Use conditional probabilities to find the intersection of a collection of events. In other words, consider events $A_1, A_2, \ldots, A_n$, and find the probability that all n of the events occur.

We want $P(A_1 \cap A_2 \cap \ldots \cap A_n)$.

We do this by finding the probability A_1 occurs, times the probability A_2 occurs given that A_1 occurred, times the probability A_3 occurs given that A_1 and A_2 occurred, etc., etc.

$$P(A_1 \cap A_2 \cap \ldots \cap A_n) = P(A_1)P(A_2|A_1)P(A_3|A_1 \cap A_2) \cdots P(A_n|A_1 \cap A_2 \cap \ldots A_{n-1}).$$

Example: Consider three children who each pick 1 cookie from a cookie jar, without replacement. Suppose that the cookie jar has 12 cookies, exactly 5 of which are chocolate. What is the probability that all three children get a chocolate cookie?

Let A_j be the event that the jth child gets a chocolate cookie.

We want $P(A_1 \cap A_2 \cap A_3)$.

$$P(A_1 \cap A_2 \cap A_3) = P(A_1)P(A_2 \mid A_1)P(A_3 \mid A_1 \cap A_2) = (5/12)(4/11)(3/10) = 1/22 = 0.045\ldots$$