1 What is the largest-possible number of inversions a 6-element array can have?

1. 15
2. 21
3. 36
4. 64

(1) is correct. The inversions are the largest when the array is arranged in descending order such that if $x_i < x_j \implies A[x_i] > A[x_j]$. We construct an example [6, 5, 4, 3, 2, 1]. We see that the number of inversions are $5 + 4 + 3 + 2 + 1 = \sum_{i=1}^{5} i = 15$. In general the largest-possible number of inversions for an array of length n is $\sum_{i=1}^{n-1} i = \frac{(n-1)\cdot n}{2}$.