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# Probability and multiplication rule

Conditional probability and multiplication rule. Addition rules and multiplication rules for probability worksheet. Difference between conditional probability and multiplication rule. Joint probability and multiplication rule. Addition and multiplication rules of probability. Probability addition and multiplication rule worksheet with answers. Probability in genetics multiplication and addition rules worksheet. When to use addition and multiplication rule in probability.

In probability theory, the chain rule (also called the general rule of the product[1][2]) allows the calculation of any member of the joint distribution of a set of random variables using only conditional odds. The rule is useful in the study of Bayesian networks, which describe a probability distribution in terms of conditional probability. Chain rule for events Two events The chain rule for two random events  $A$  and  $B$  says  $P(A \text{ prudent } B) = P(B \text{ \textcircled{A}}) \times P(A)$ . Example This rule is illustrated in the following example. Urn 1 has 1 black ball and 2 white balls and Urn 2 has 1 black ball and 3 white balls. Suppose you choose a random urn and then select a ball from that urn. Let the event  $A$  is choosing the first urn:  $P(A) = P(A^c) = 1/2$ . The possibility to choose a white ball, since we chose the first urn, is  $P(B|A) = 2/3$ . Event  $A$  slavish  $B$  would be their intersection: choosing the first urn and a white ball from it. The probability can be found by the chain rule by chance:  $P(A \text{ \textcircled{B}}) = P(A) \times P(B|A) = 1/2 \times 2/3 = 1/3$ . Two random variables For two random variables  $X, Y$ , to find the joint distribution, we can apply the conditional probability definition to get:  $P(X, Y) = P(X) \times P(Y|X)$ . Consider an indexed collection of random variables  $X_1, \dots, X_n$ . To find the value of this joint distribution member, we can apply the definition of conditional probability to obtain:  $P(X_n, \dots, X_1) = P(X_n | X_{n-1}, \dots, X_1) \times P(X_{n-1} | X_{n-2}, \dots, X_1) \times \dots \times P(X_1)$ . Repeat this process with each final term creates the product:  $P(X_1, \dots, X_n) = \prod_{k=1}^n P(X_k | X_{k-1}, \dots, X_1)$ . Esempio con quattro variabili ( $n = 4$ ), la regola della catena produce questo prodotto delle probabilitàA condizionali:  $P(x_4, x_3, x_2, x_1) = P(x_4 | A \text{ \textcircled{E}} x_3, x_2, x_1) \times P(x_3 | A \text{ \textcircled{E}} x_2, x_1) \times P(x_2 | A \text{ \textcircled{E}} x_1) \times P(x_1)$ .

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