Segment Trees

CS 491 – Competitive Programming

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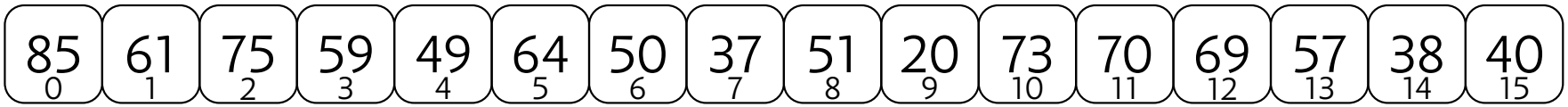
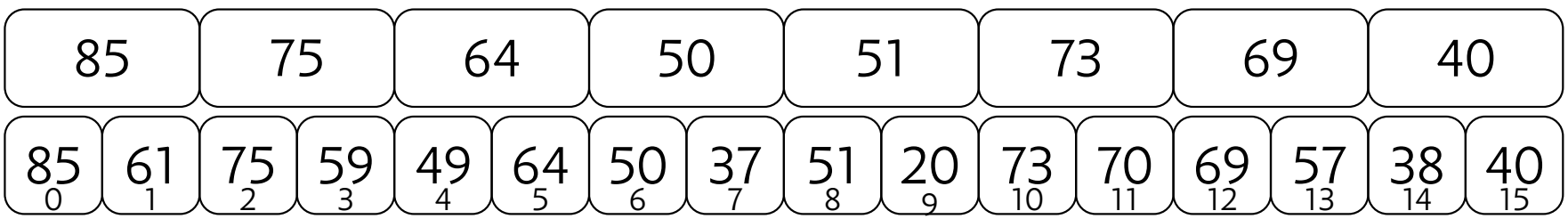
Running Example

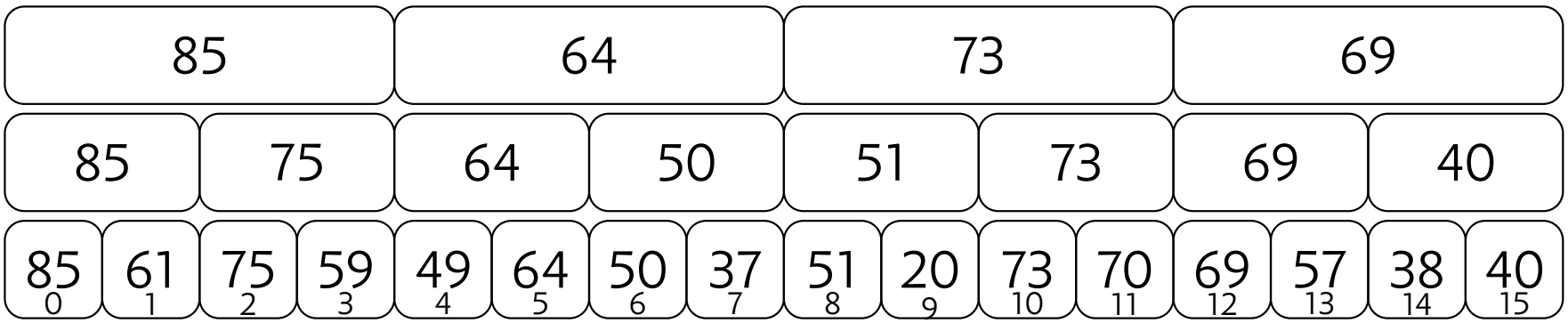
- Consider the following array:



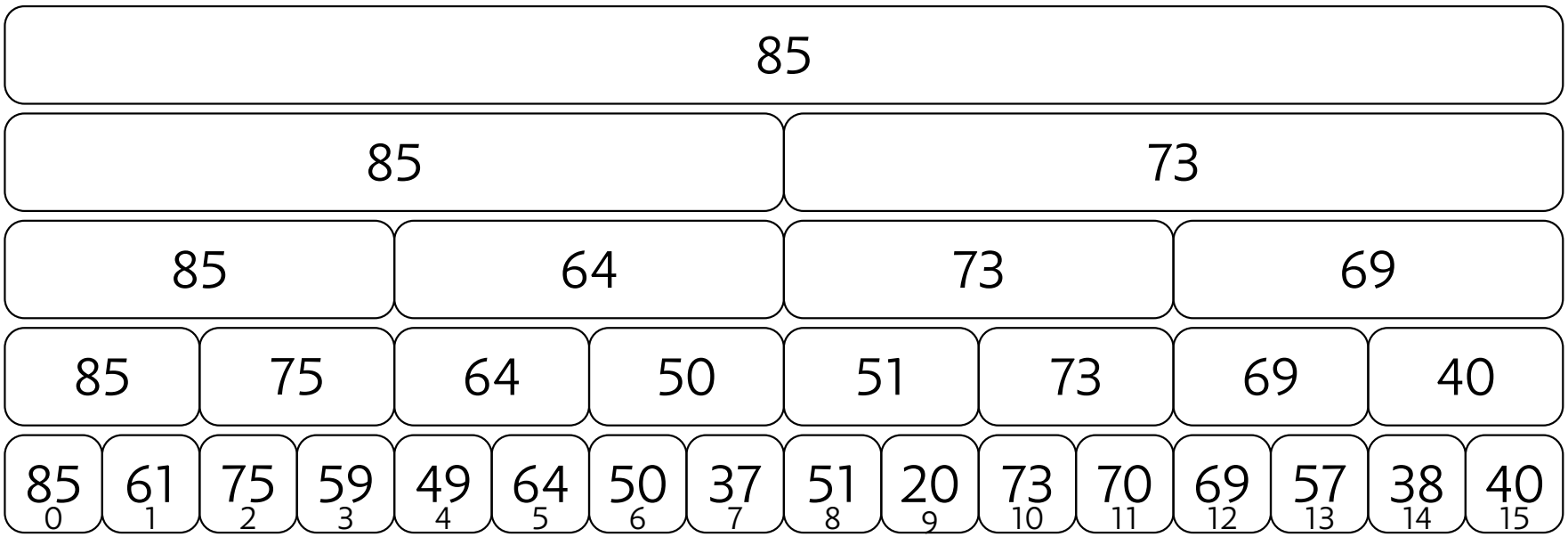
Segment Trees, Level 1



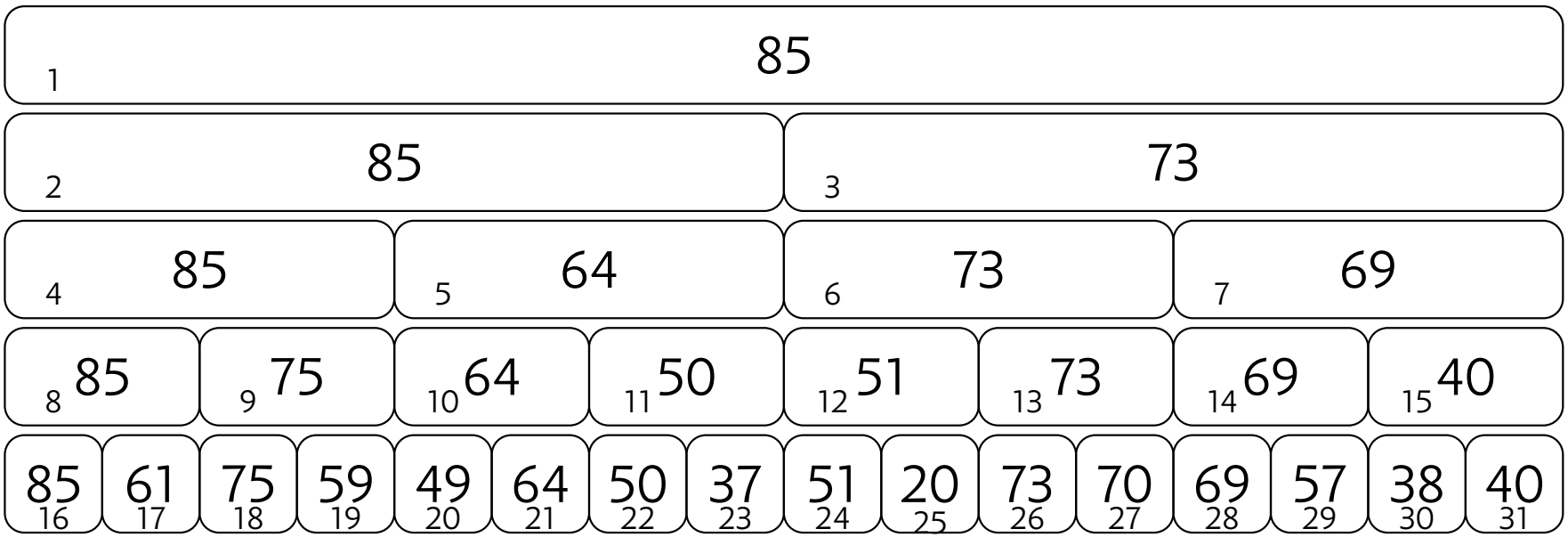
Segment Trees, Level 2



Segment Trees, Level 3 and 4



Segment Trees, Numbering the Elements



Build the Segement Tree

- L and R give you the bounds with respect to the orignal array.
- This code gives you a max range.

```
1  void build(int p, int L, int R) {
2    if (L == R) // as L == R, either one is fine
3       st[p] = data[L]; // store the data
4    else {
5      // recursively compute the values
6      build(left(p) , L                 , (L + R) / 2);
7      build(right(p), (L + R) / 2 + 1, R             );
8      int p1 = left(p), p2 = right(p);
9      st[p] = max(st[p1],st[p2]);
10   } }
```

Query the Tree

- L and R give you the bounds with respect to the orignal array.
- i and j give you the bounds for the query

```
1  int rmq(int p, int L, int R, int i, int j) {
2    if (i > R || j < L) return -1; // current segment outsid
3    if (L >= i && R <= j) return st[p];
4    // compute the min position in the left and right part o
5    int lm = rmq(left(p) , L         , (L+R)/2, i, j);
6    int rm = rmq(right(p), (L+R)/2+1, R      , i, j);
7    if (lm == -1) return rm;
8    // if we try to access segment outside query
9    if (rm == -1) return lm;
10   return max(lm,rm);
11 }
12
```