(p, q) unshuffle

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Let p and q be positive natural numbers. Further, let $S(k)$ be the symmetric group on the numbers $\{1, \ldots, k\}$. A permutation $\tau \in S(p+q)$ is a (p, q) *unshuffle* if there exist $i_1 < \cdots < i_p$ and $j_1 < \cdots < j_q$ s.t.

$$\tau(i_1) = 1, \ldots, \tau(i_p) = p$$

and

$$\tau(j_1) = p + 1 \ldots, \tau(j_q) = p + q.$$

Alternatively a (p, q) *unshuffle* is a permutation $\tau \in S(p+q)$ s.t. τ^{-1} is a (p, q) shuffle.

Since a (p, q) unshuffle is completely determined by $\{i_1, \ldots, i_p\}$, the cardinality of $\{\sigma \in S(p+q) | \sigma \text{ is an unshuffle}\}$ is $\binom{p+q}{q}$.