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LINEAR OPERATIONS IN PROBABILITY.

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Fundamental Thms. in prob.:

(I) "Addition thm" for mutually exclusive events:

If $E_1, E_2 \ldots E_n$ are n events, mutually exclusive, respect. prob., $p_1 p_2 \ldots p_n$, where $\sum p_i = 1$.
then the prob. in a single trial of $E_a, E_b \ldots E_r$ happen. is
$p_a + p_b \ldots + p_r$.

(II) Multiplication thm., for indep. events
If $E_1, E_2, \ldots E_k$ are indep. events, or events belonging to indep. systems, [the p_i are not nec. s.t. $\sum p_i = 1$] the prob., that all events occur together is $p_1 p_2 \ldots p_k$.

(III) Multiplication for dep. events in a prescribed order, if p_1 is prob. of E_1, say

$$p_1 = p(E_1)$$

If p_2 is prob of E_2, if or when E_2 has occurred

$$p_2 = p(E_2 | E_1)$$

If $p_3 = p(E_3 | E_1, E_2)$

then the prob. that all events $E_1 \ldots E_k$ happen in this order is $p_1 p_2 \ldots p_k$.