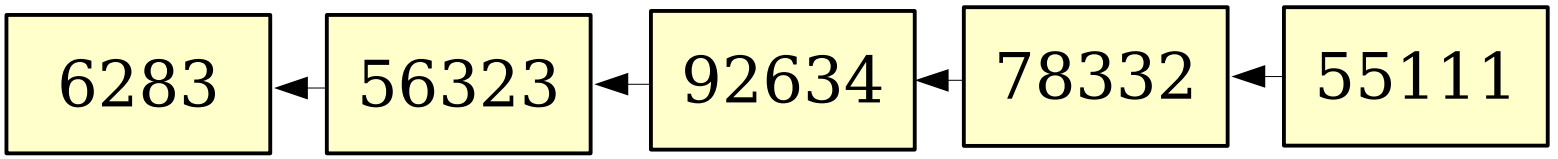

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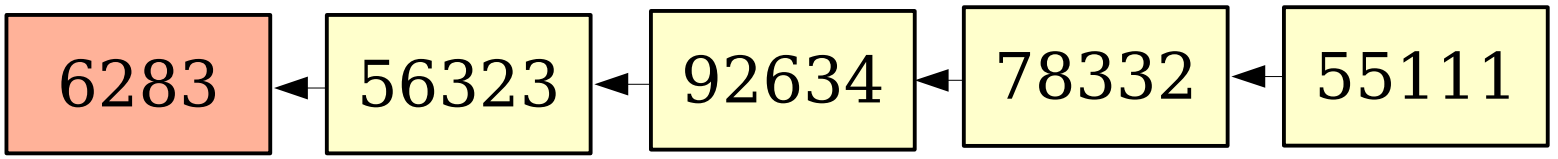

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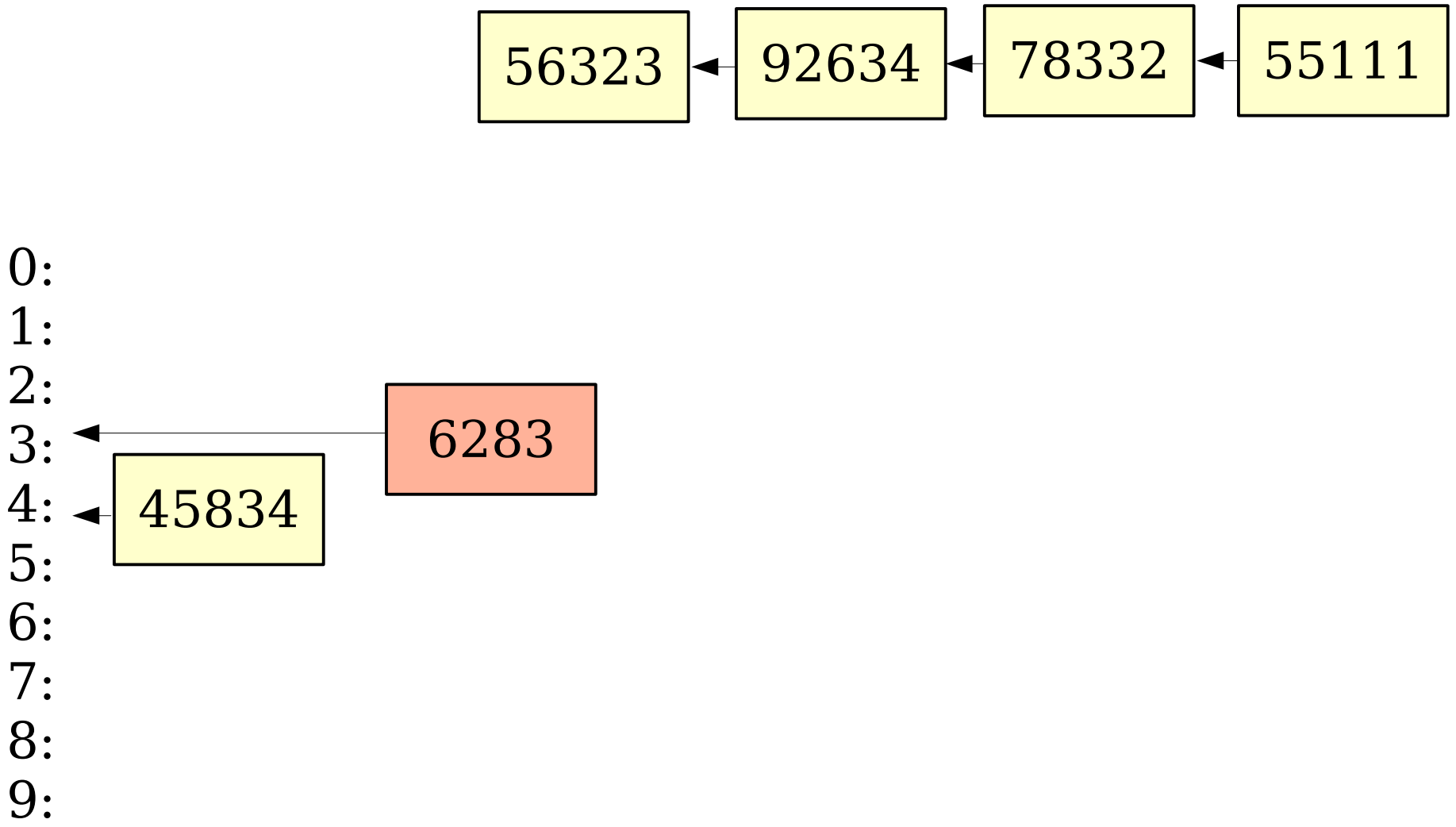

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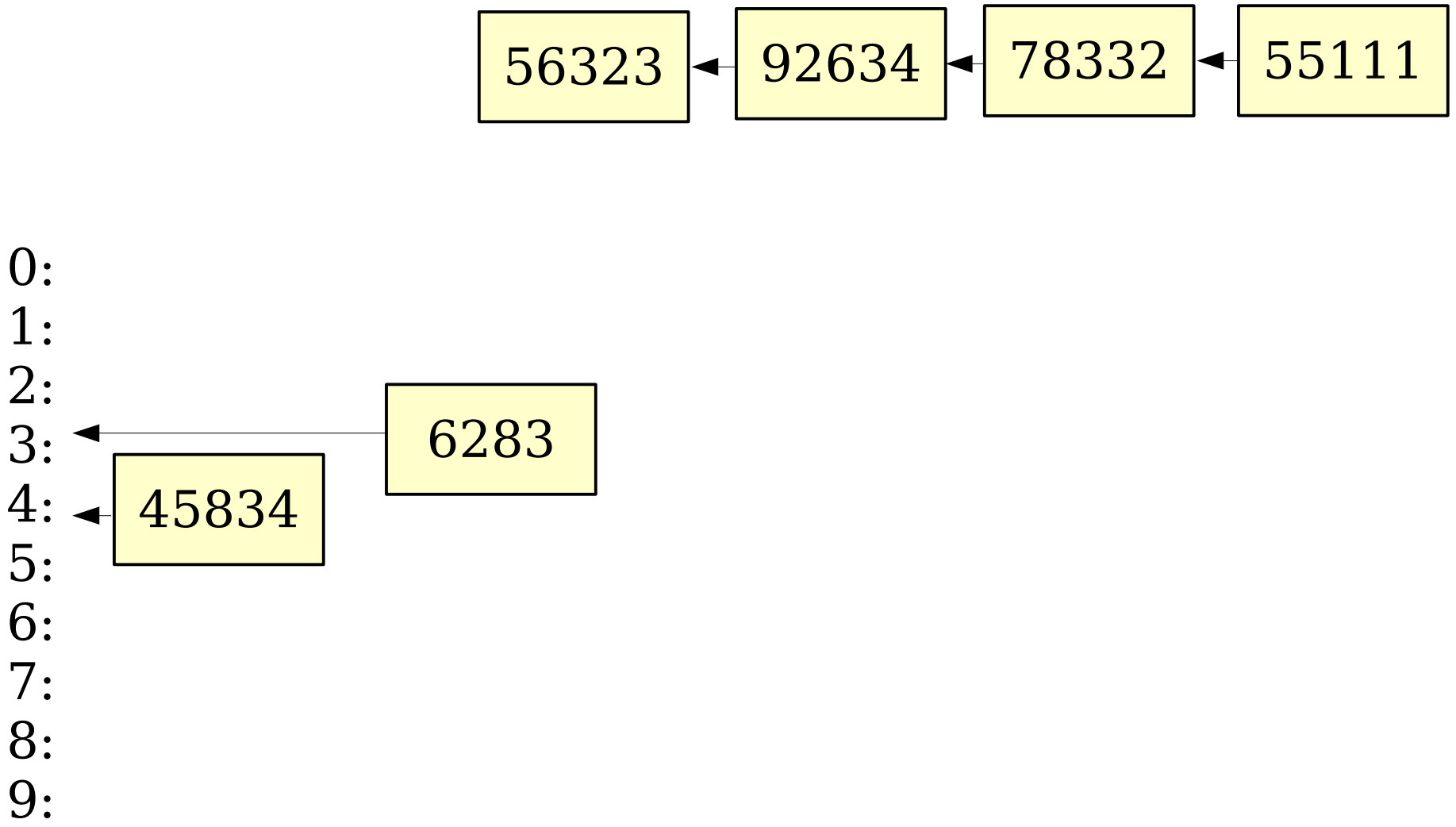

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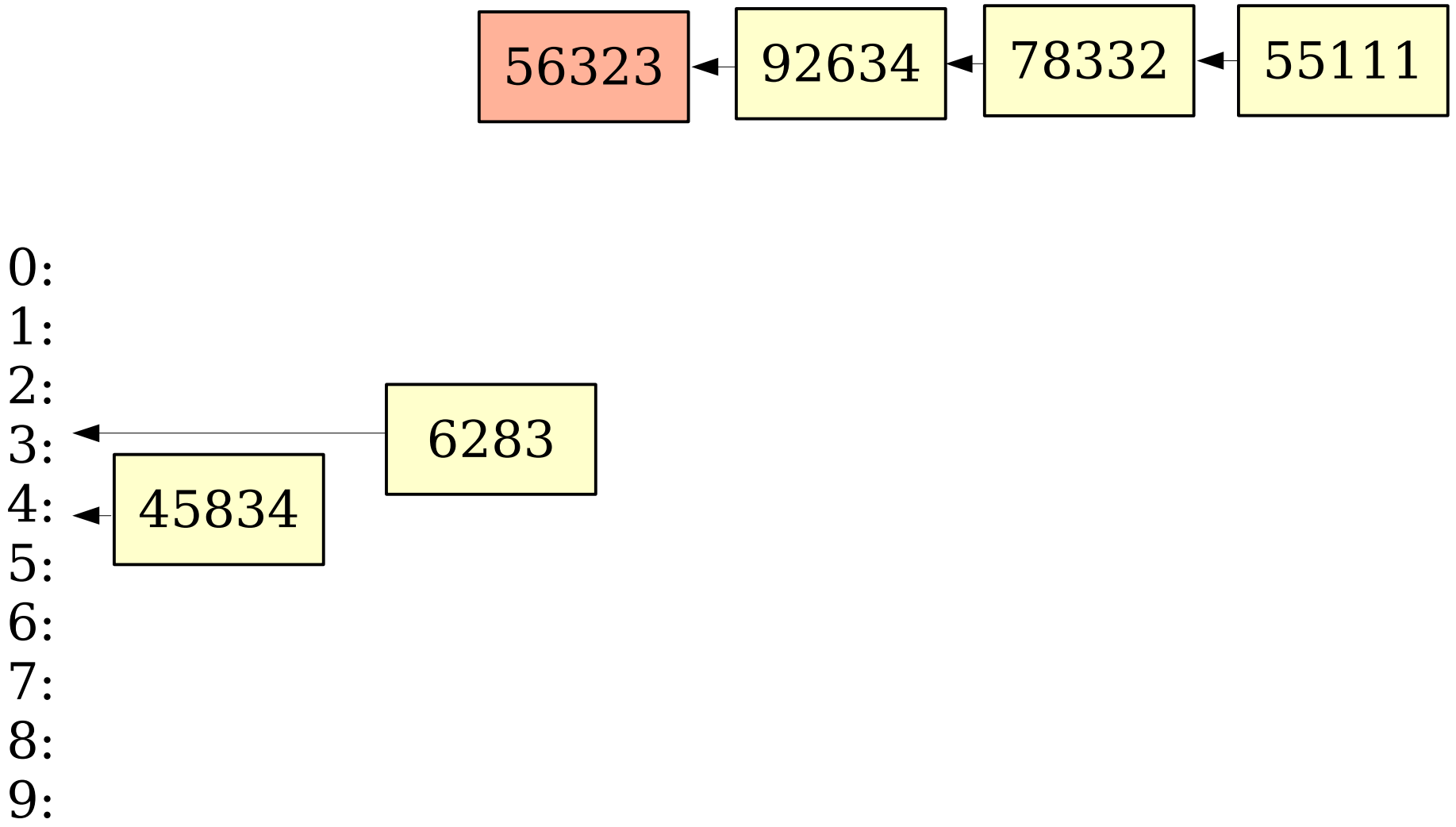

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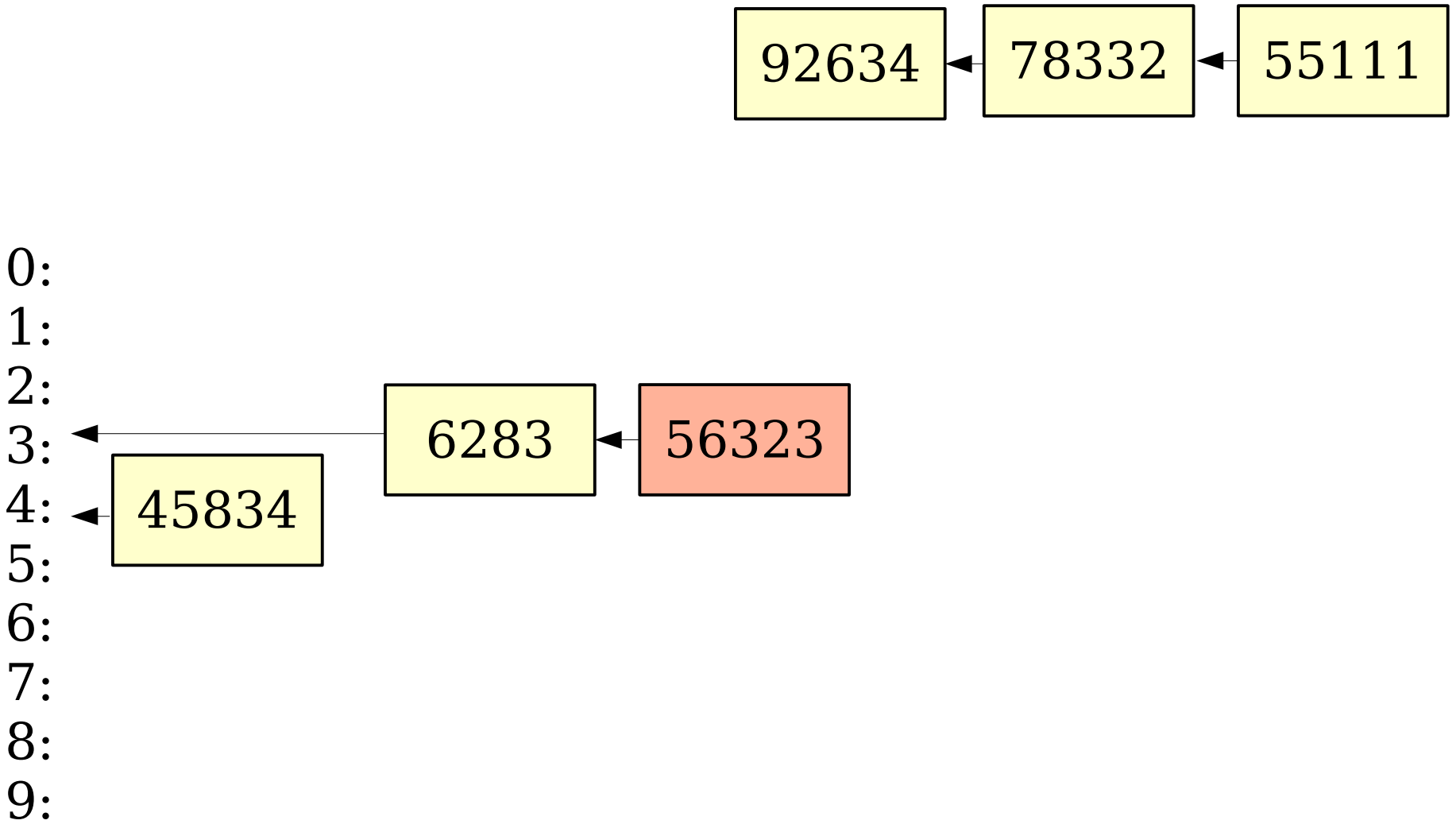

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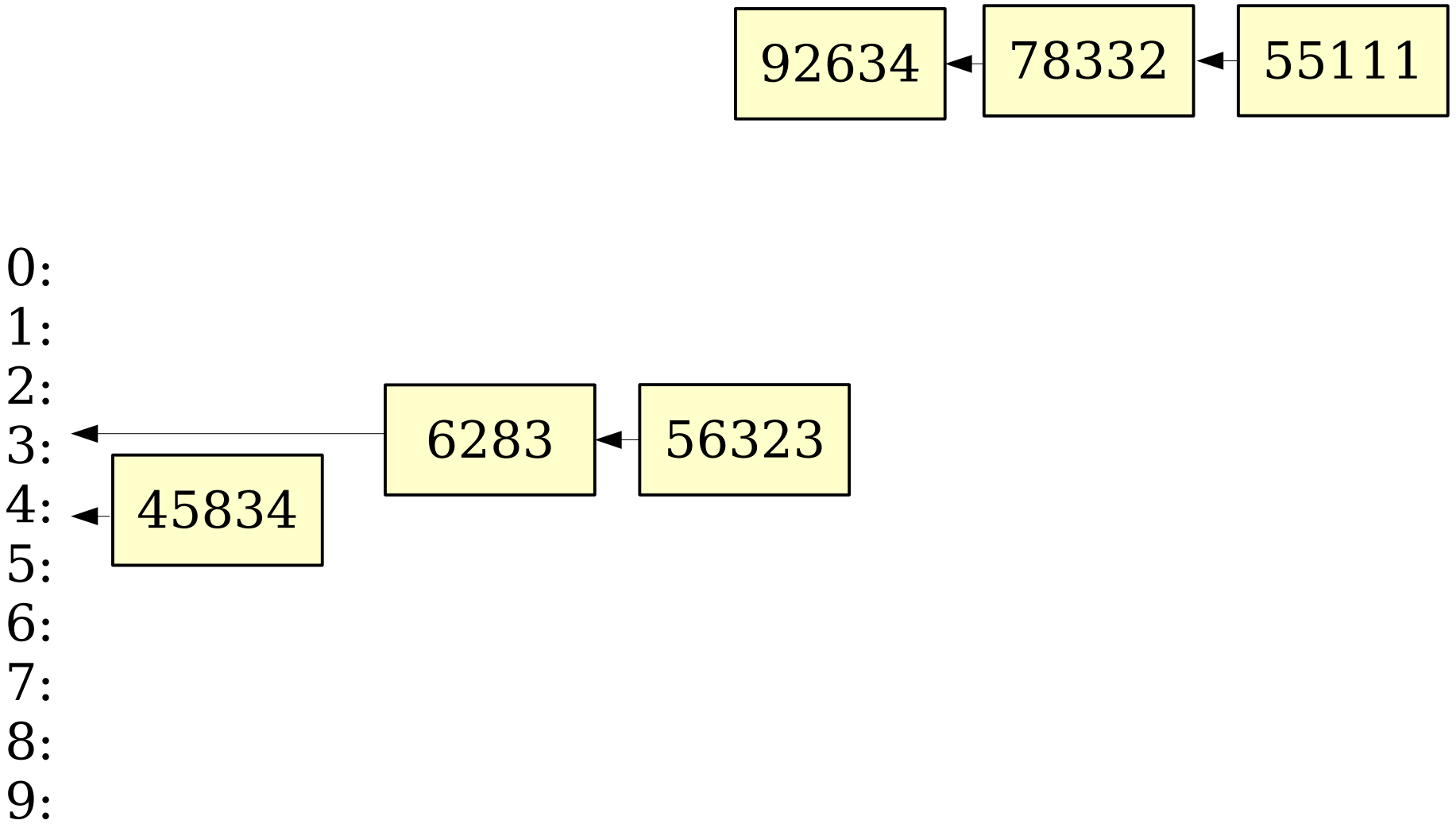

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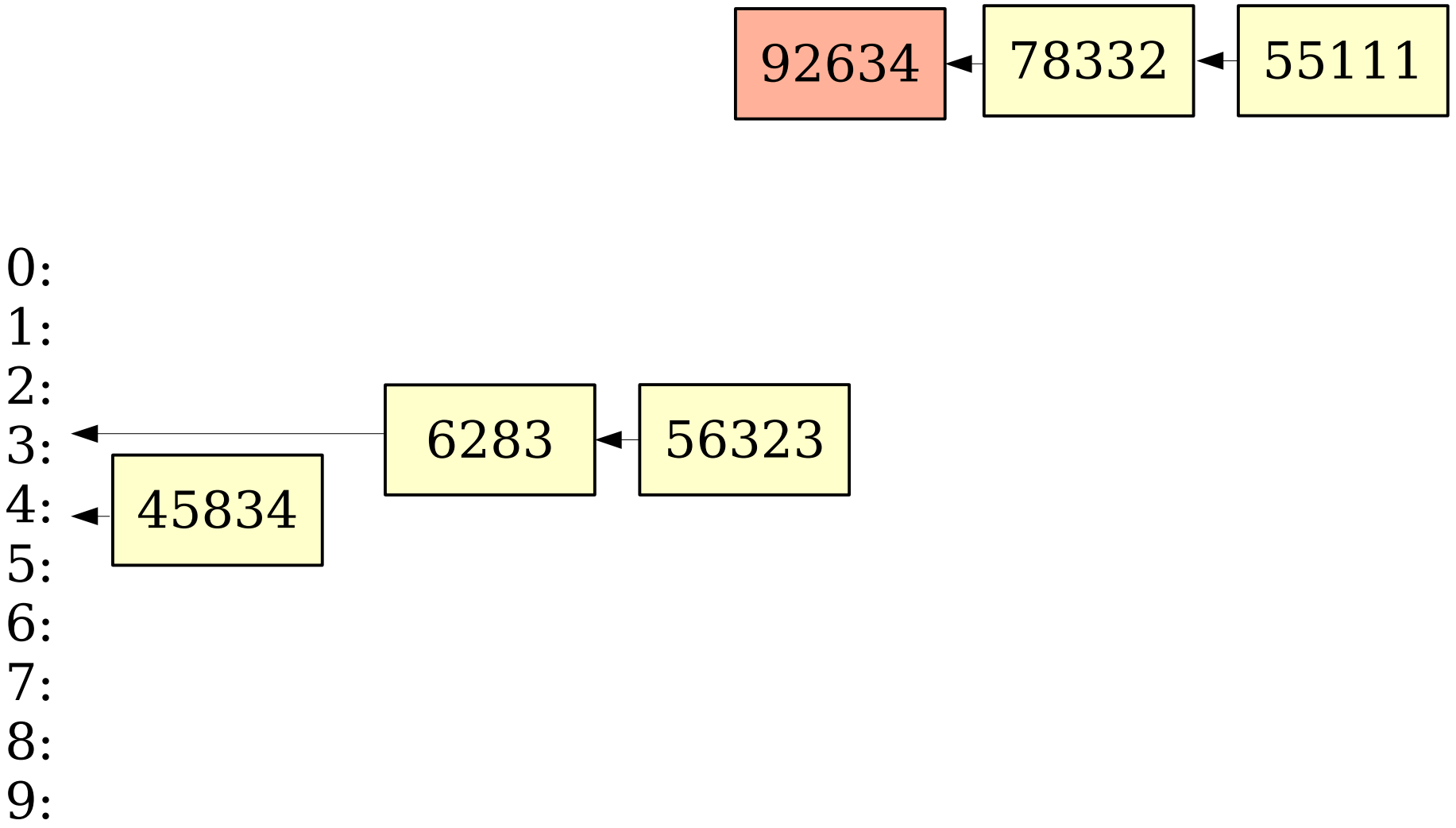

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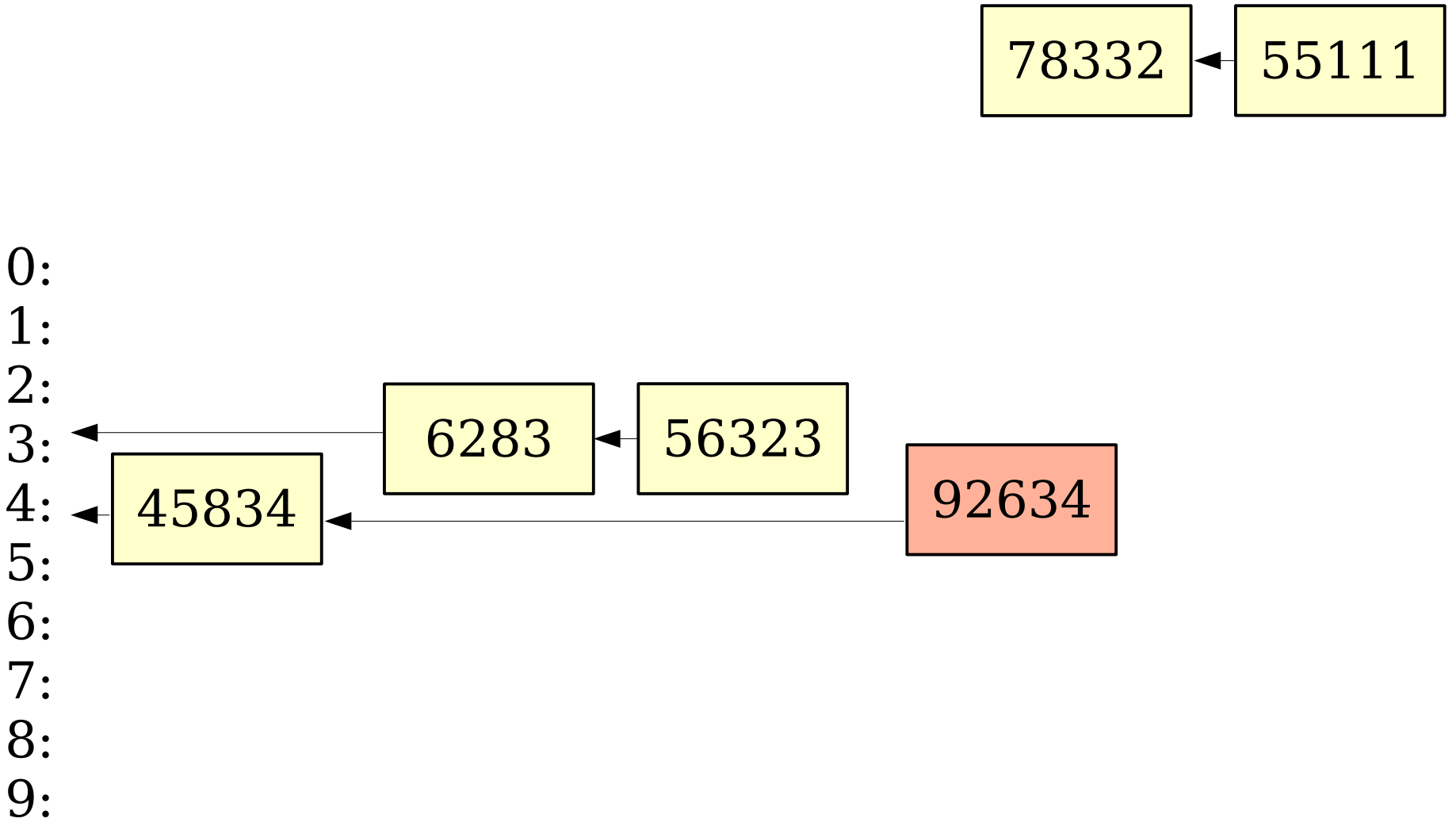

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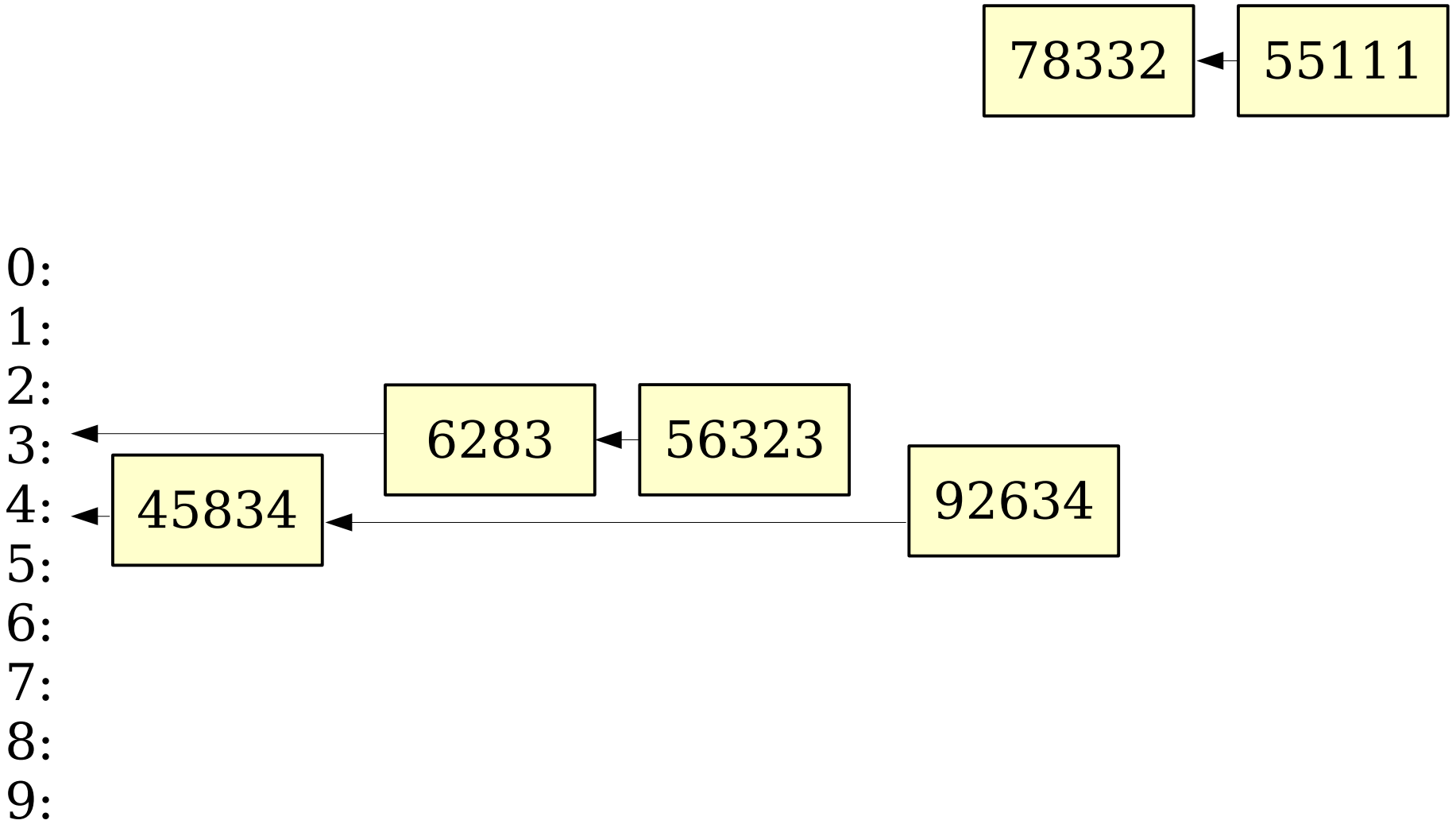
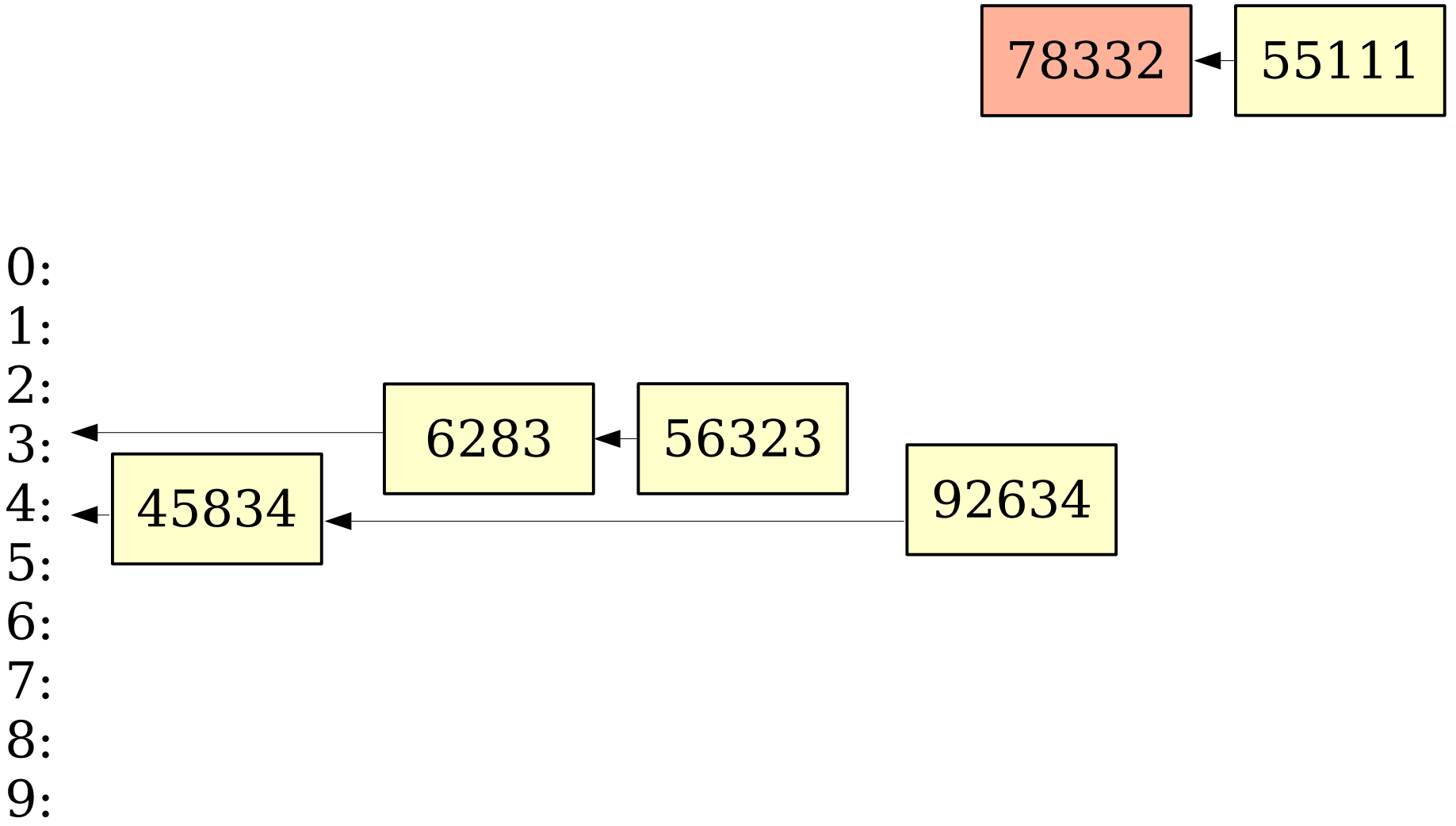
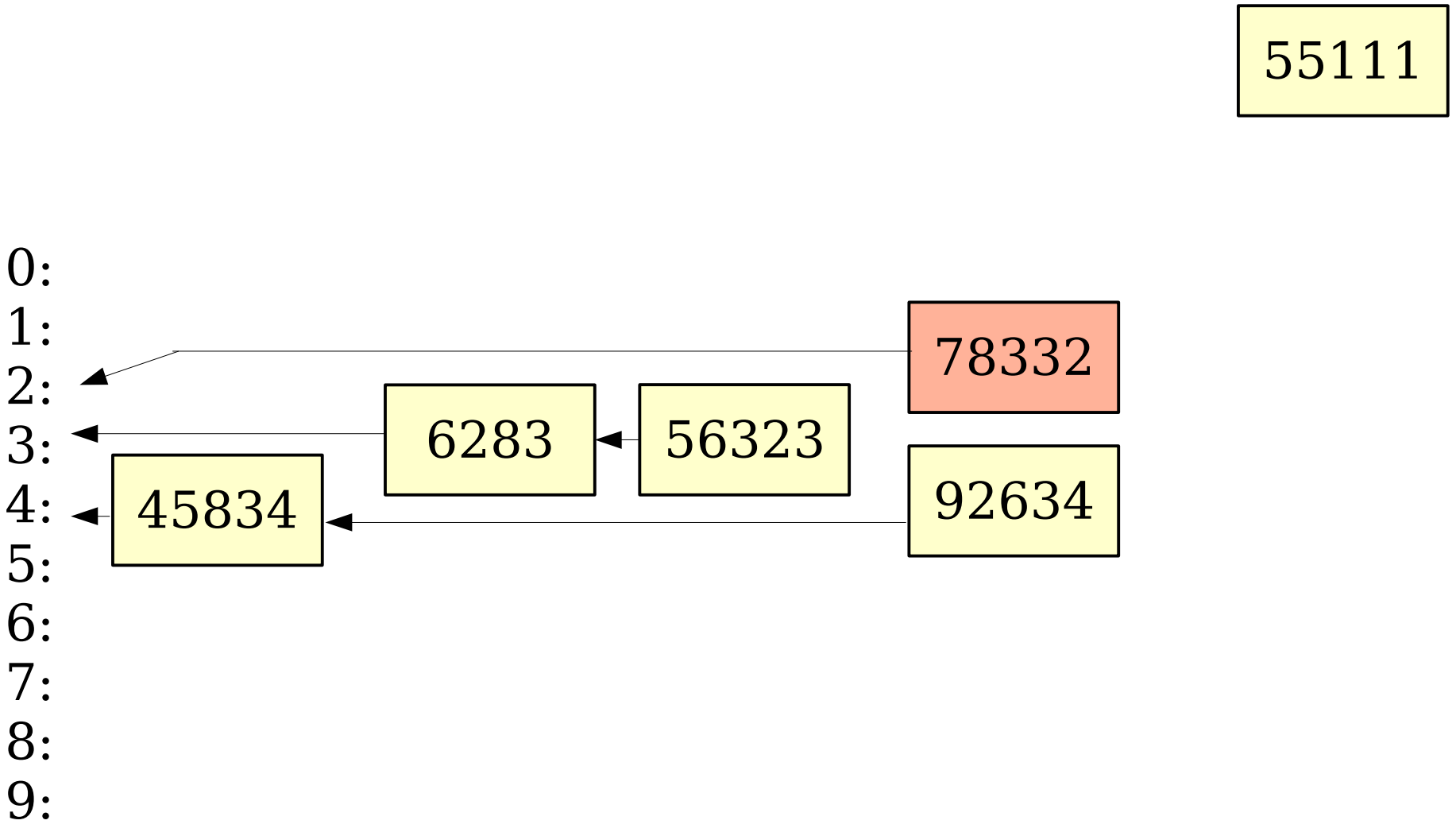


Radix Sort



Radix Sort



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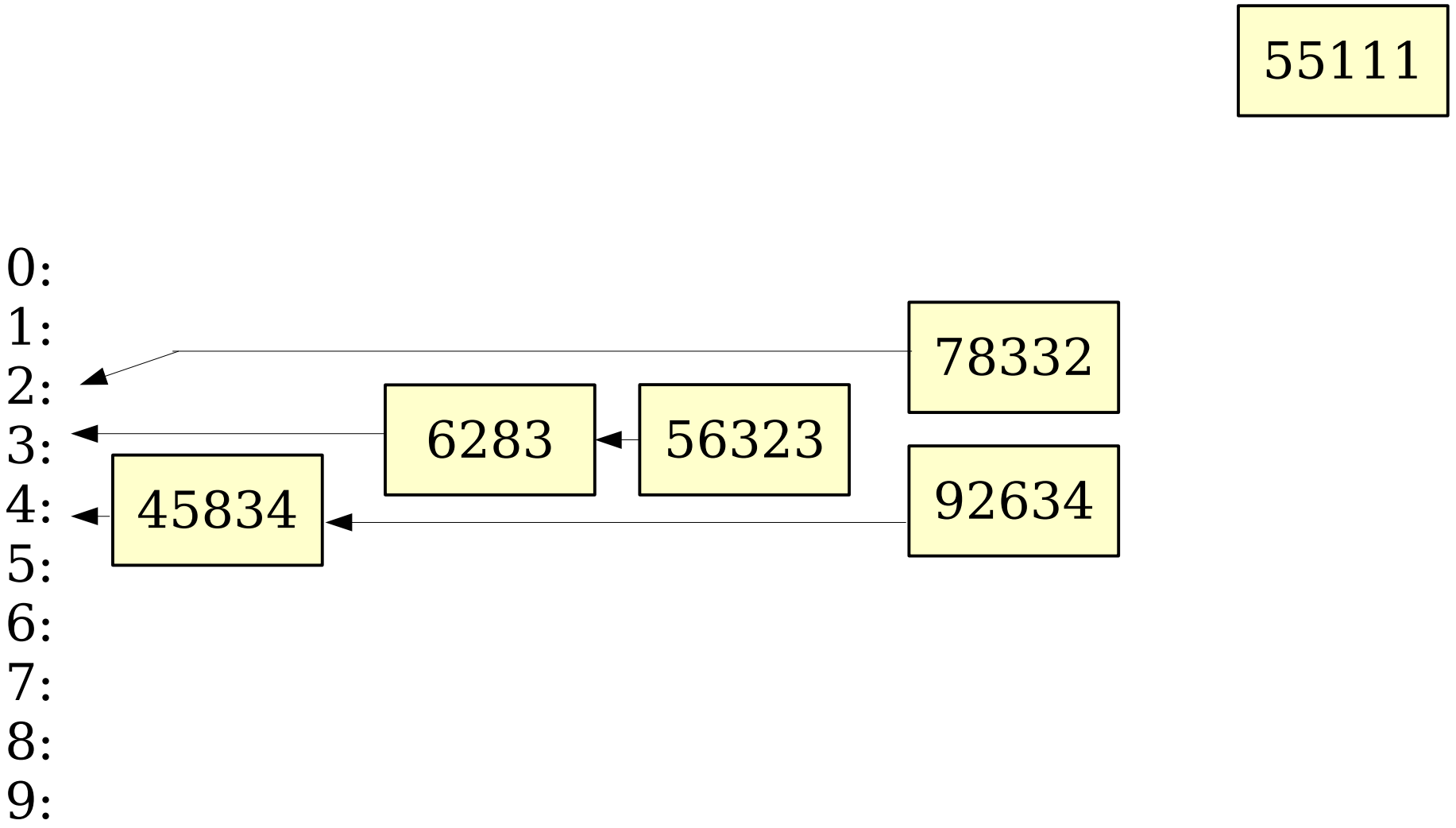
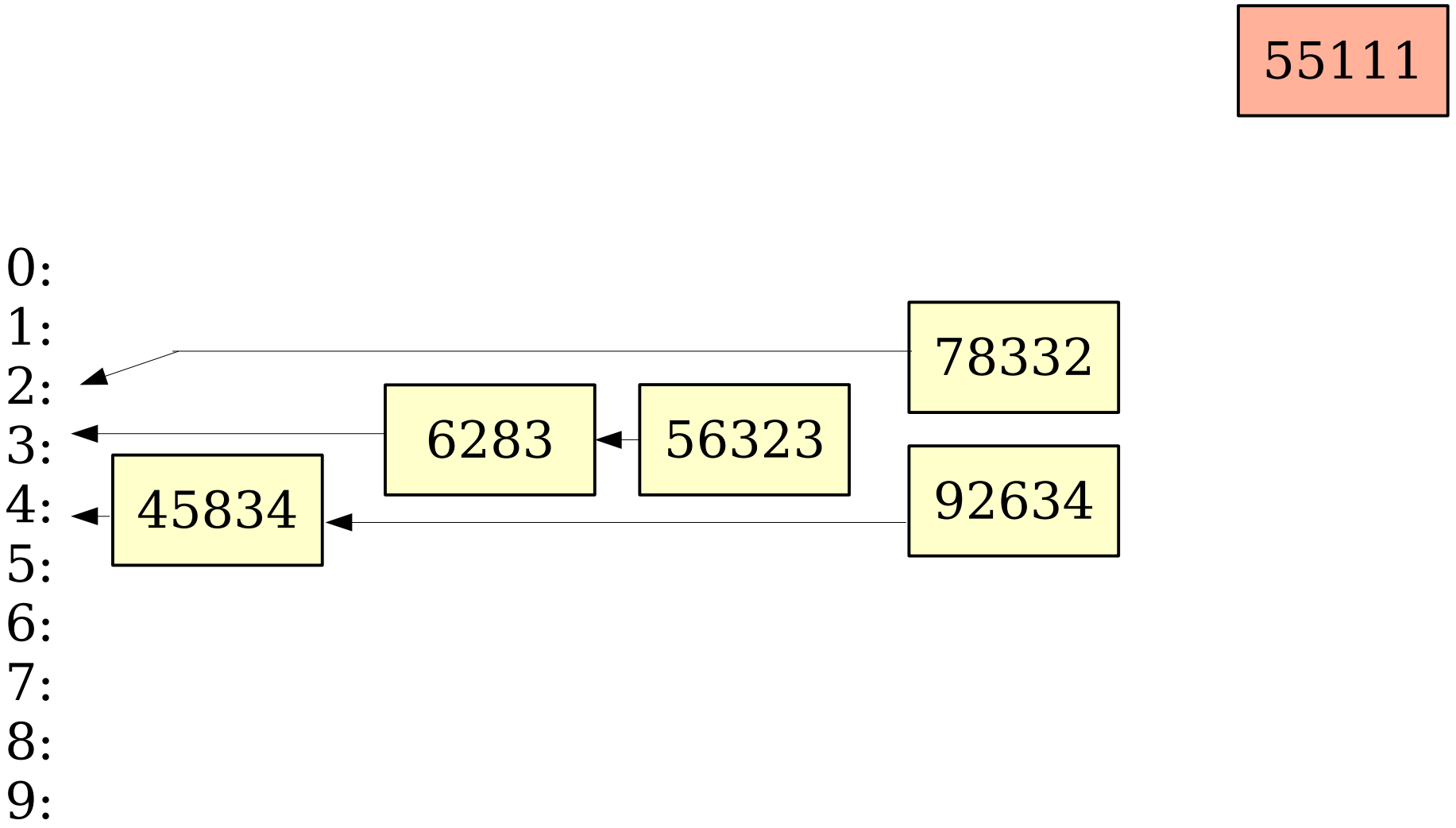


Radix Sort



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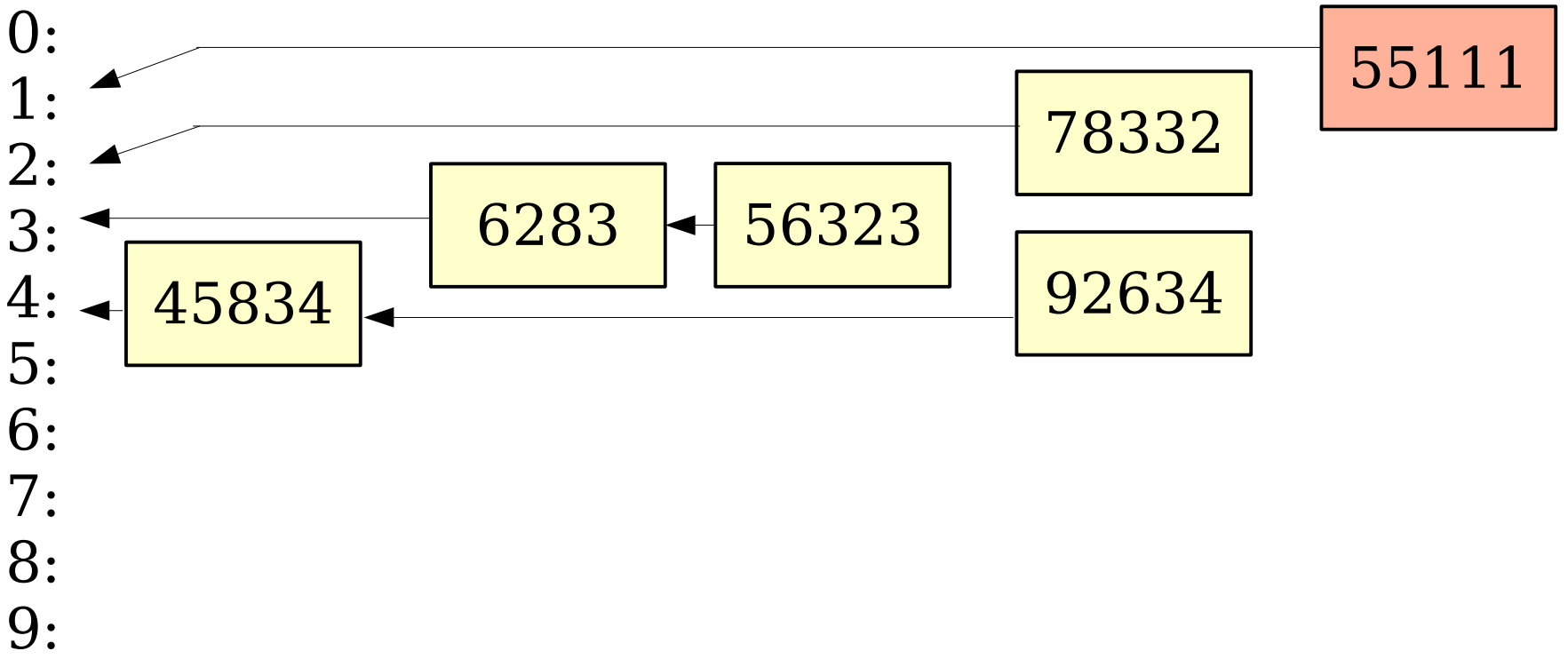

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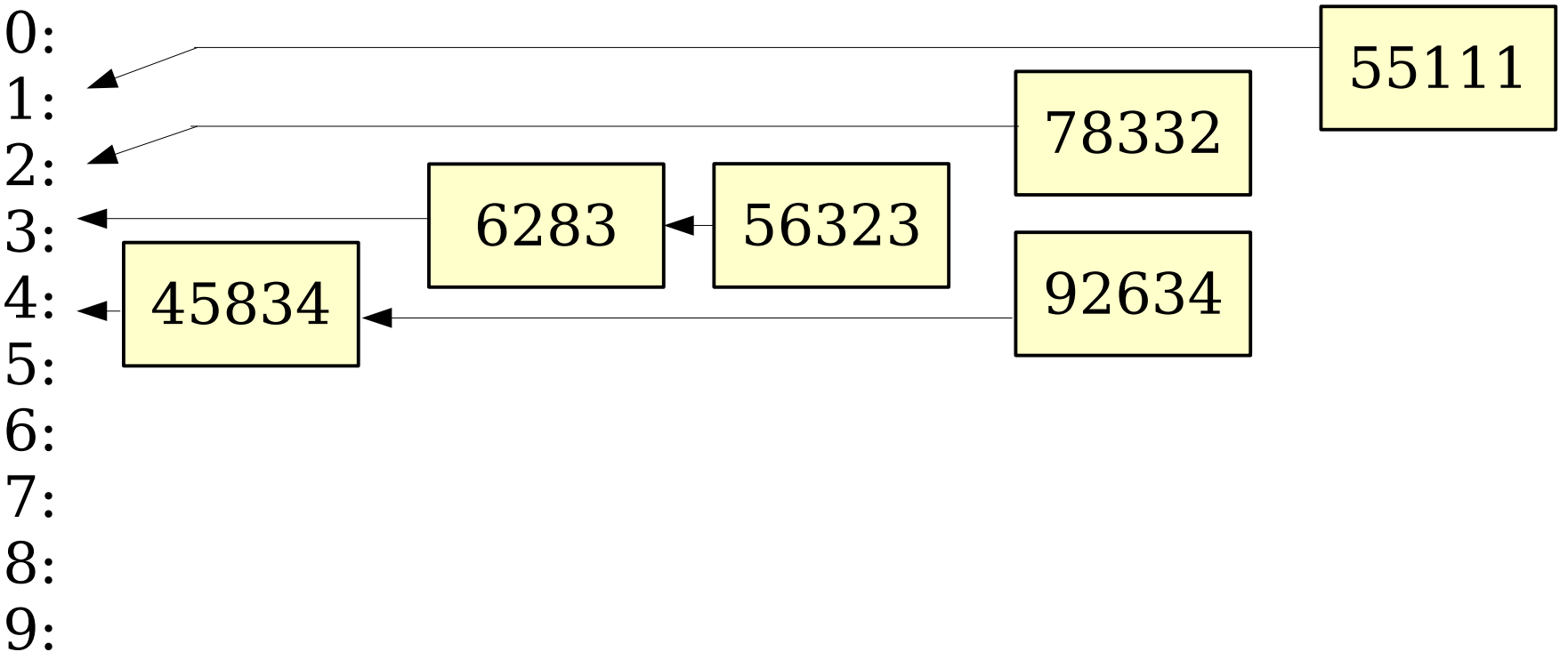

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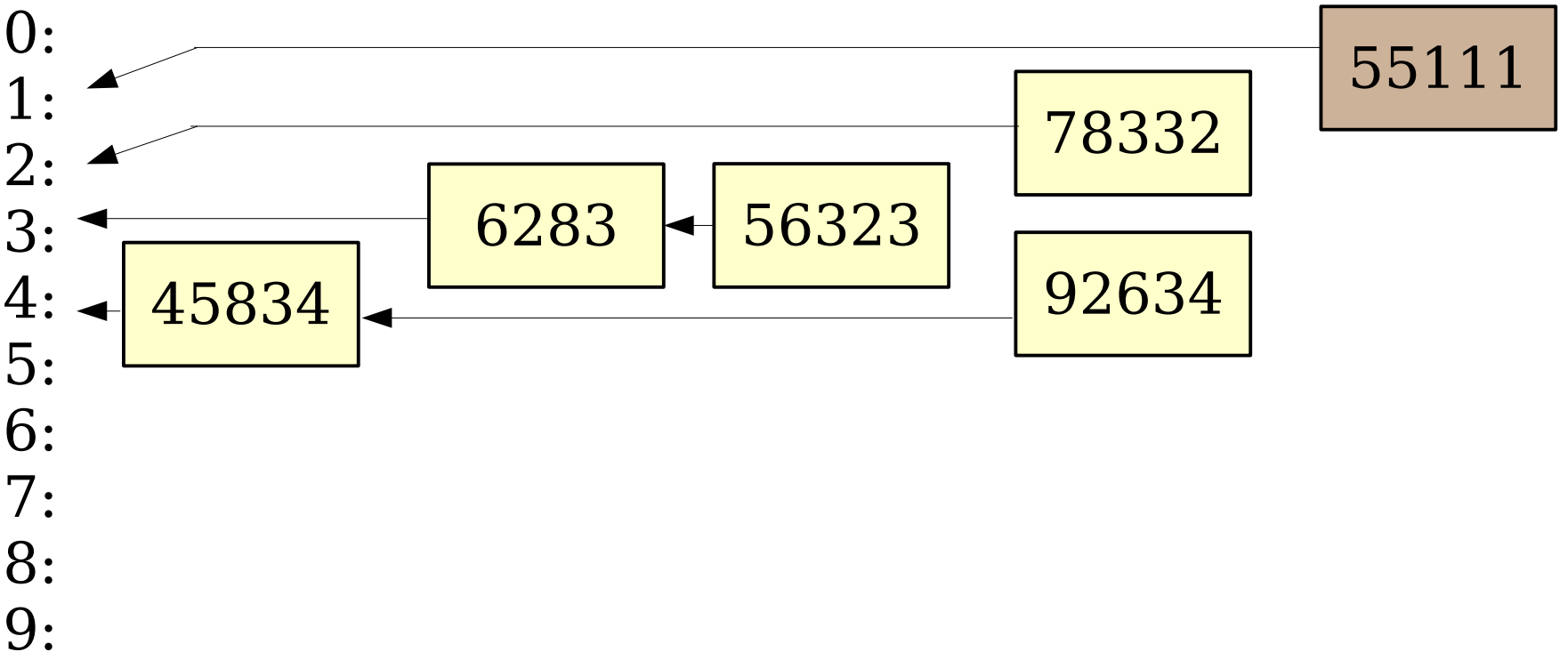

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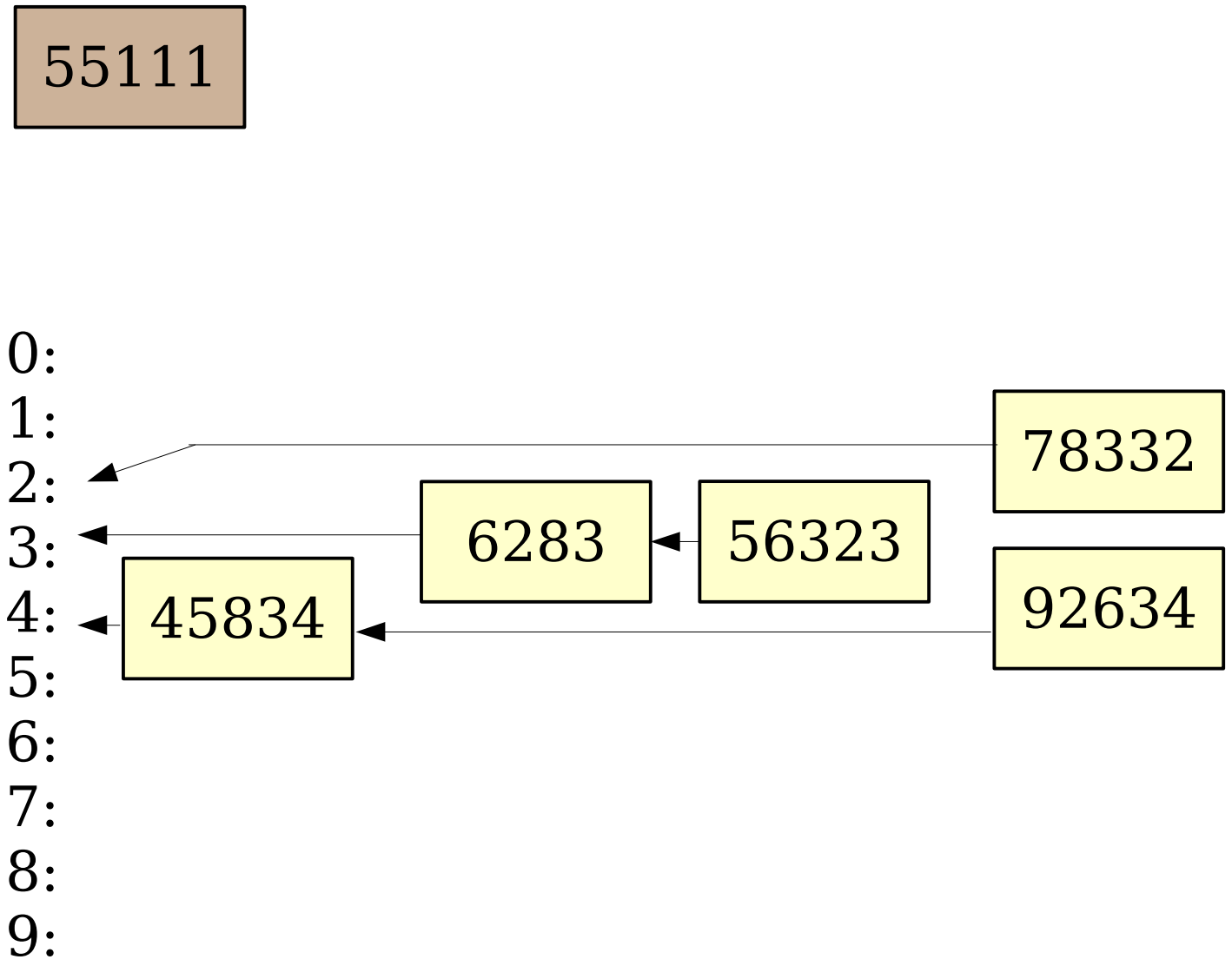

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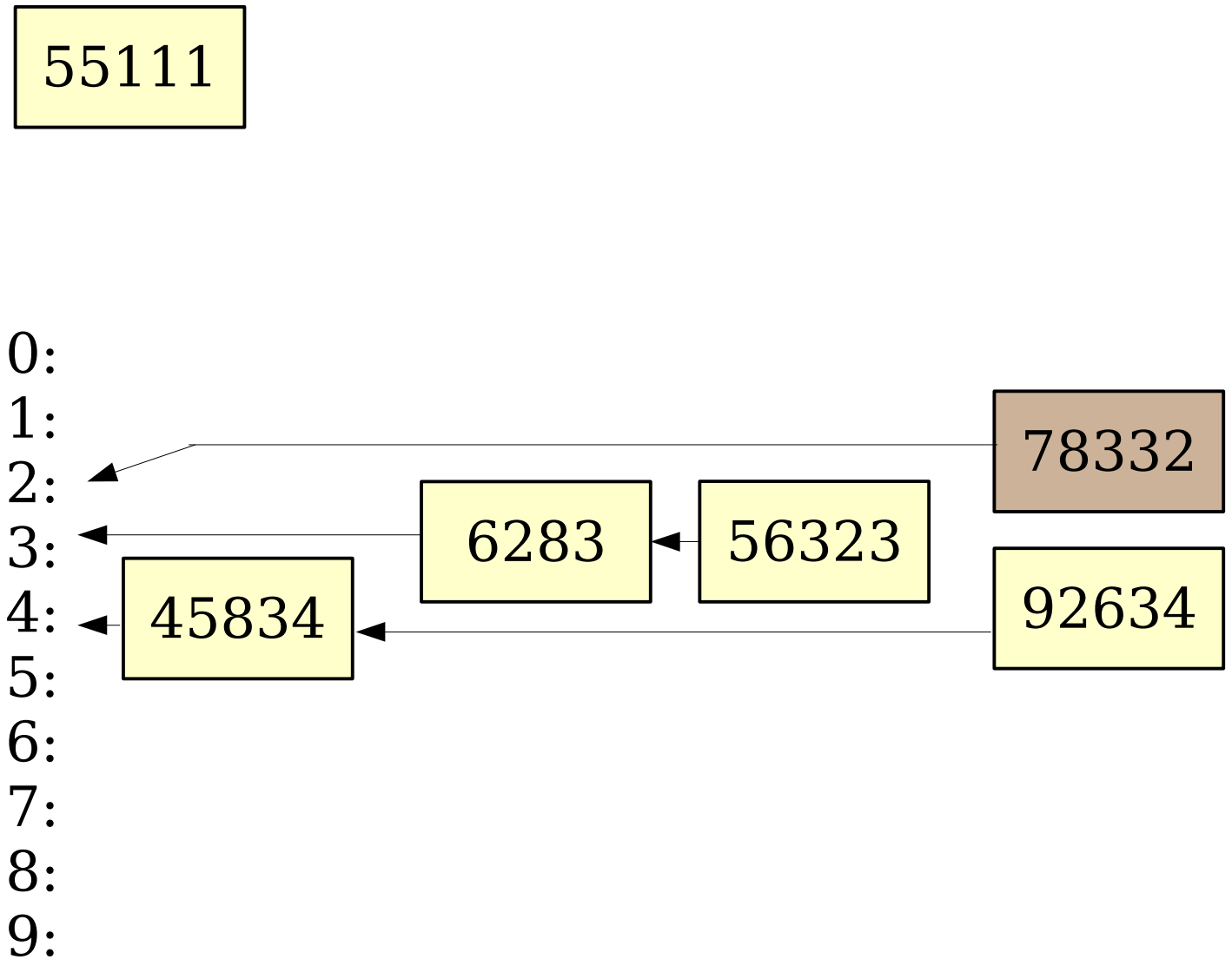

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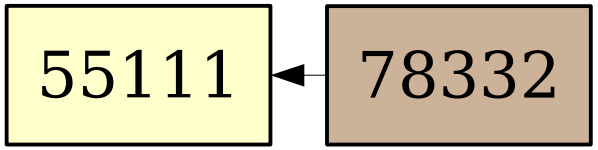

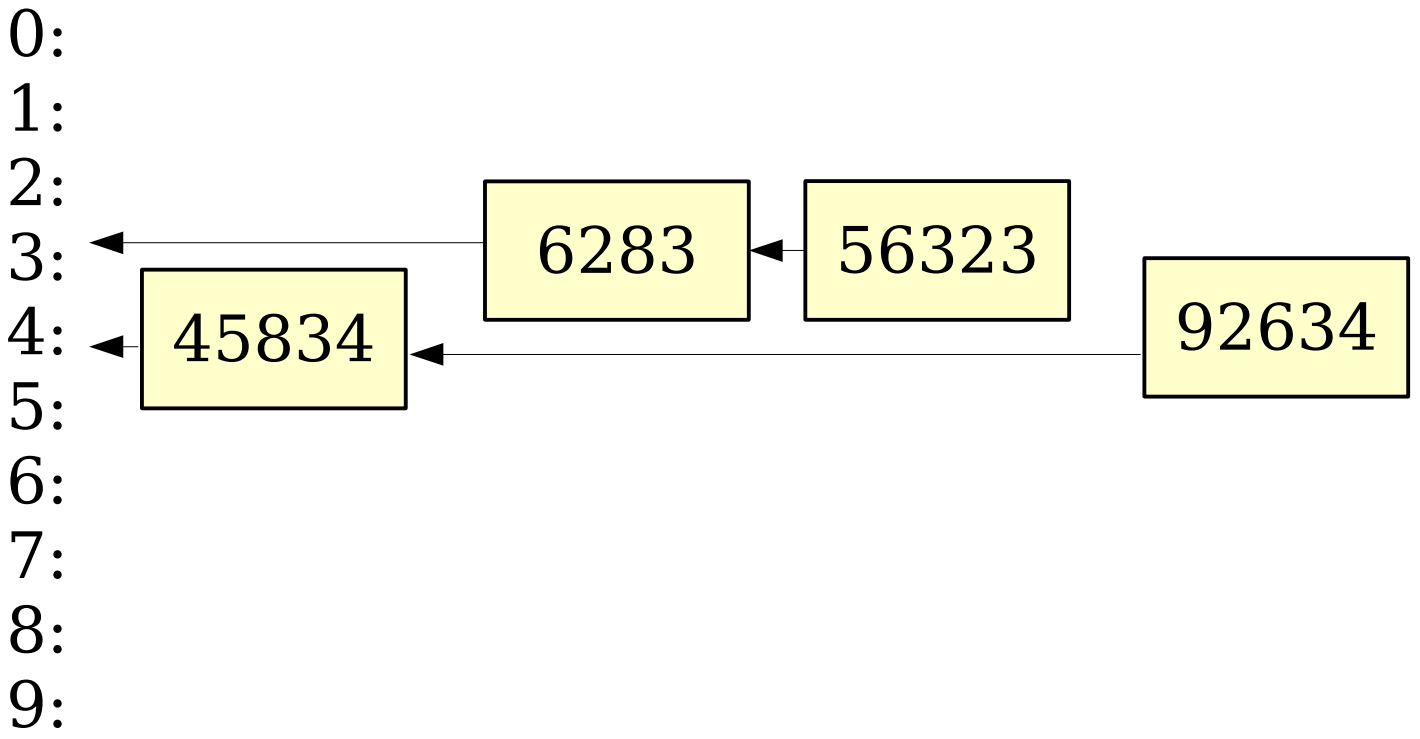

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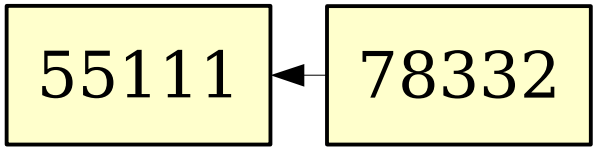

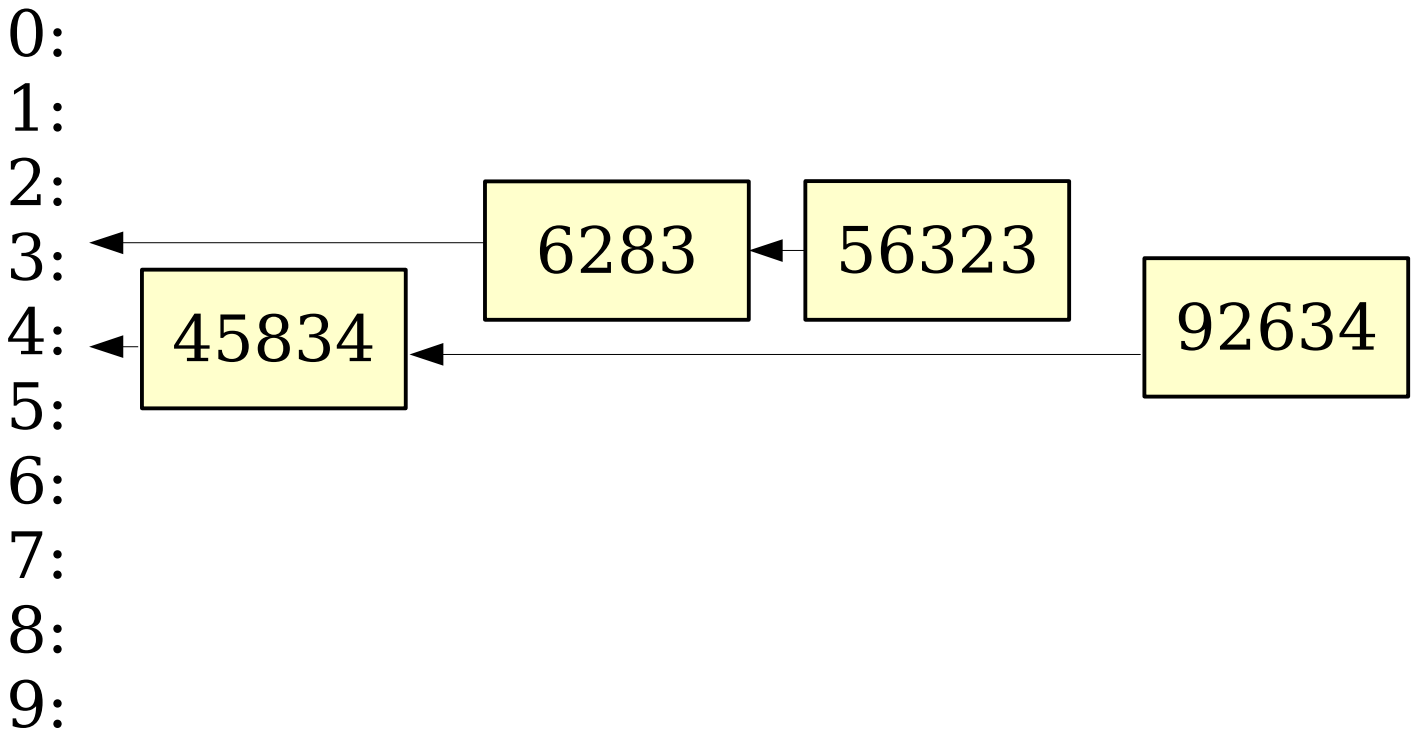

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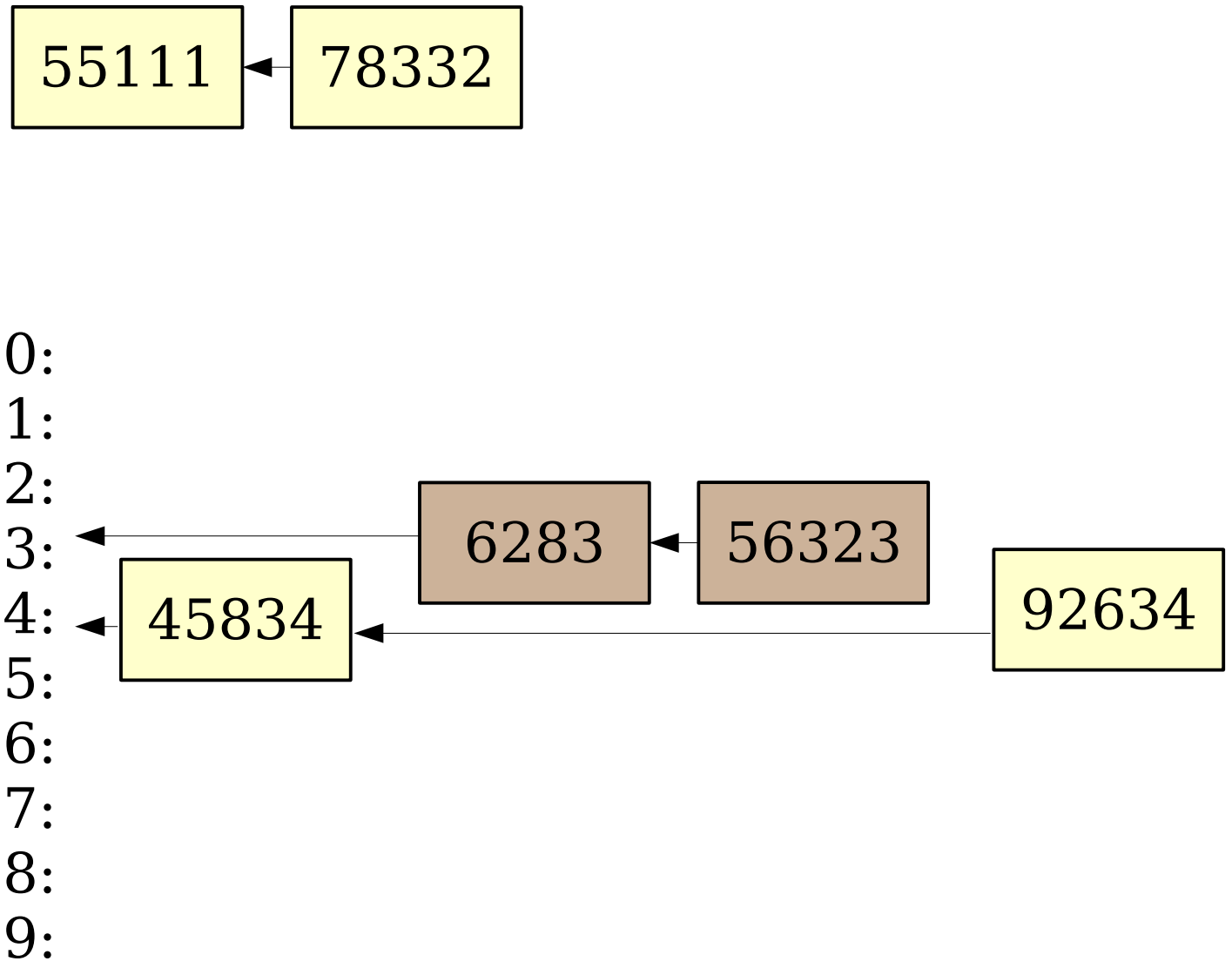

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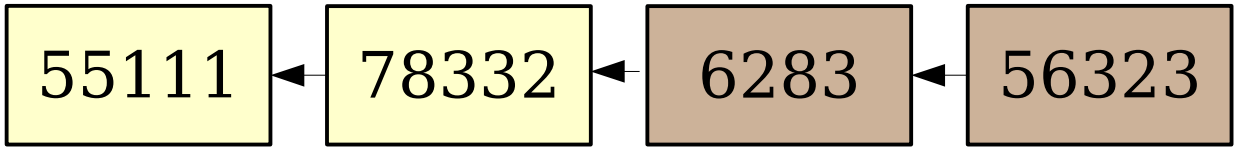

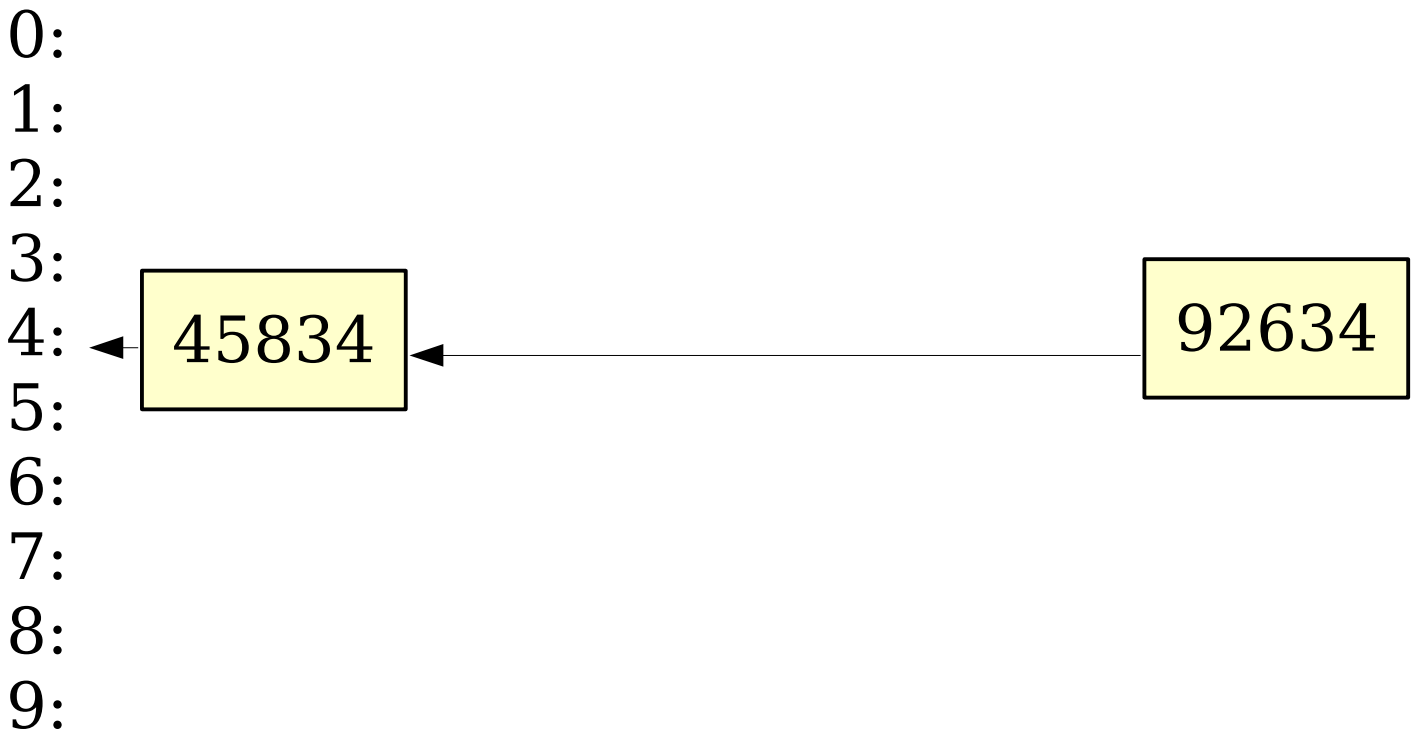

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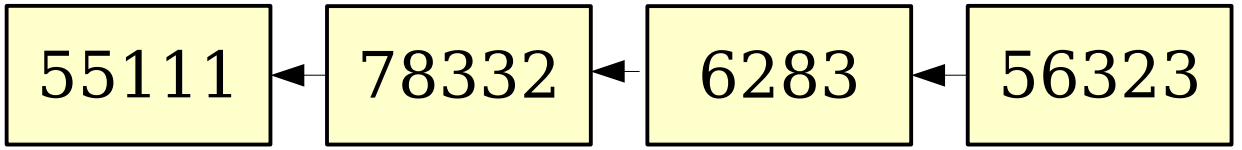

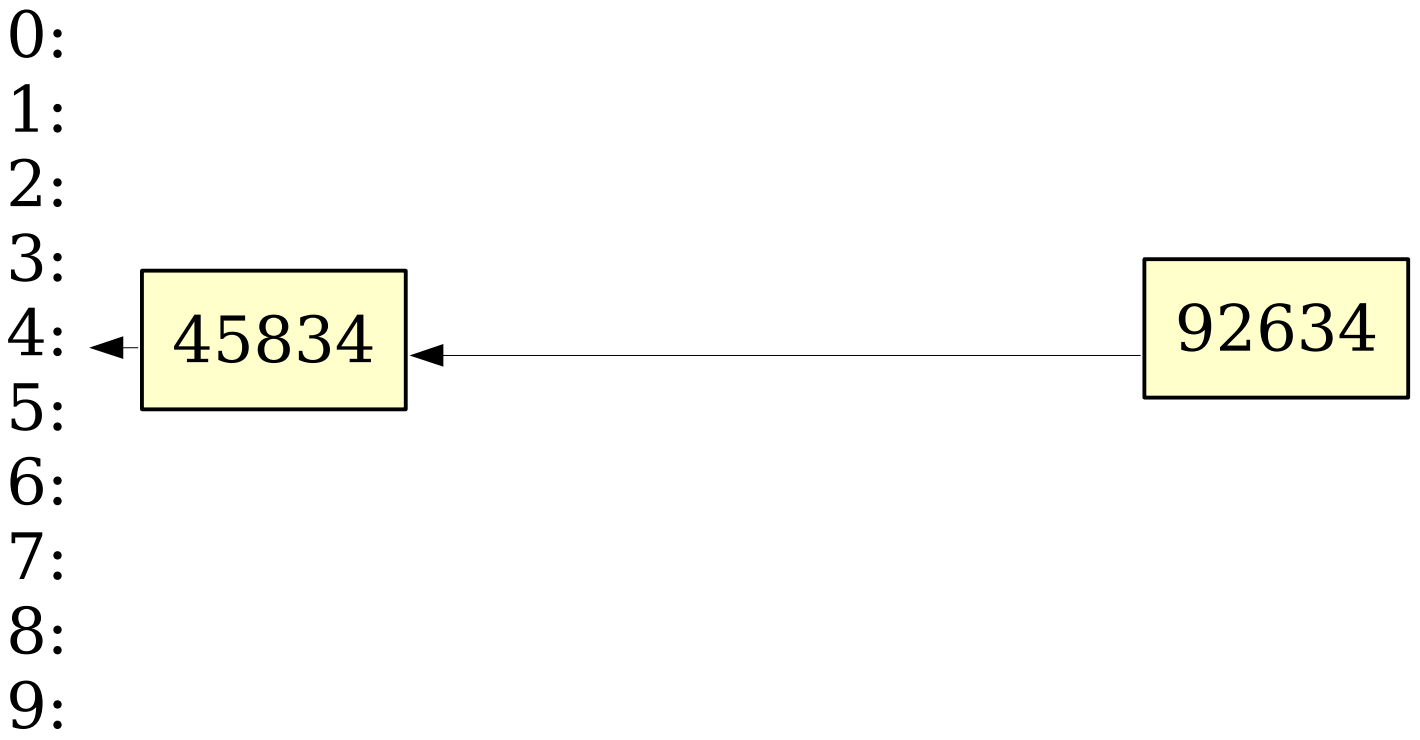

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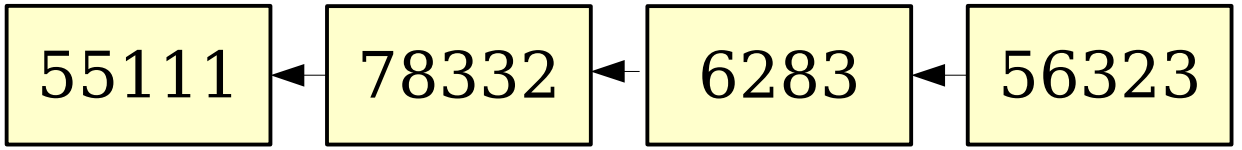

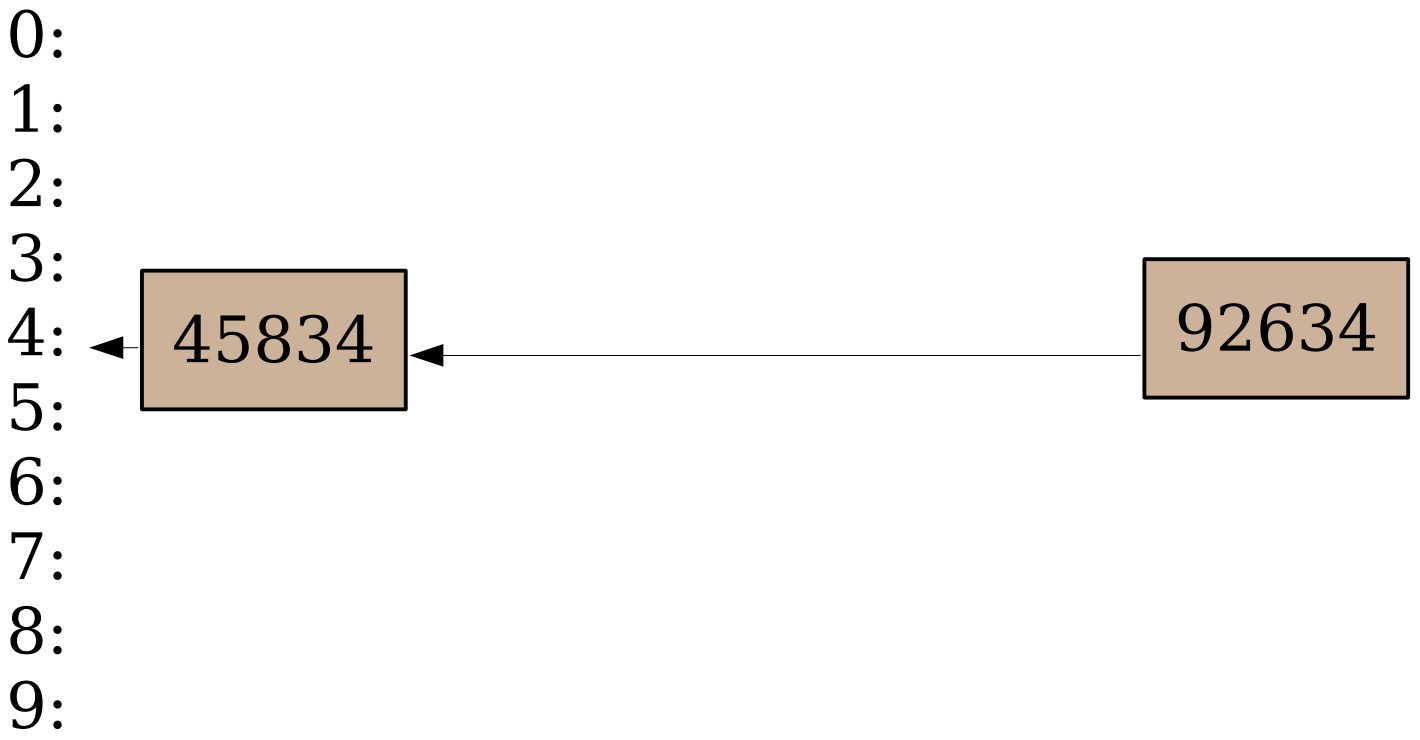

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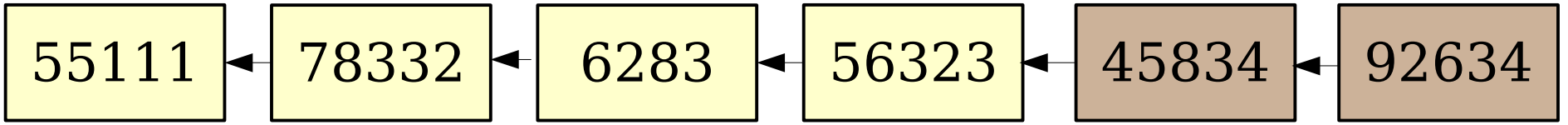

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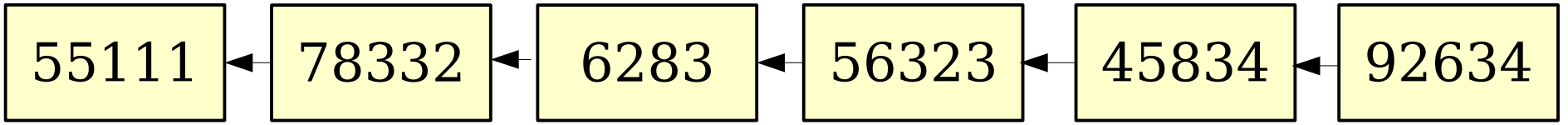

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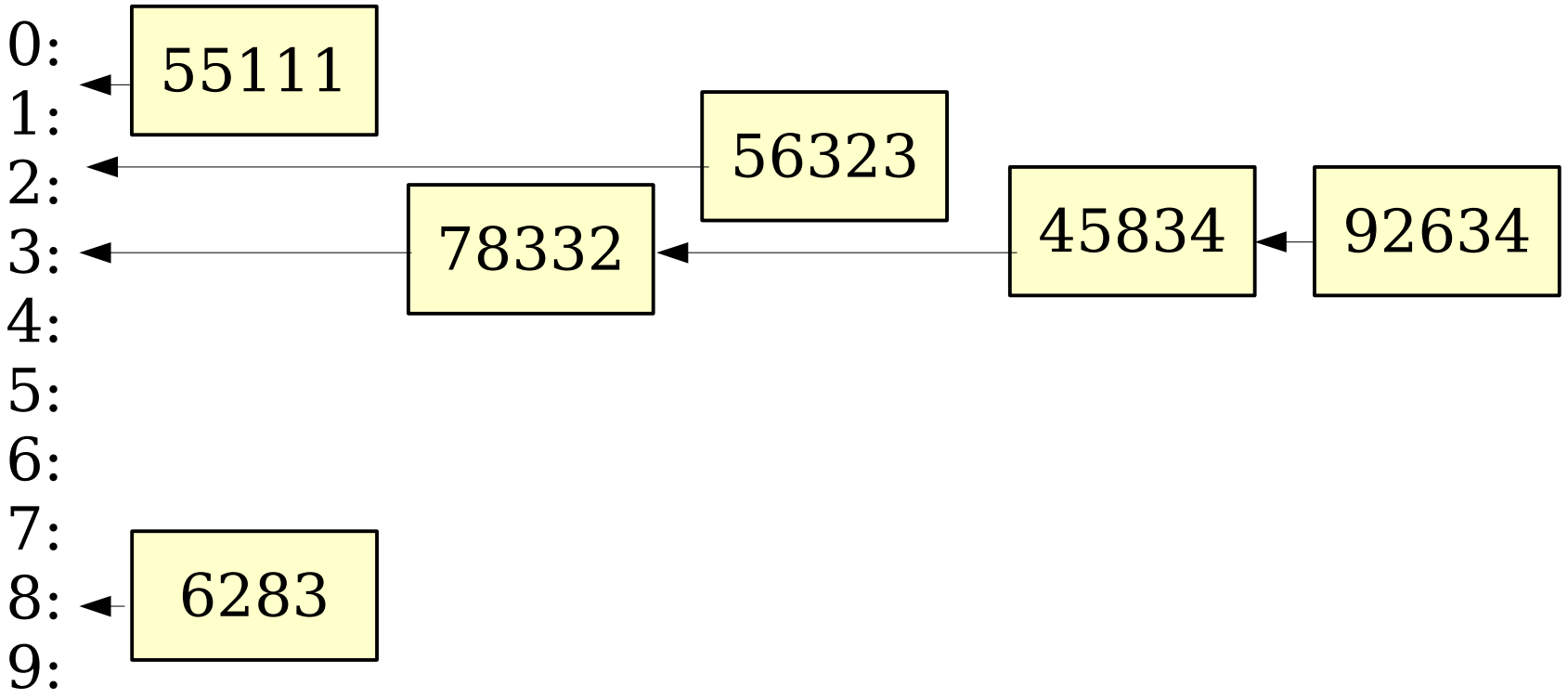

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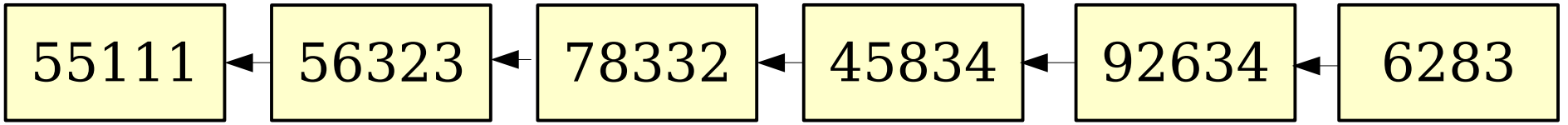

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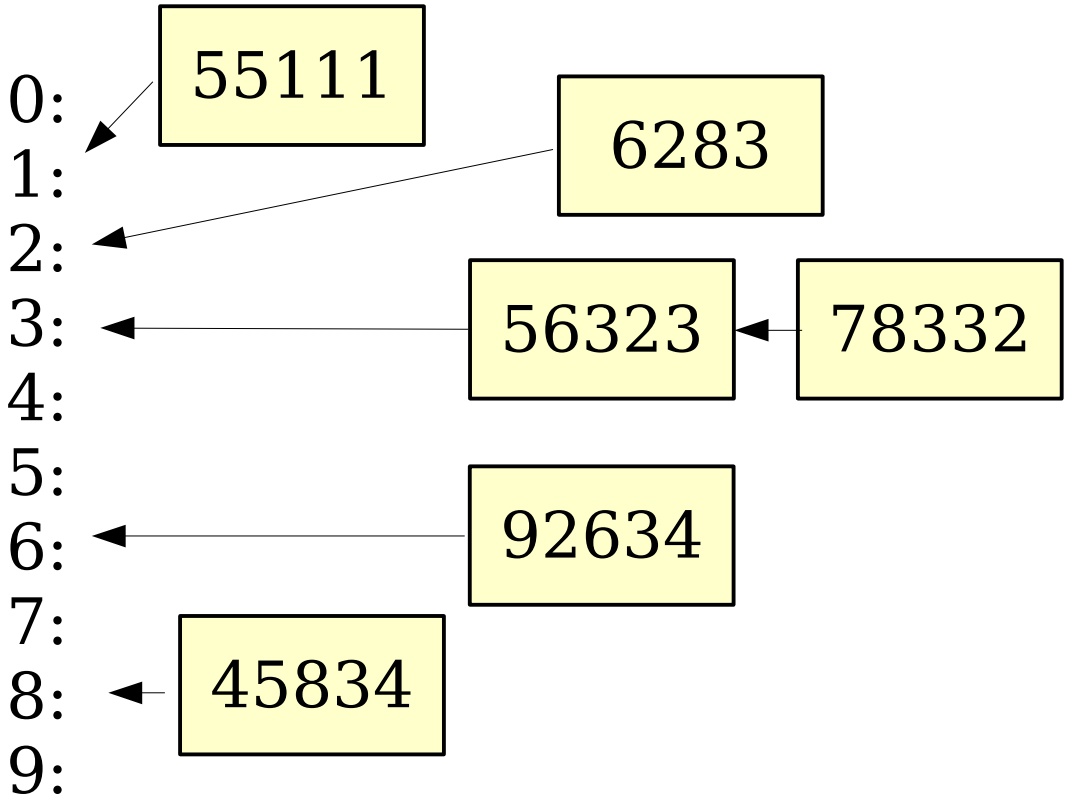

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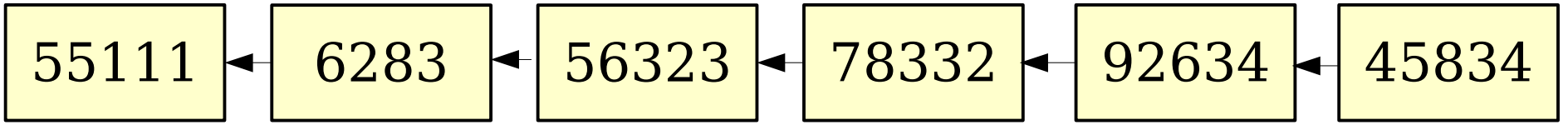

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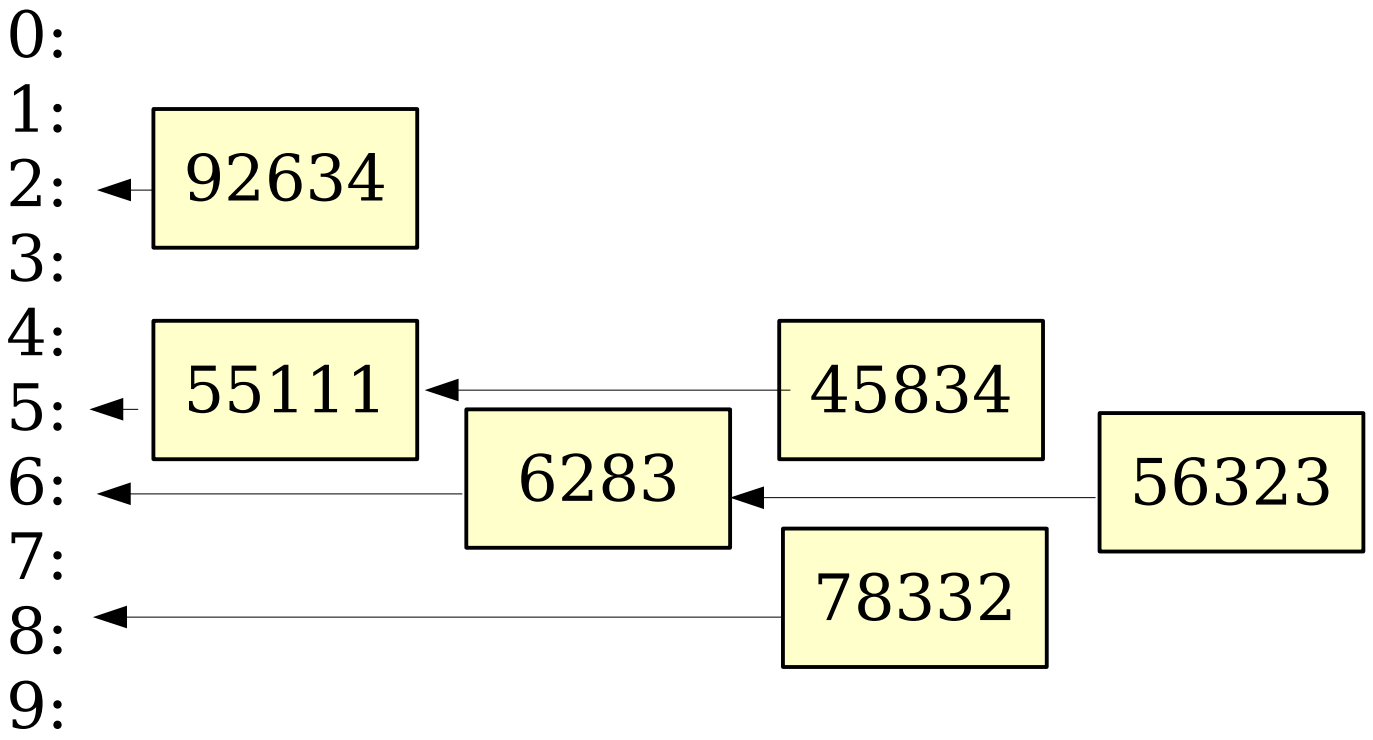

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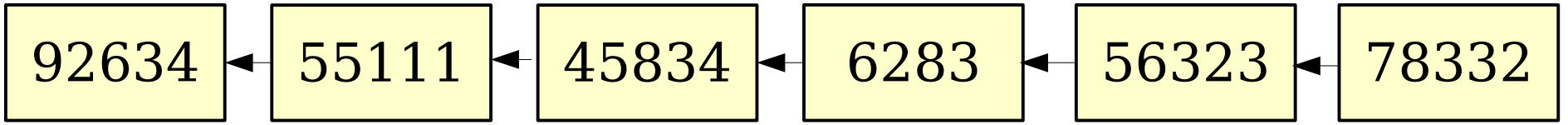

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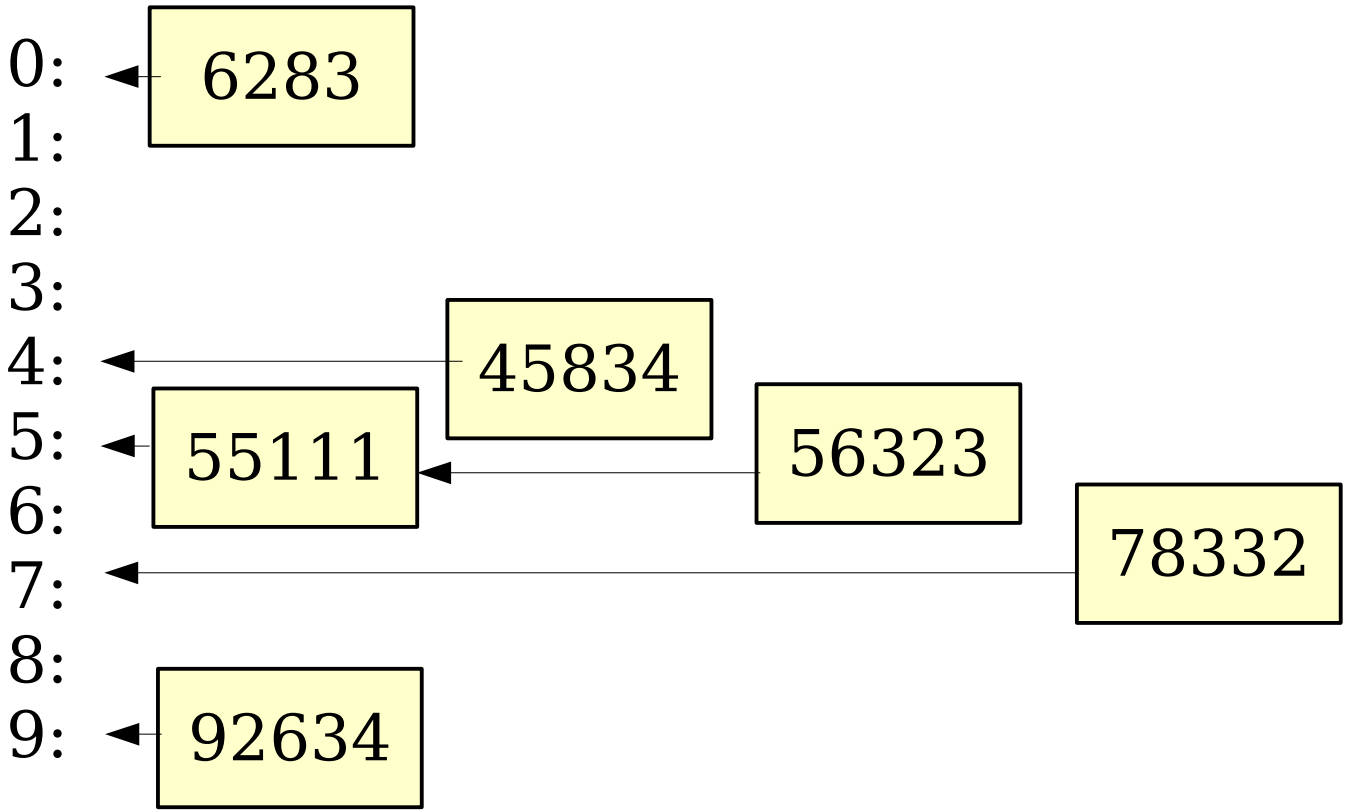
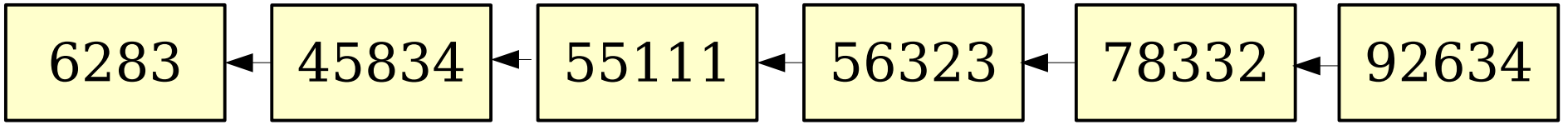


Radix Sort



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Radix Sort

Example shows working from LSD to MSD. Is radix sort correct working from MSD to LSD?

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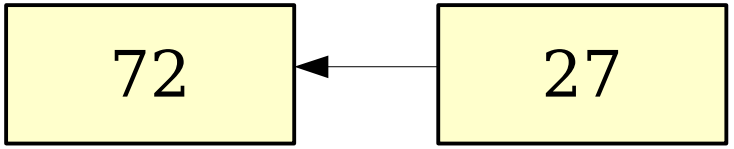
No! Here is a counter-example:



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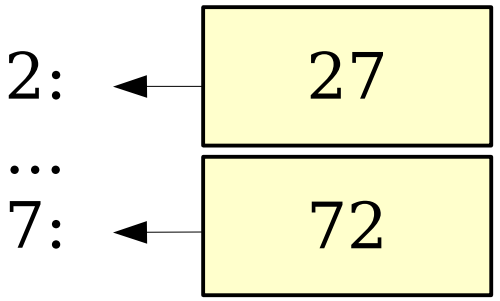

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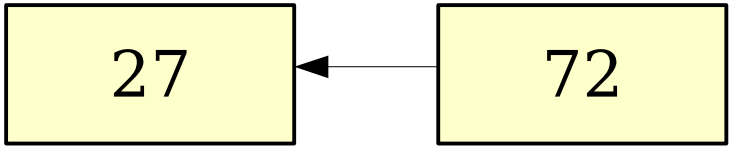

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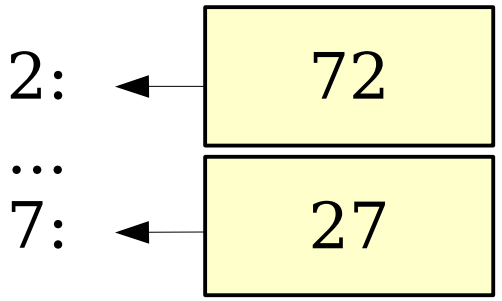
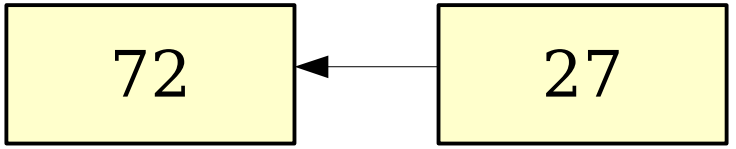


Radix Sort

Example shows working from LSD to MSD. Is radix sort correct working from MSD to LSD?

No! Here is a counter-example - numbers not increasing:



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Can we prove that radix sort is correct when working from LSD to MSD?

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Base step: After 1^{st} step – all numbers in order on LSD

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Base step: After 1^{st} step – all numbers in order on LSD

Induction step: suppose (P) after k^{th} step that all numbers are in non-decreasing order on k least significant digits.

Radix Sort

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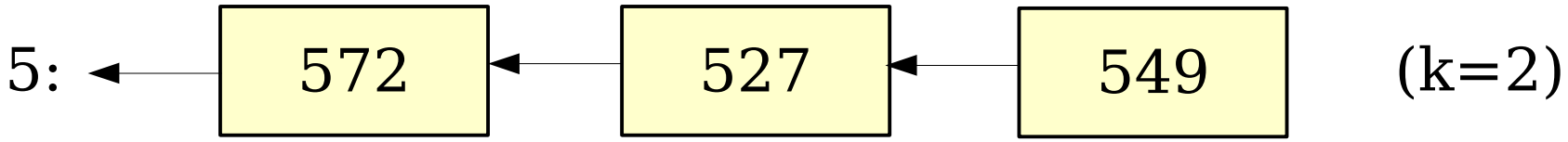
Yes! By induction on the digit being sorted

Base step: After 1^{st} step – all numbers in order on LSD

Induction step: suppose (P) after k^{th} step that all numbers are in non-decreasing order on k least significant digits. Consider a queue on the $k+1^{st}$ step where at least two numbers are out of order in the k least significant digits. For example,



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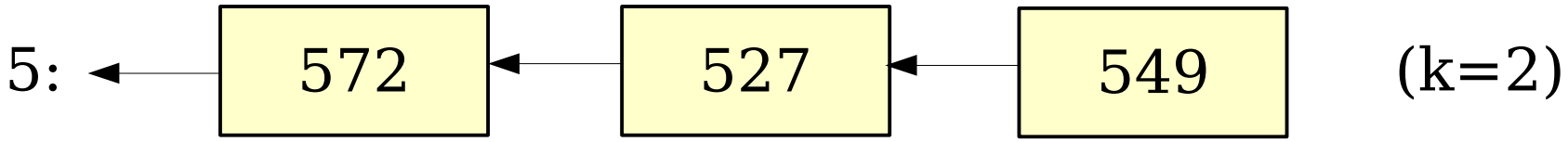


The numbers in that queue are in the same order they were in the list following the k^{th} step. But that is a violation of (P). Hence, all numbers in a queue are in non-decreasing order.

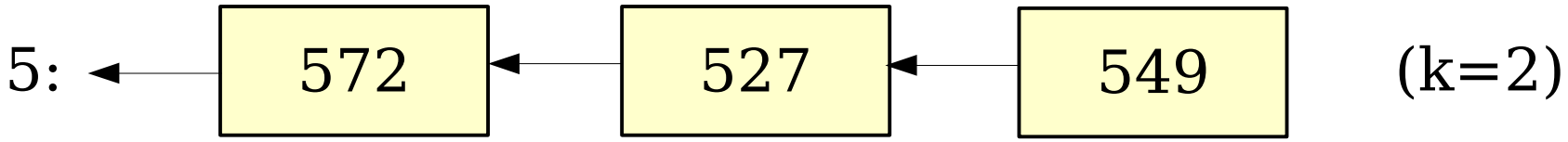
Radix Sort

Can we prove that radix sort is correct when working from LSD to MSD?

Yes! By induction on the digit being sorted

Base step: After 1^{st} step – all numbers in order on LSD

Induction step: suppose (P) after k^{th} step that all numbers are in non-decreasing order on k least significant digits. Consider a queue on the $k+1^{st}$ step where at least two numbers are out of order in the k least significant digits. For example,



The numbers in that queue are in the same order they were in the list following the k^{th} step. But that is a violation of (*P*). Hence, all numbers in a queue are in non-decreasing order. Since assembling the list after the $k+1^{st}$ step is by increasing queue rank ($k+1^{st}$ digit) all numbers in the list are in non-decreasing order.