Fix size input equal probability random sampling

Each element i, has a probability of $x = \frac{K-|S|}{N-i} = \frac{K}{N}$ to put into the sample set S.

When $i = 0, x = \frac{K}{N}, as\ |S| = 0.$

When $i = 1, x = \frac{K}{N}\frac{K-1}{N-1} + \frac{N-K}{N}\frac{K}{N-1} = \frac{K}{N}$
There are 2 cases, first element didn't select with probability $\frac{N-K}{N}$, or first element selected into the sample set with probability $\frac{K}{N}$.

When $i = 2, x = (\frac{K}{N})^2\frac{K-2}{N-2} + 2\frac{K}{N}\frac{N-K}{N}\frac{K-1}{N-2} + (\frac{N-K}{N})^2\frac{K}{N-2} = \frac{K}{N}$
There are 3 cases, both first and second elements are selected with probability $(\frac{K}{N})^2$, either one of the first two elements is selected with probability $2\frac{K}{N}\frac{N-K}{N}$, or both first and second elements aren't selected with probability $(\frac{N-K}{N})^2$.

Up until $i = N - 1$