

General formula for the order statistics of  $n$  independent, continuous random variables that each have a common density  $f_X(x)$ .

The joint density of the order statistics  $X_{(1)}, \dots, X_{(n)}$  is

$$f_{X_{(1)}, \dots, X_{(n)}}(x_1, \dots, x_n) = n! f(x_1) f(x_2) \dots f(x_n) \quad \text{for } x_1 < x_2 < \dots < x_n \\ = 0 \quad \text{otherwise}$$

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General formula for the density of just  $X_{(j)}$  i.e. of the  $j$ th order statistic, it is

$$f_{X_{(j)}}(x_j) = \frac{\binom{n}{j-1, 1, n-j} f_X(x_j) (F_X(x_j))^{j-1} (1 - F_X(x_j))^{n-j}}{n! / ((j-1)! 1! (n-j)!)}$$