1. Consider a function \( f(x_1, x_2, \ldots, x_n) \) of \( n \) variables at least \( r \) times differentiable. How many different partial derivatives of order \( r \) does \( f \) process?

**Solution:** Assuming that the derivative with respect to \( x_k \) occurs \( r_k \) times in the derivatives of order \( r \), we know that the desired number of different partial derivatives is the same as the number of non-negative integral solutions of the equation

\[
r_1 + r_2 + \cdots + r_n = r.
\]

So the number is

\[
\binom{n + r - 1}{n - 1} = \binom{n + r - 1}{r}.
\]
2. Suppose that $A$ and $B$ are mutually exclusive events for which $P(A) = .3$ and $P(B) = .5$. What is the probability that

(a) either $A$ and $B$ occurs?
(b) $A$ occurs but $B$ does not?
(c) both $A$ and $B$ occur?

**Solution:** “Mutually exclusive” means that $A \cap B = \emptyset$, $A \subseteq B^c$ and then $A \cap B^c = A$. So

(a) $P(A \cup B) = P(A) + P(B) = .3 + .5 = .8$;
(b) $P(A \cap B^c) = P(A) = .3$; and
(c) $P(A \cap B) = P(\emptyset) = 0$. 