

1. DP. let  $f[i][j]$  denote the number of permutations of  $1, \dots, i$  with  $k$  inverse pairs.  $f[i][j] = \sum_{0 \leq k \leq \min\{i-1, j\}} f[i-1][j-k]$ , use prefix sum to optimize.  $O(nk)$ .
2. in the worst case,  $k \leq O(n^2)$ . the array  $f[i]$  can be computed by convolutions of arrays  $(1) \star (1, 1) \star \dots \star (\underbrace{1, \dots, 1}_{n \text{ elements}})$ , with indices starting from 0. using the associative law of convolution, FFT and divide and conquer,  $O(n^2 \log^2 n)$  in the worst case. (divide and conquer is not very good when  $k$  is small)

## References