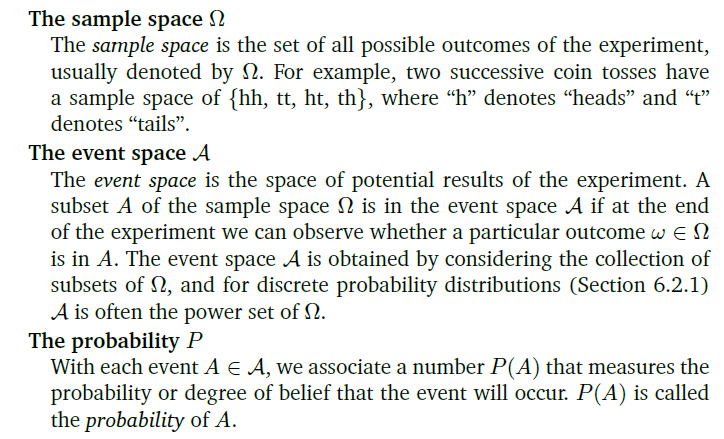
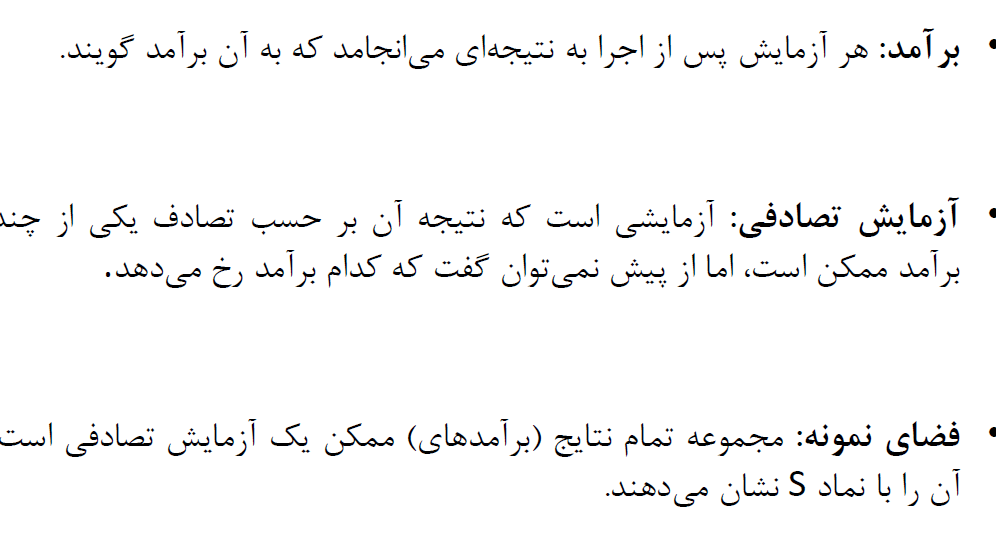
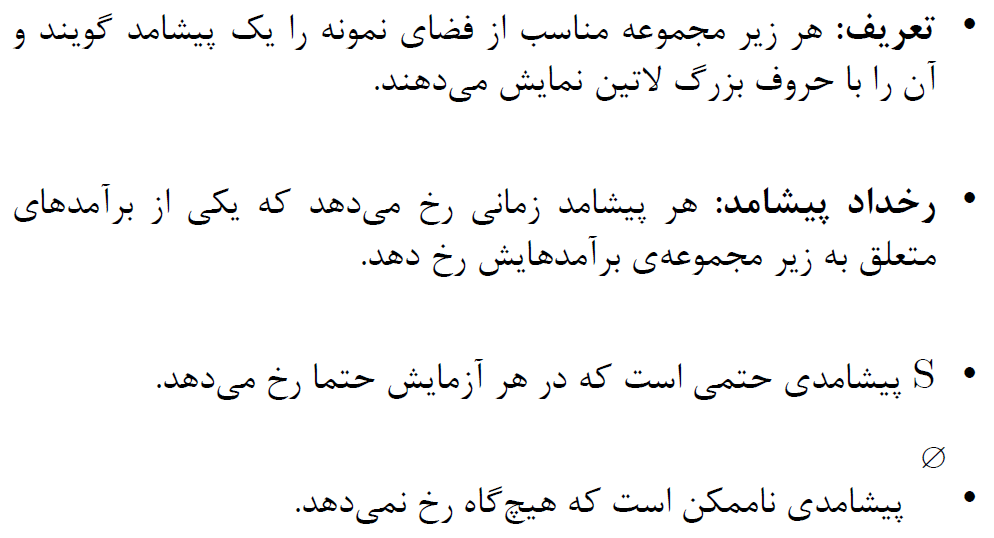
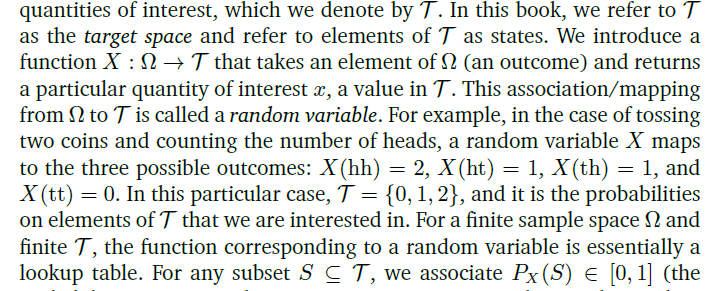
**Probability and Distributions**

Modern probability is based on a set of axioms proposed by Kolmogorov that introduce the three concepts

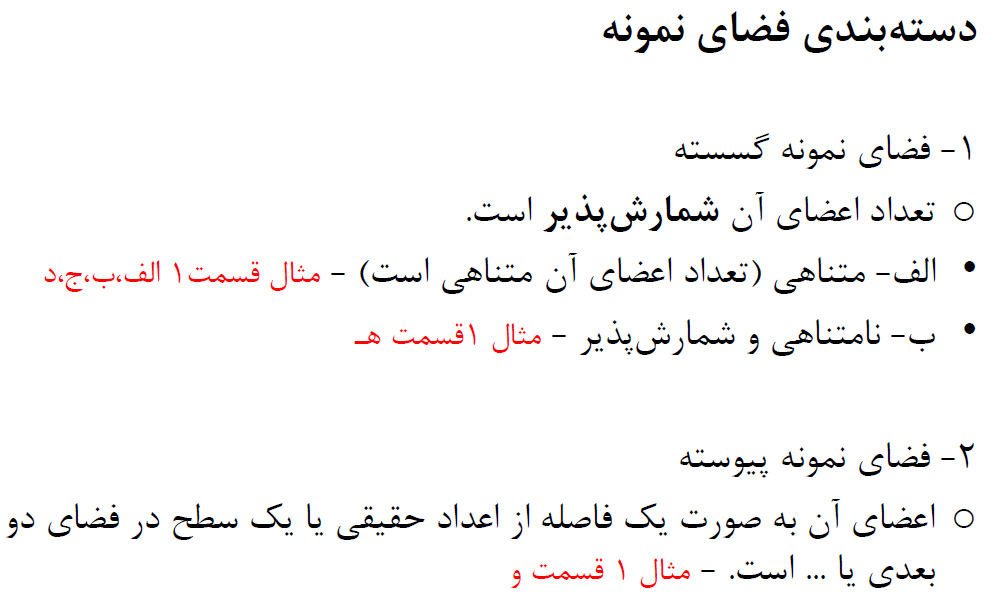
of sample space, event space, and probability measure. The probability space models a real-world process (referred to as an experiment) with random outcomes

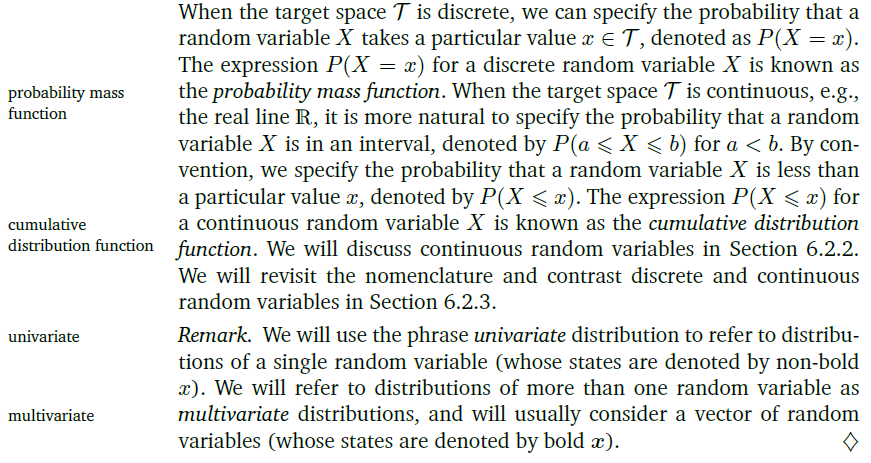


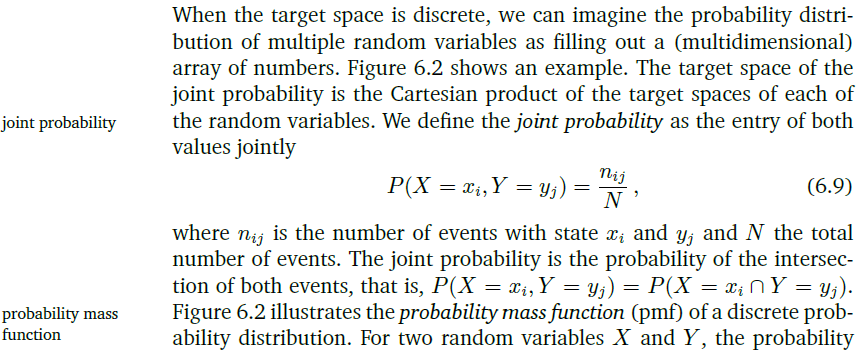


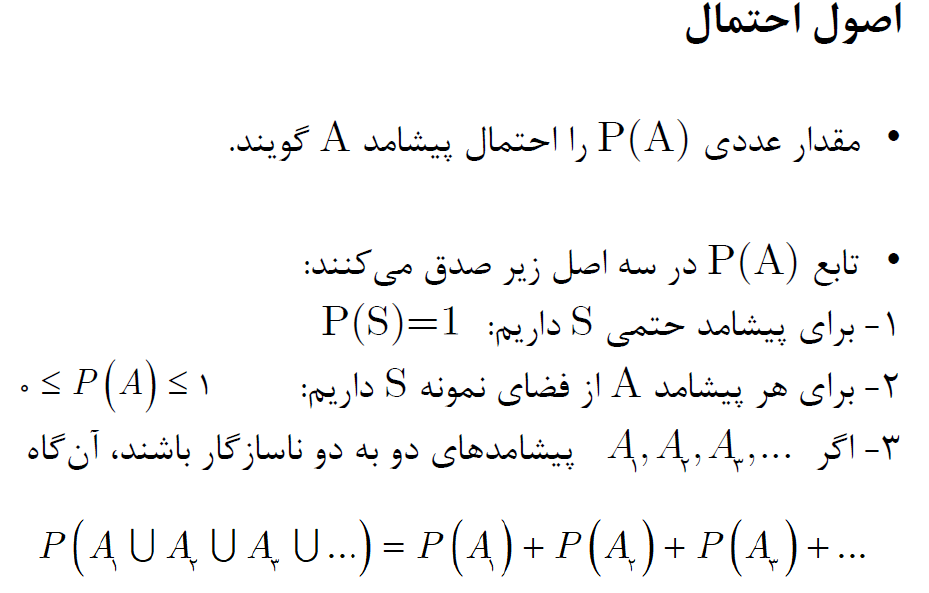


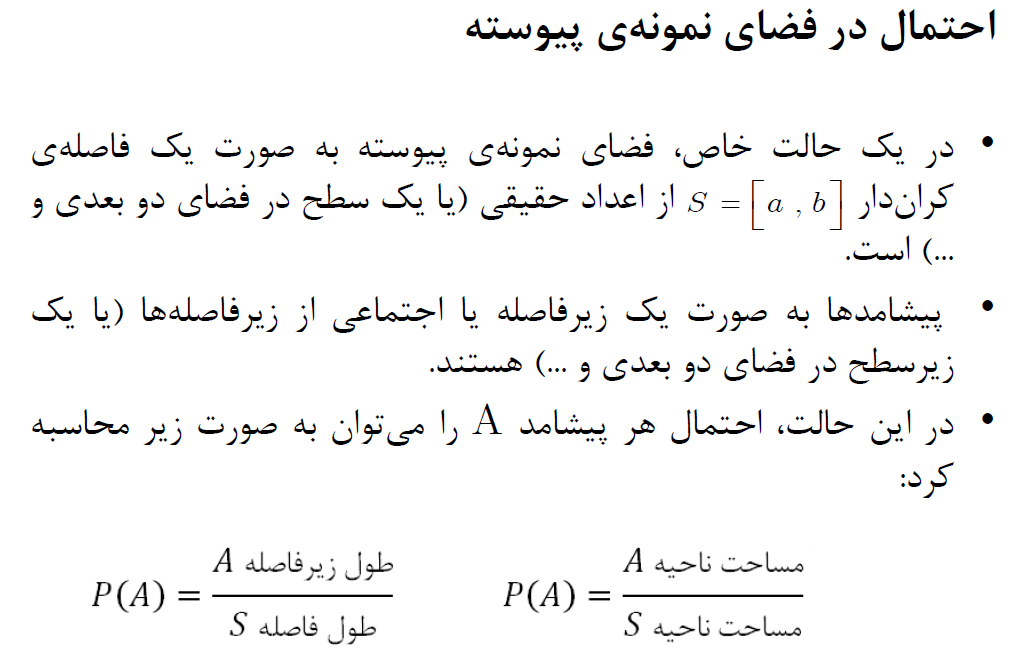
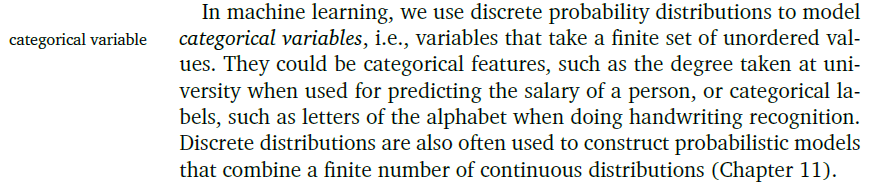
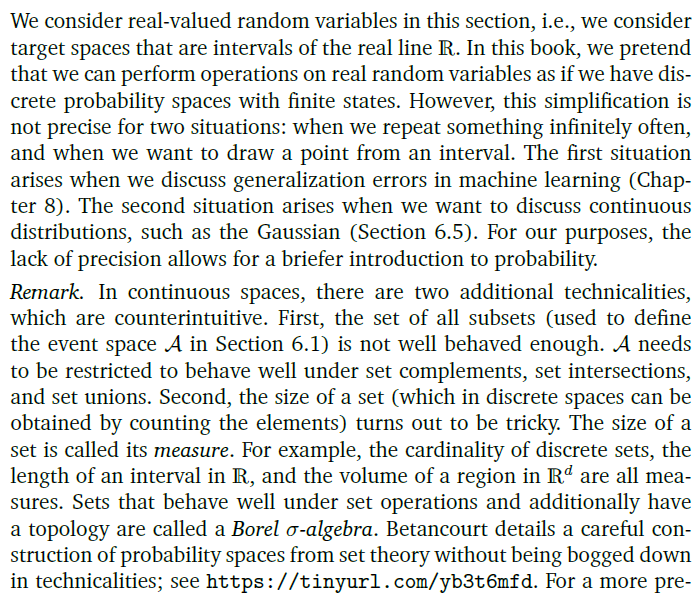
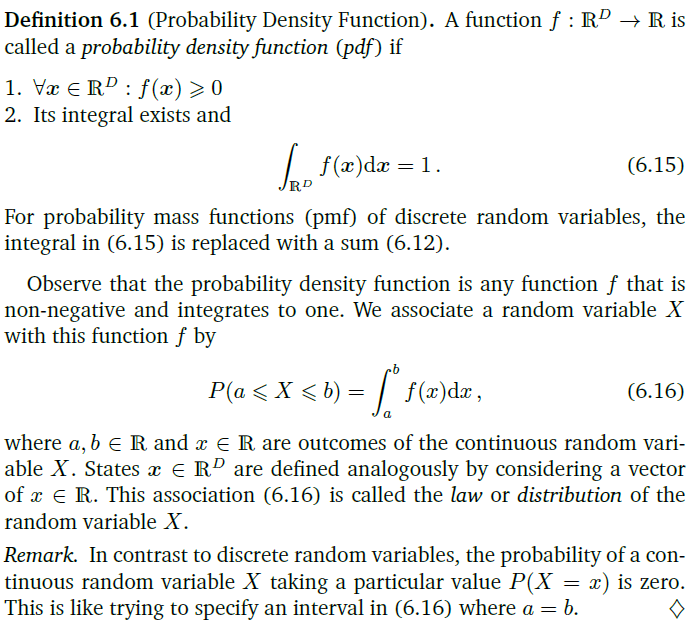
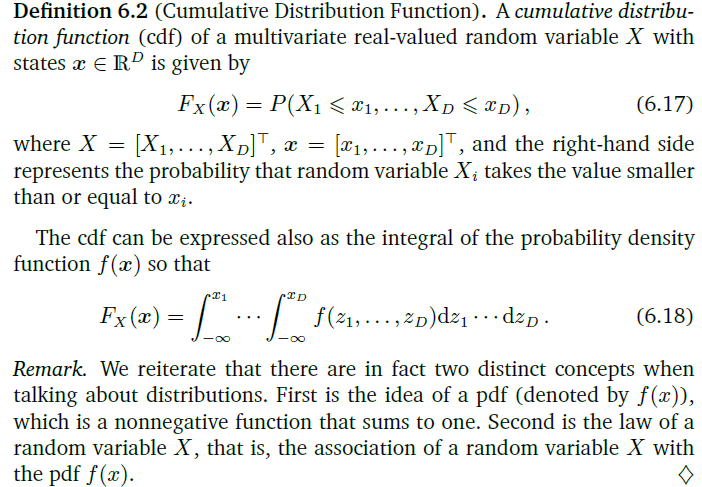






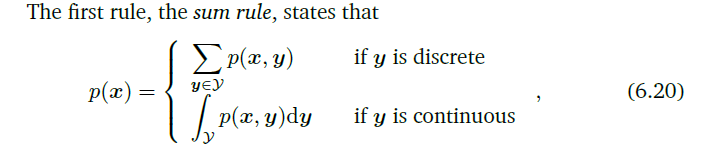




Probability Density Function (PDF) vs Cumulative Distribution Function (CDF) **The CDF is the probability that random variable values less than or equal to x whereas the PDF is a probability that a random variable, say X, will take a value exactly equal to x**.

**Sum Rule, Product Rule, and Bayes’ Theorem**



The sum rule is also known as the *marginalization property*.

Joint distribution is based on joint probability, which can be simply defined as **the probability of two events (variables) happening together**. These two events are usually coined event A and event B, and can formally be written as: p(A and B)

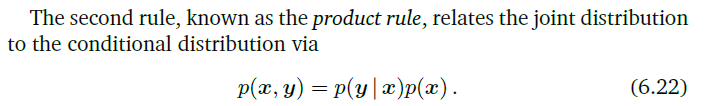
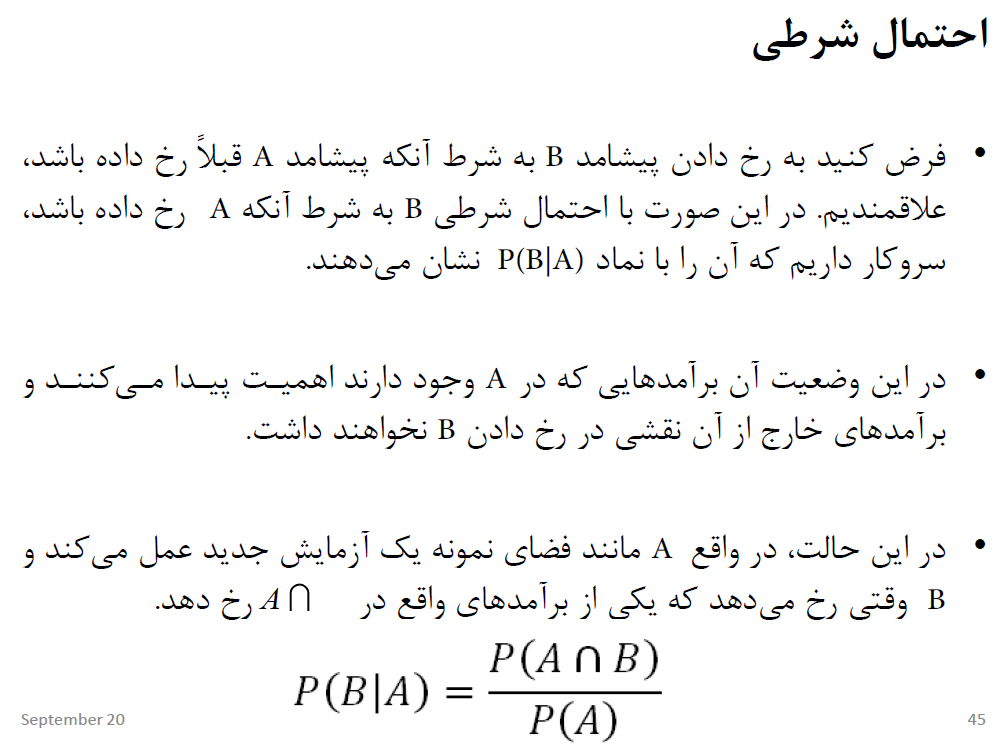
The sum rule relates the joint distribution to a marginal distribution. In

general, when the joint distribution contains more than two random variables,

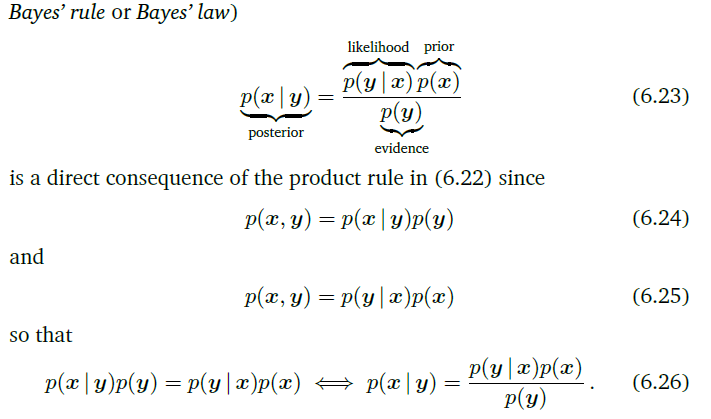
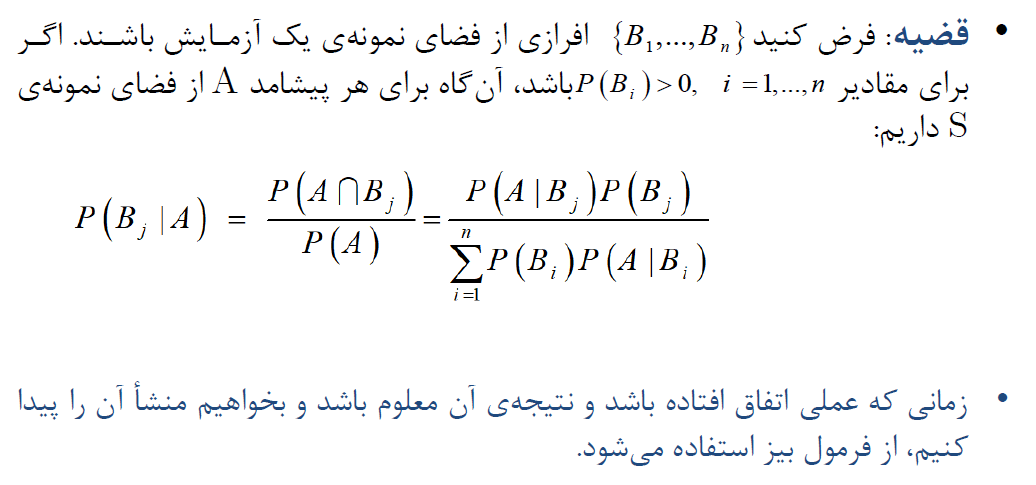
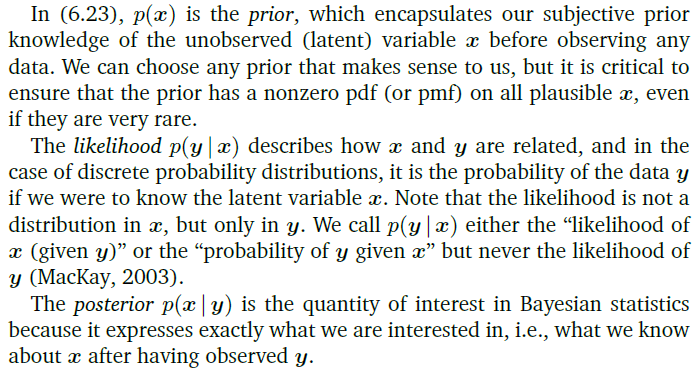
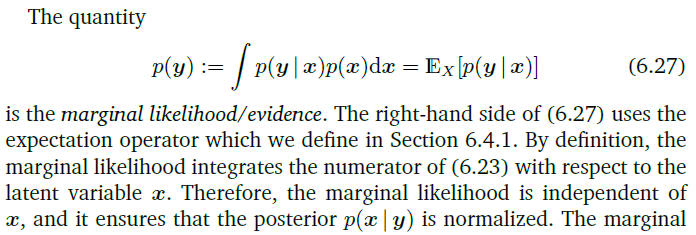
the sum rule can be applied to any subset of the random variables,

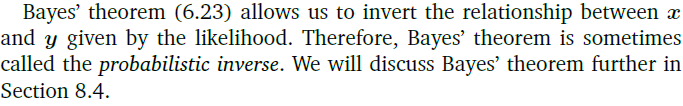
resulting in a marginal distribution of potentially more than one random

variable

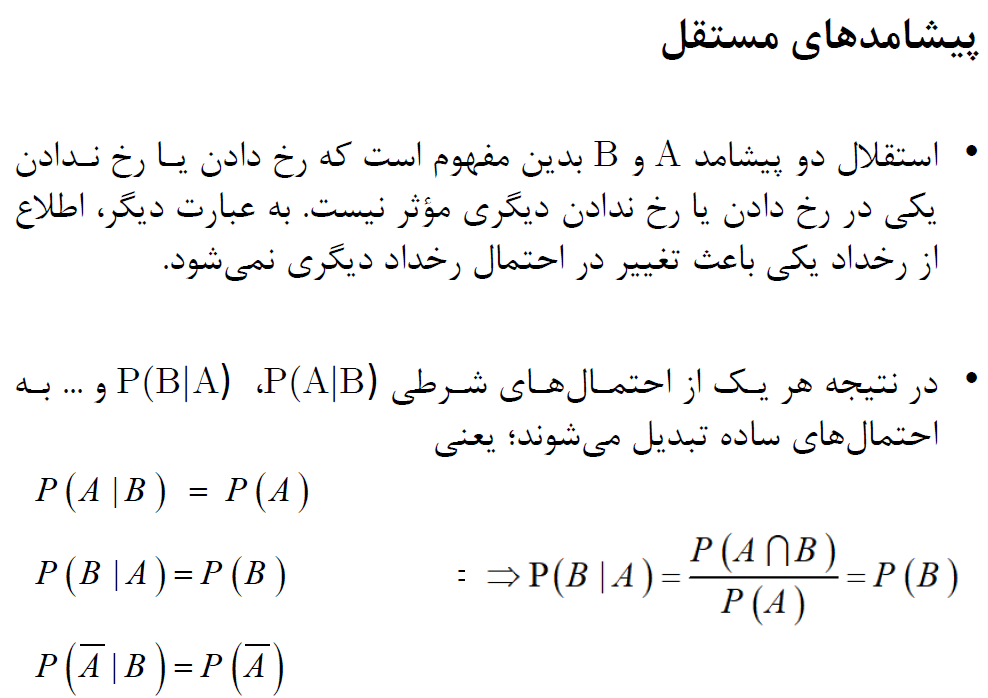


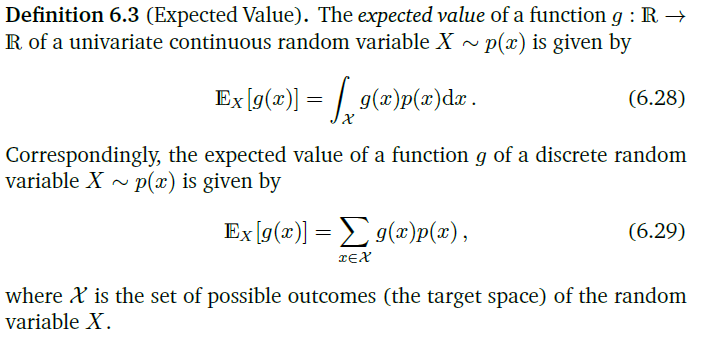
In probability theory and statistics, the marginal distribution of a subset of a collection of random variables is **the probability distribution of the variables contained in the subset**. It gives the probabilities of various values of the variables in the subset without reference to the values of the other variables.

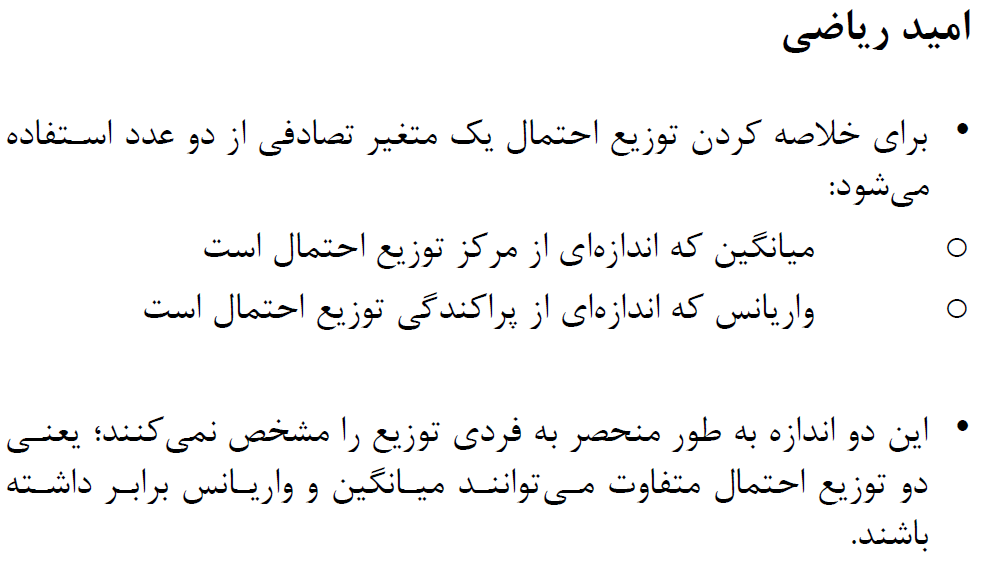
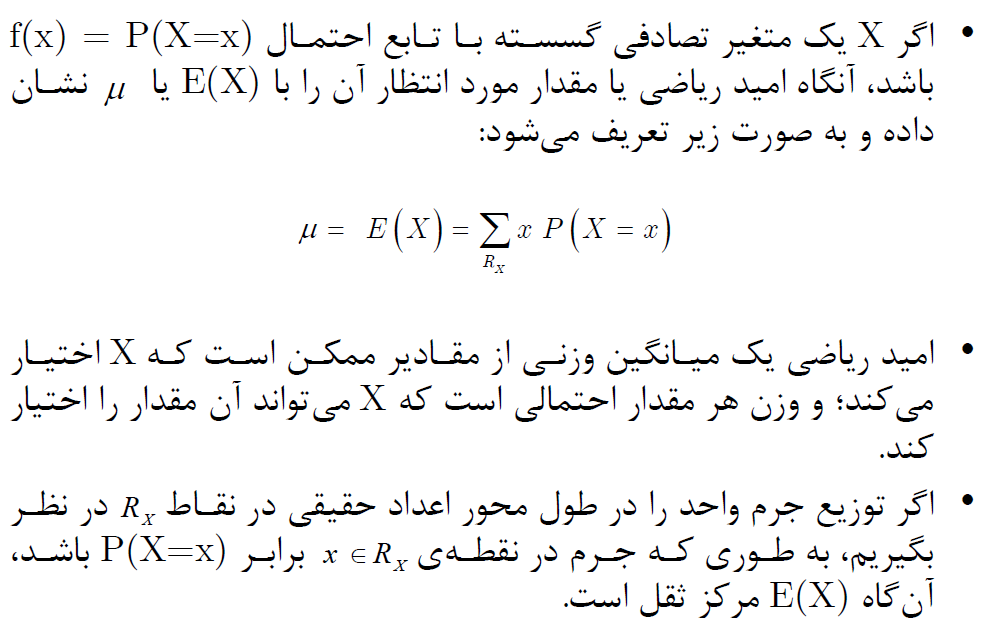
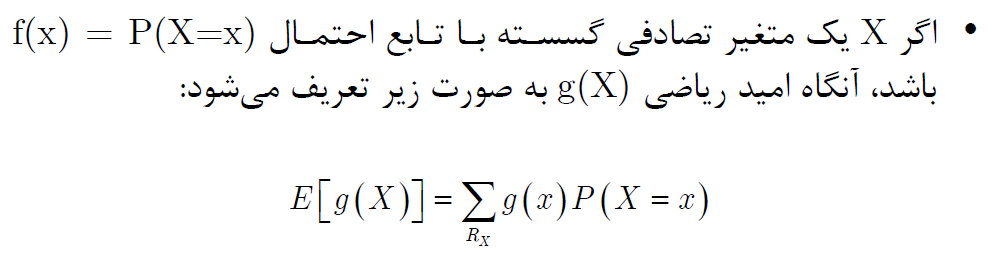
   

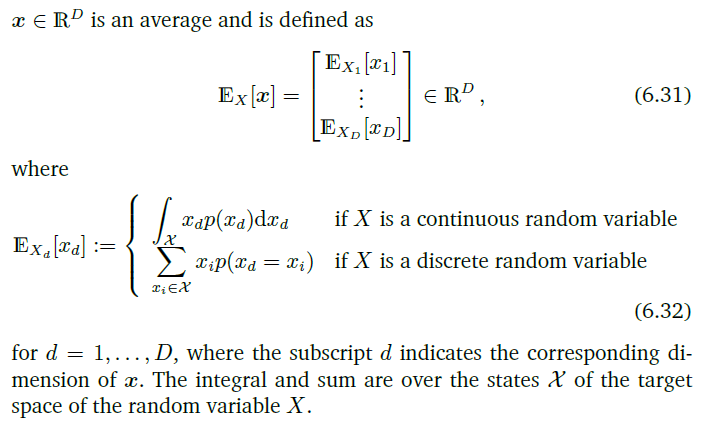


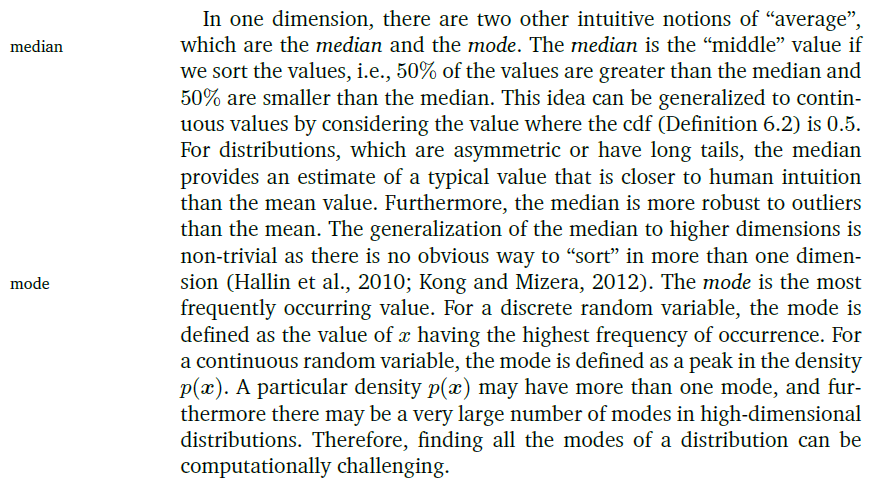
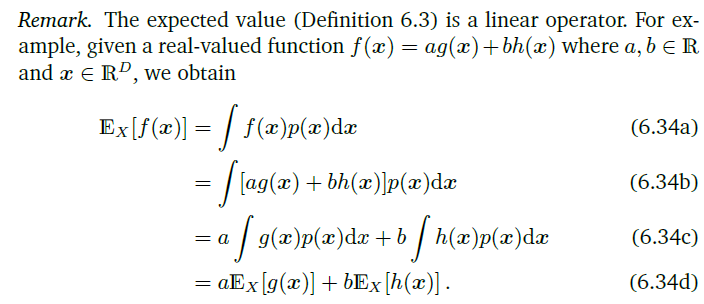
**Summary Statistics and Independence**

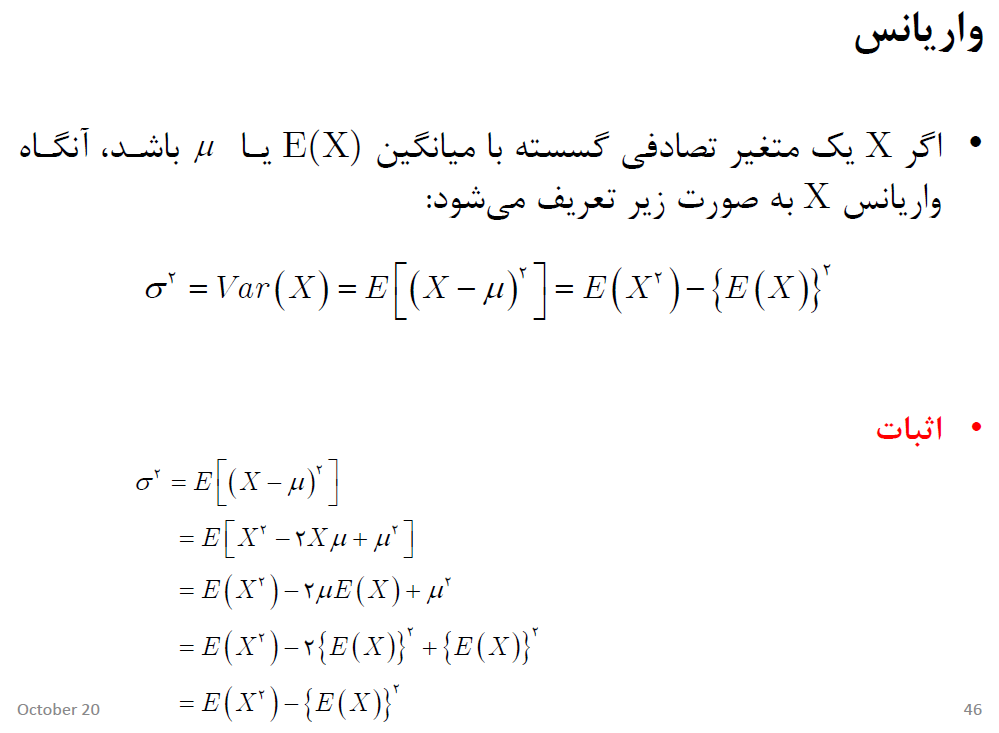
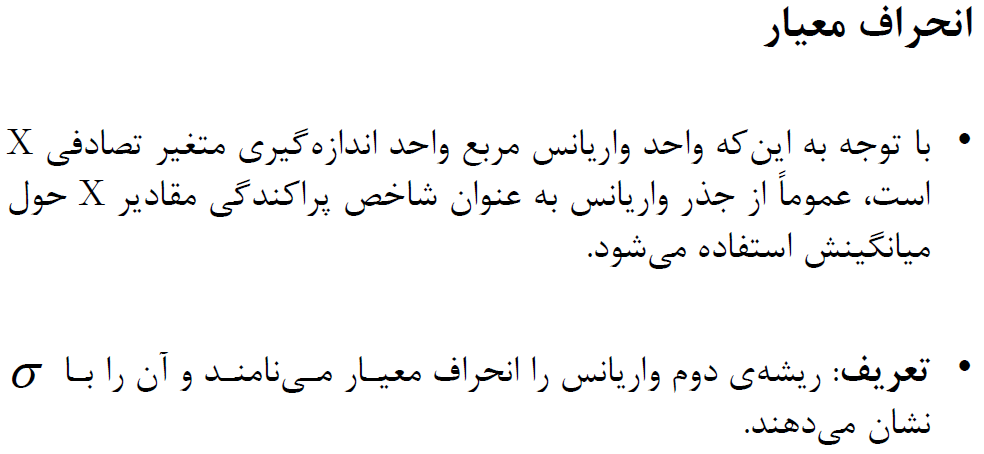
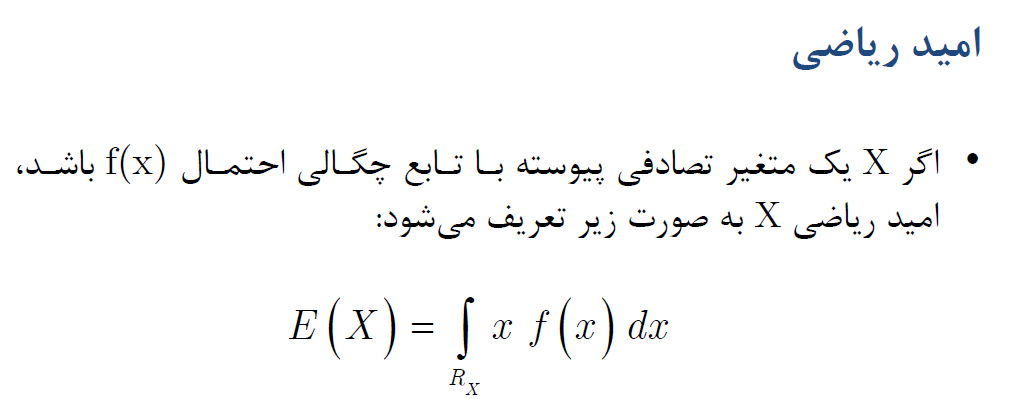
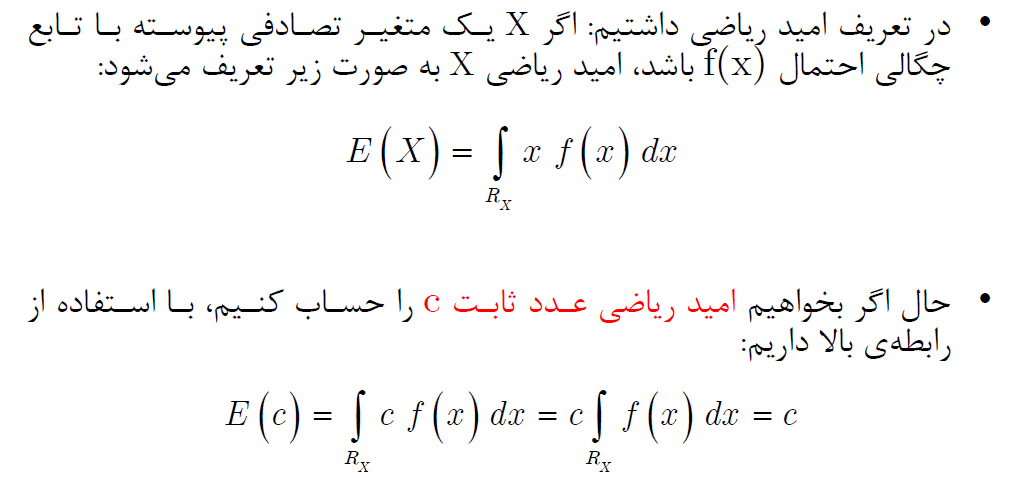
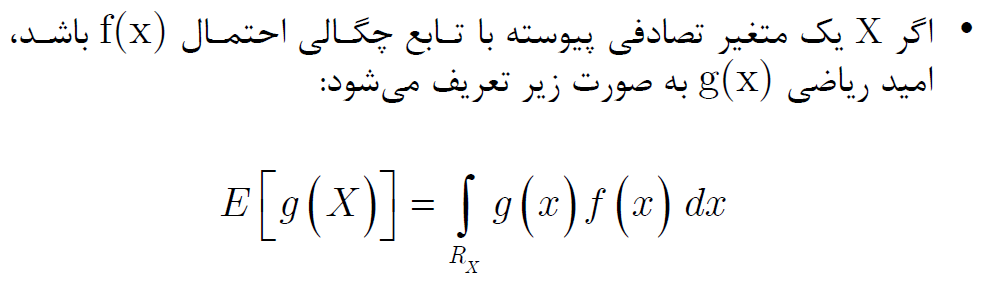
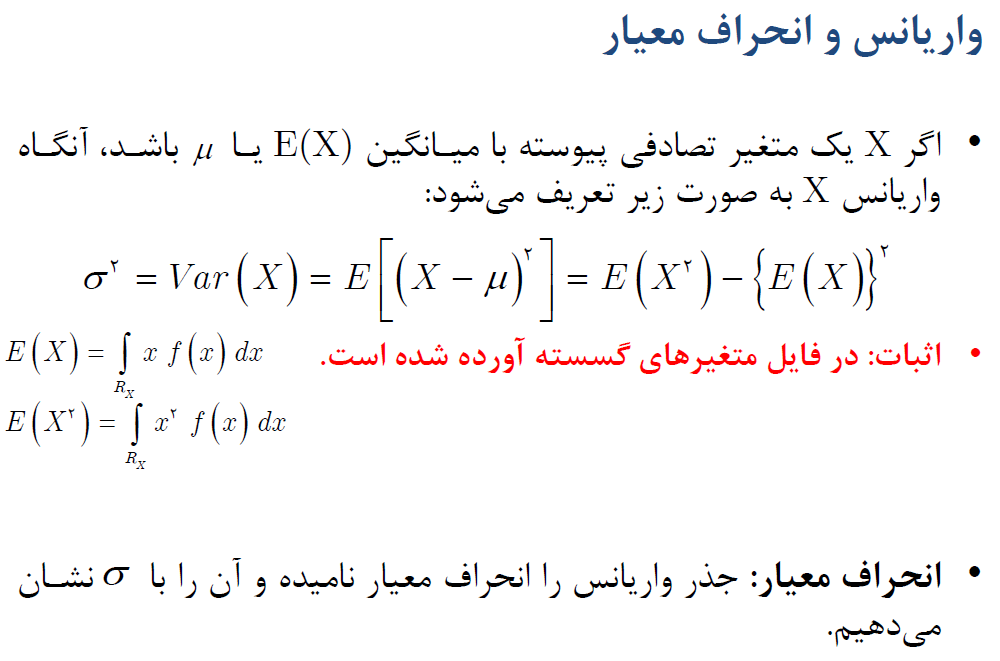
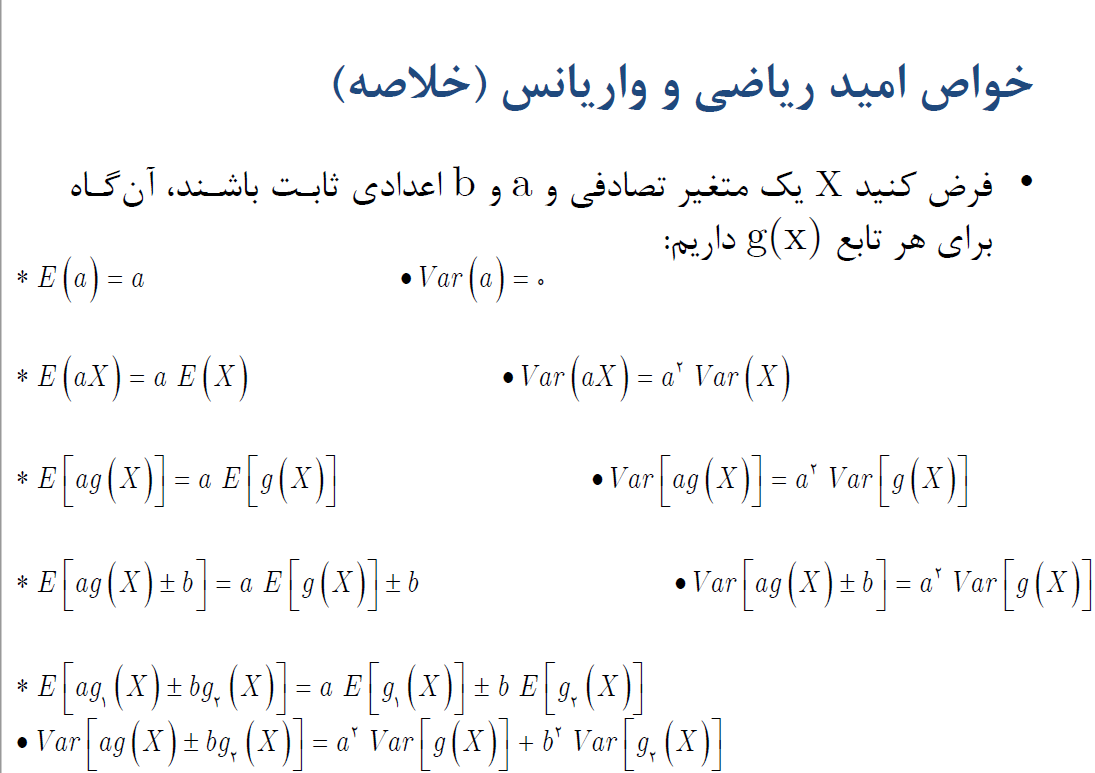


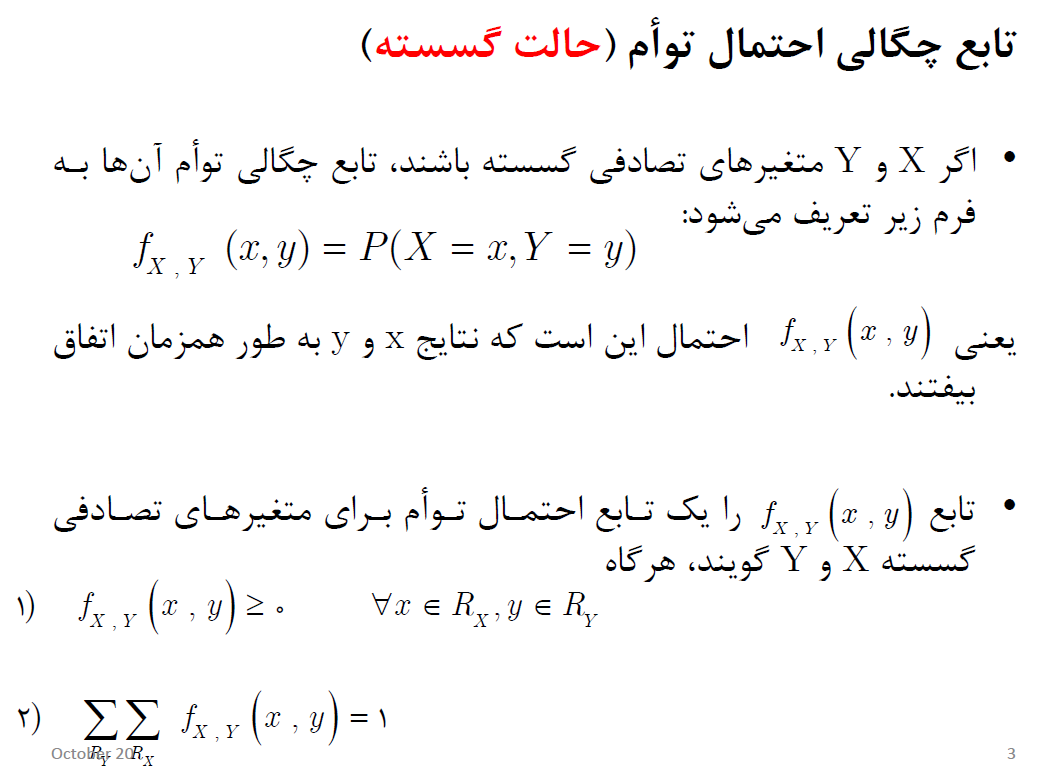
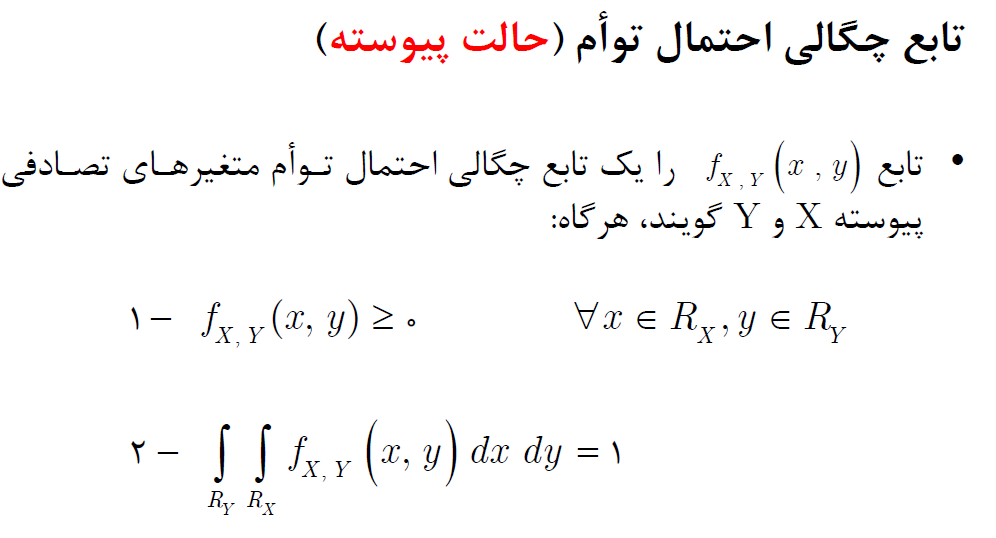
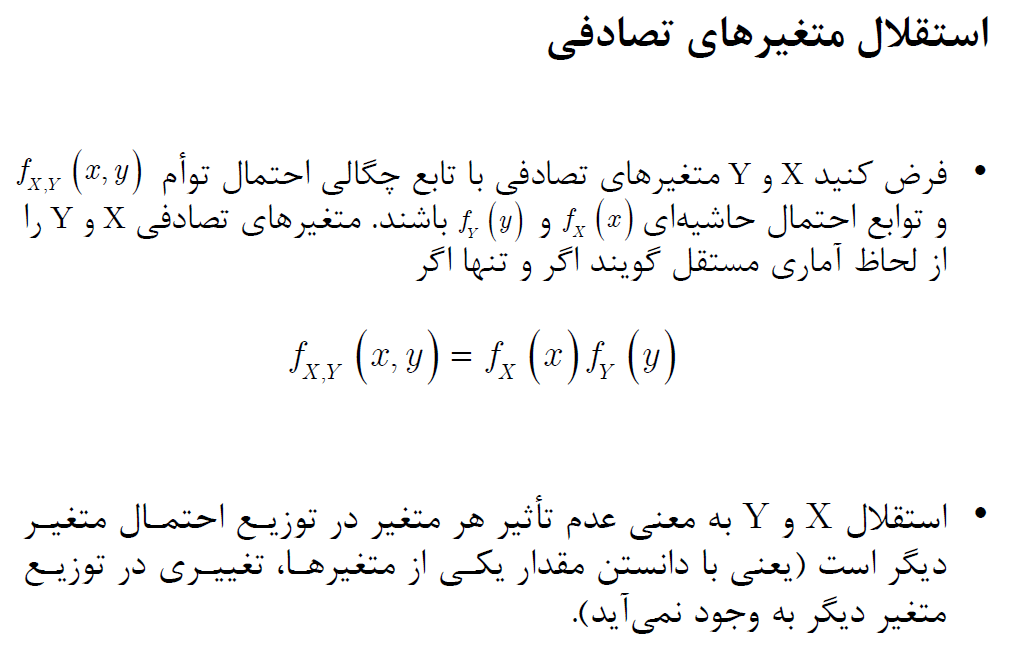
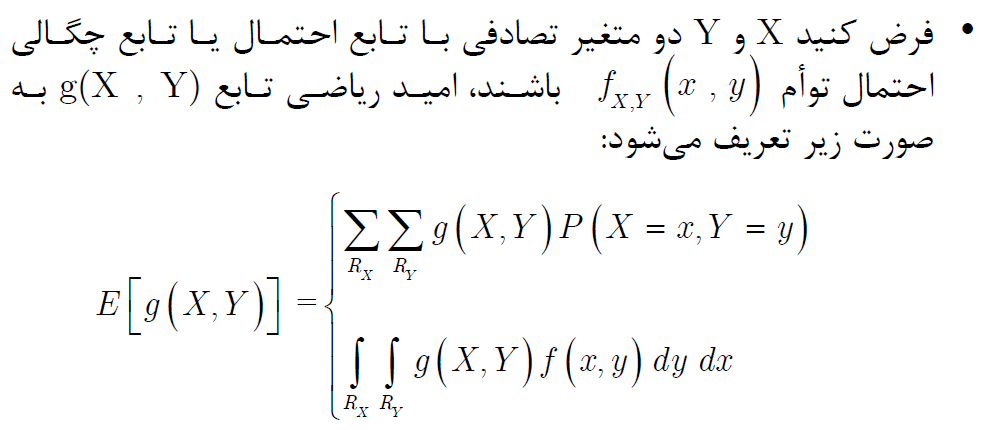
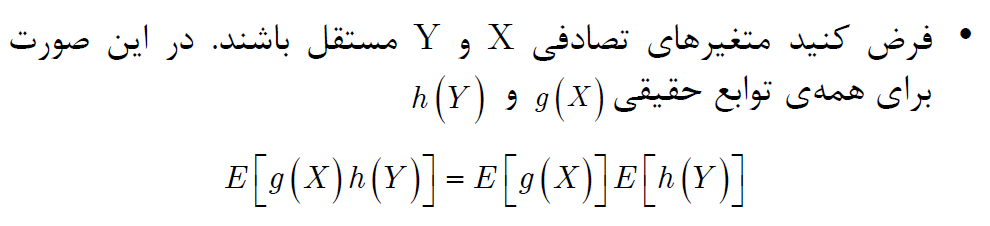


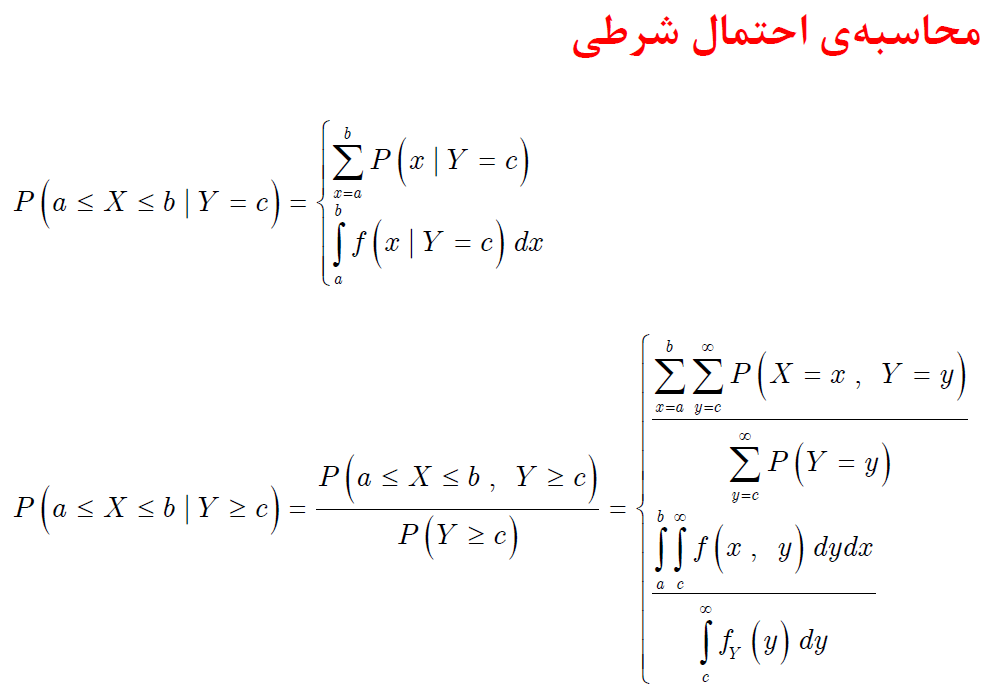
  **Mean**

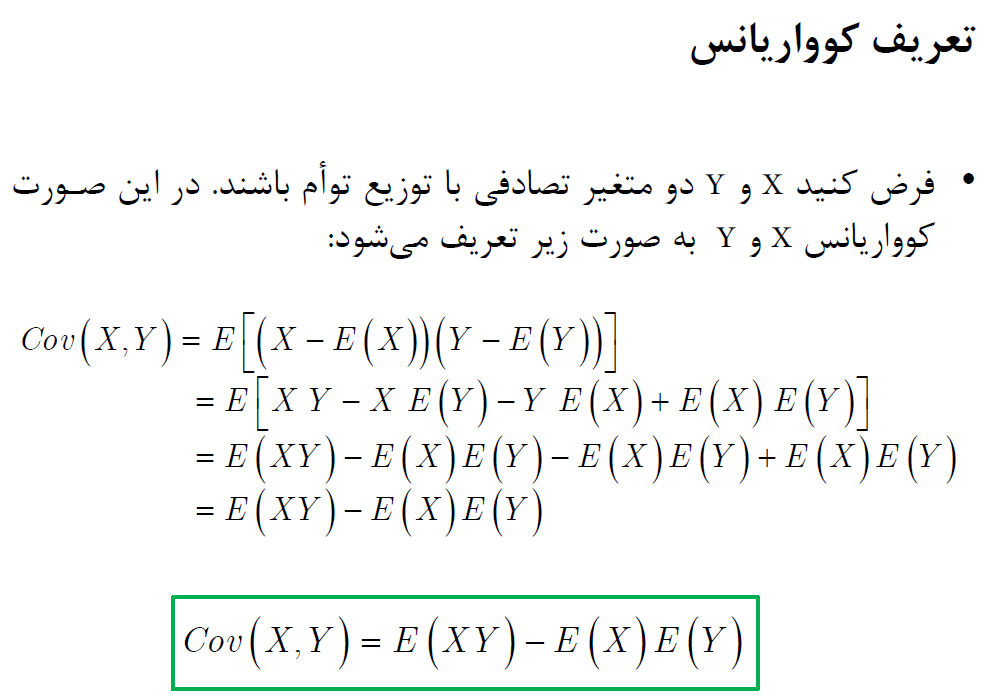


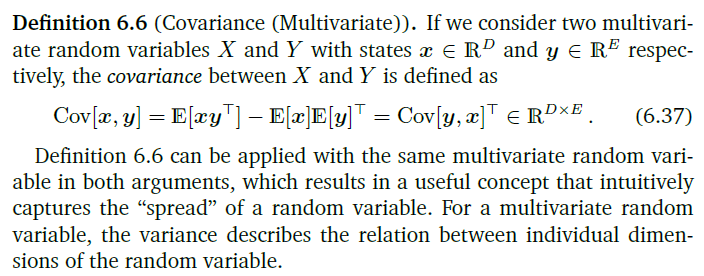
      

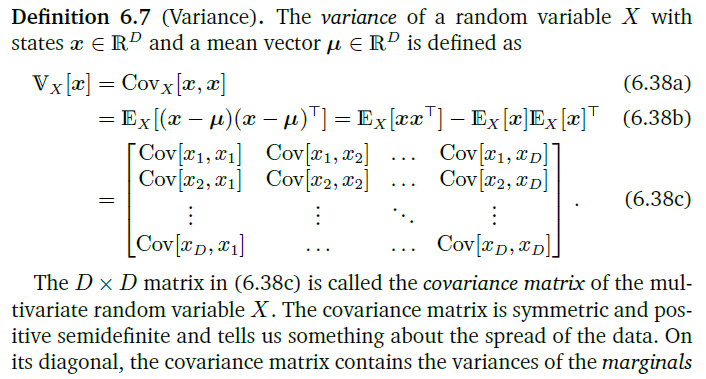
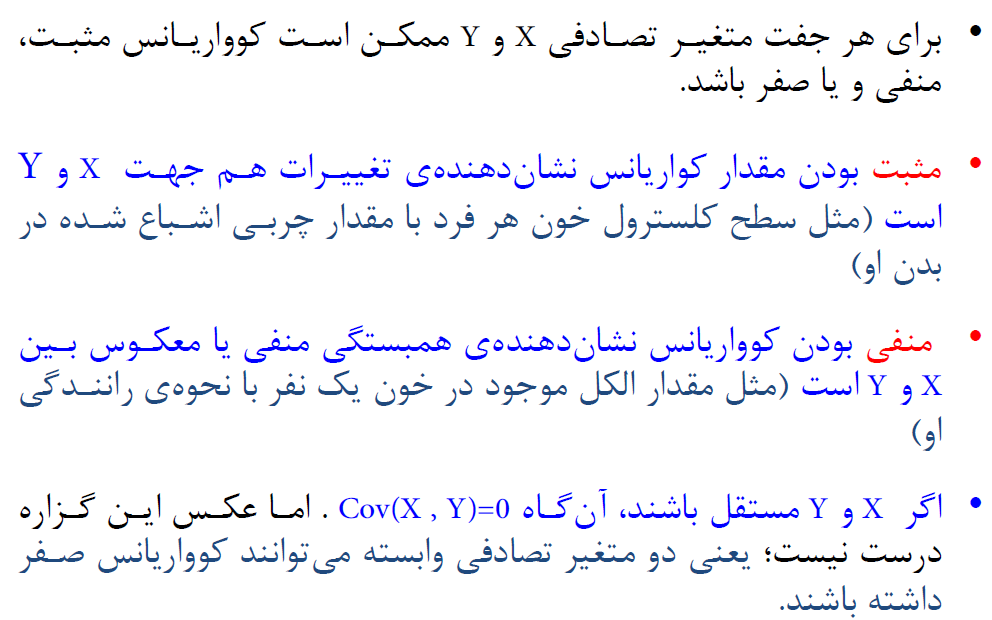
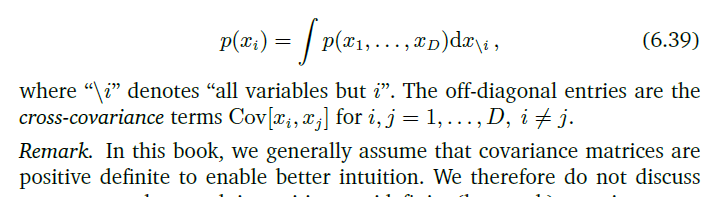
    

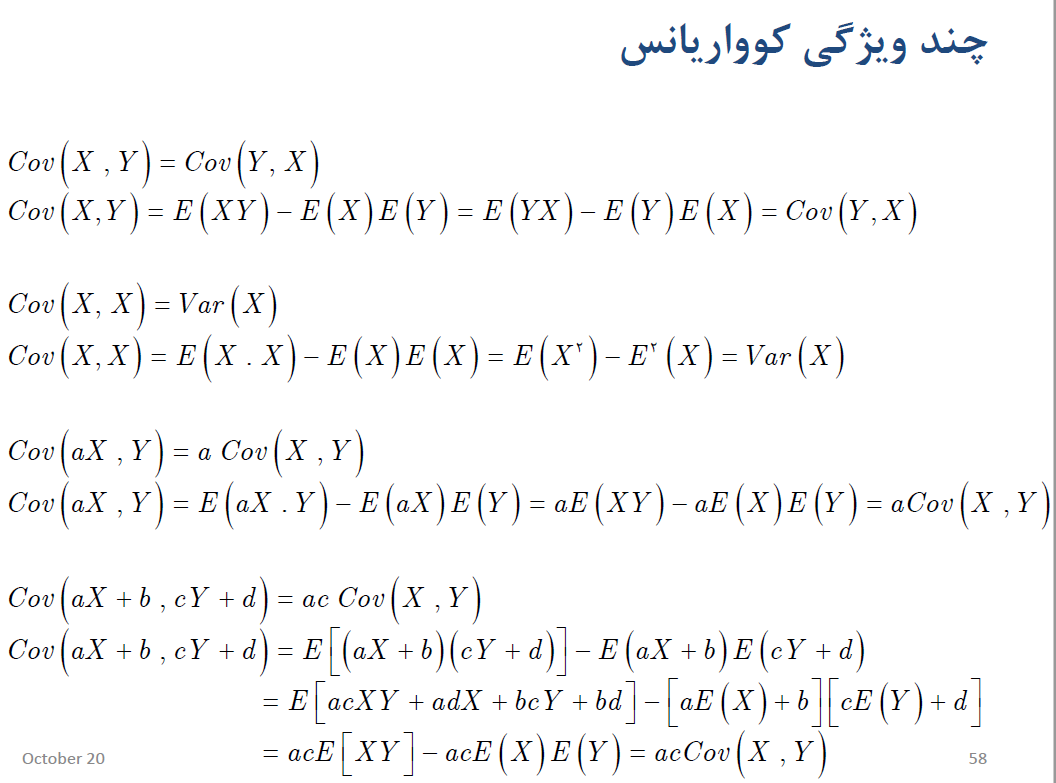
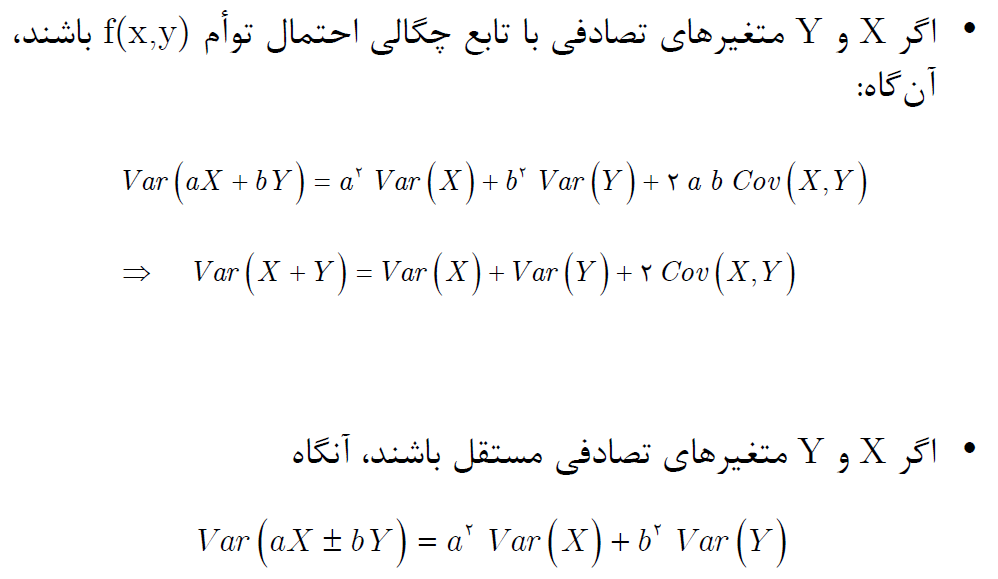
 

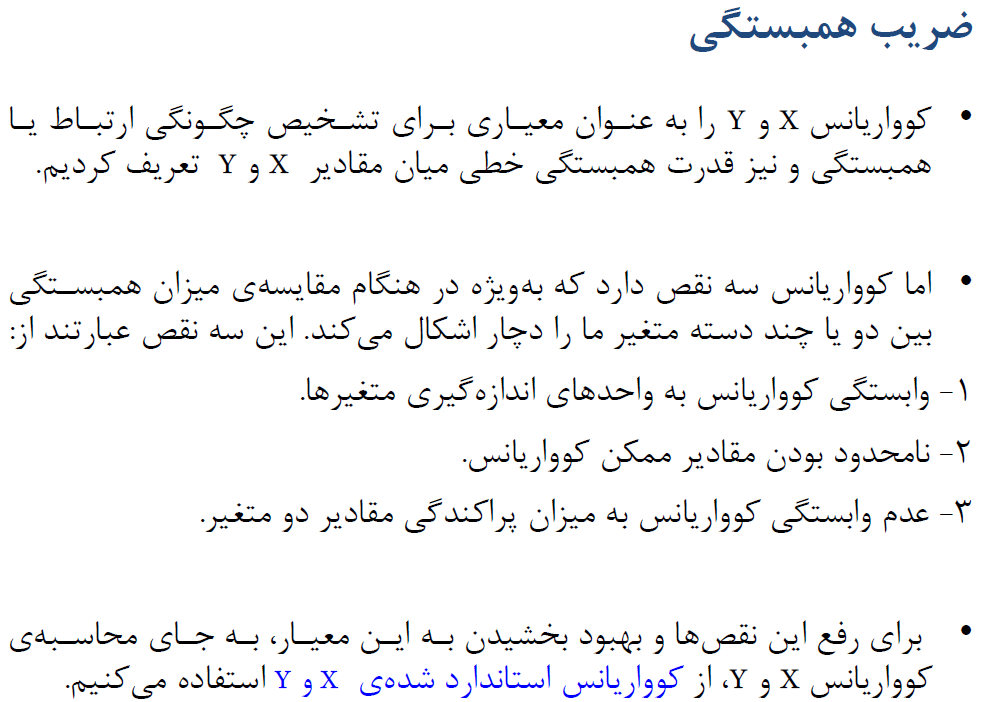


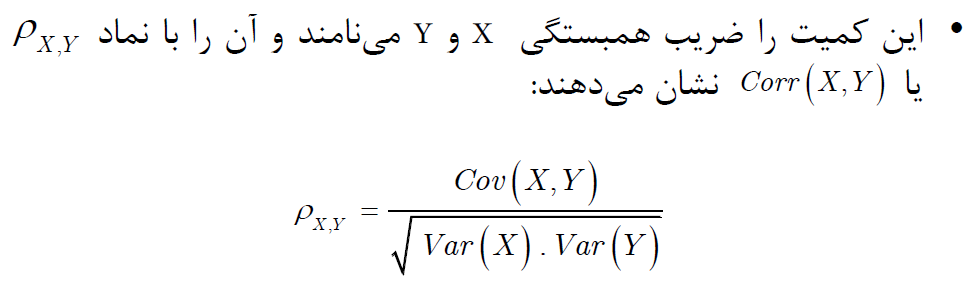
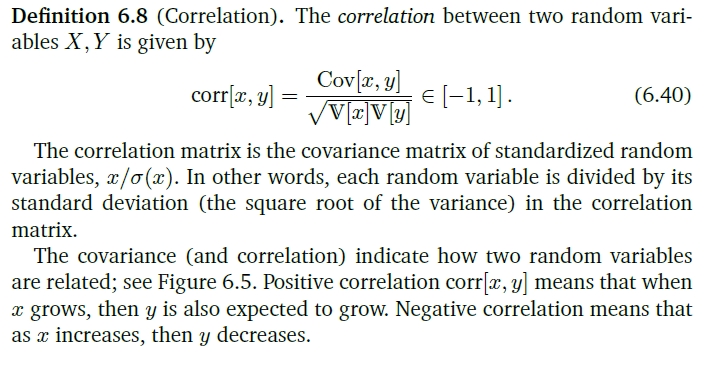
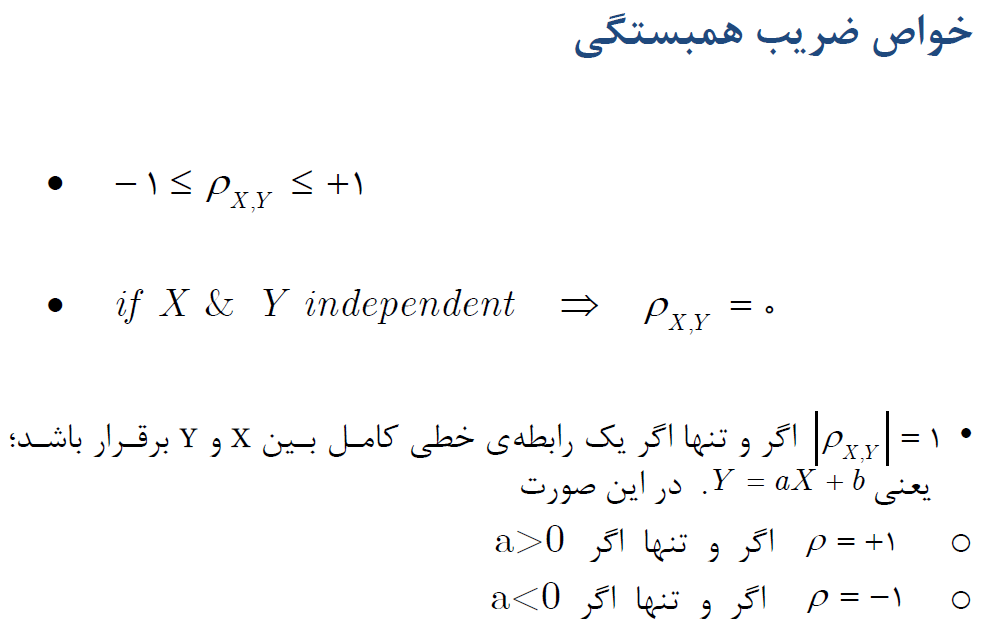


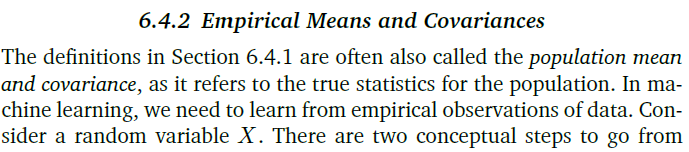


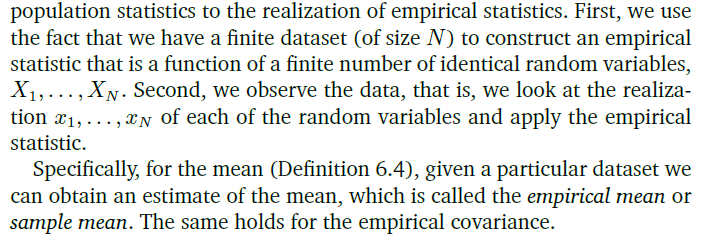
 

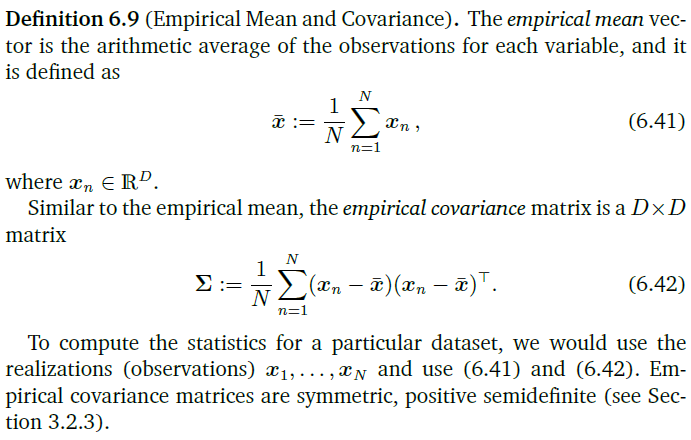


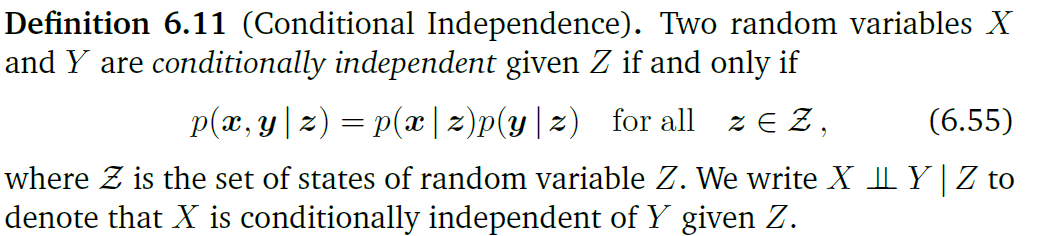
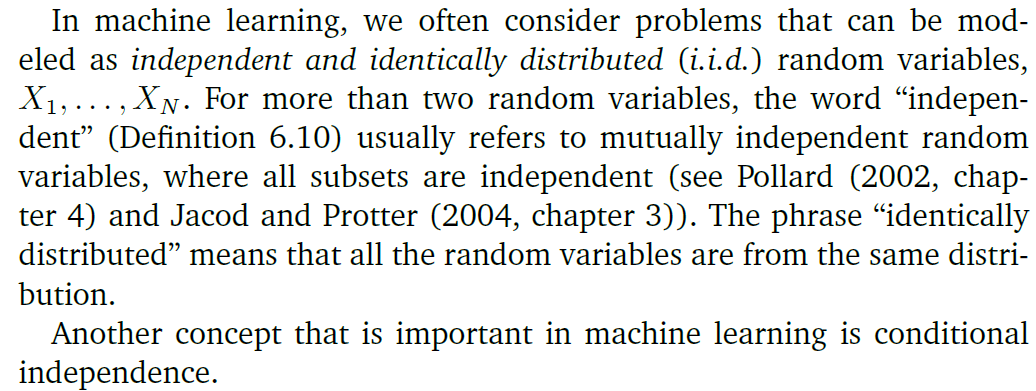
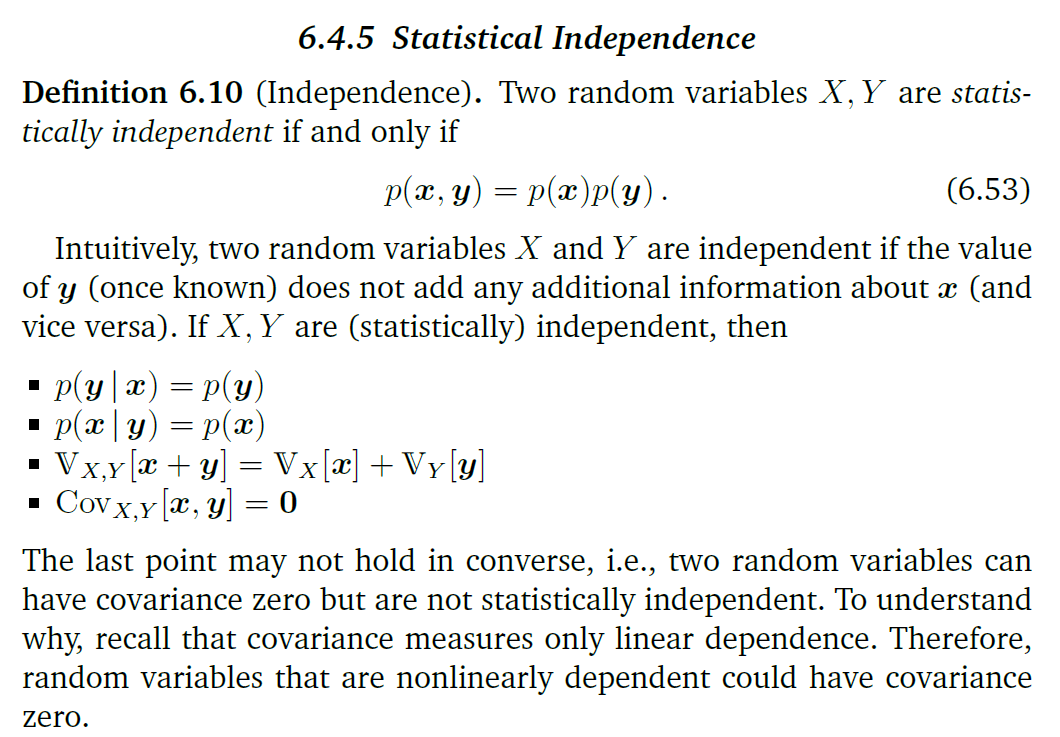


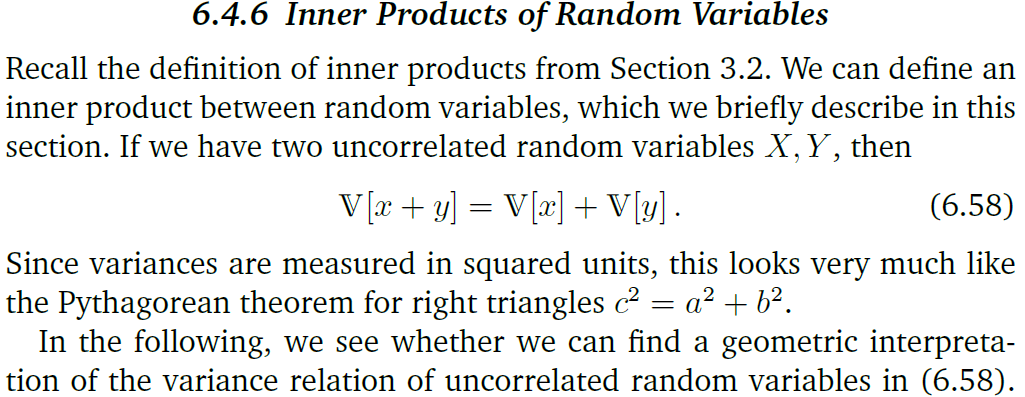
 

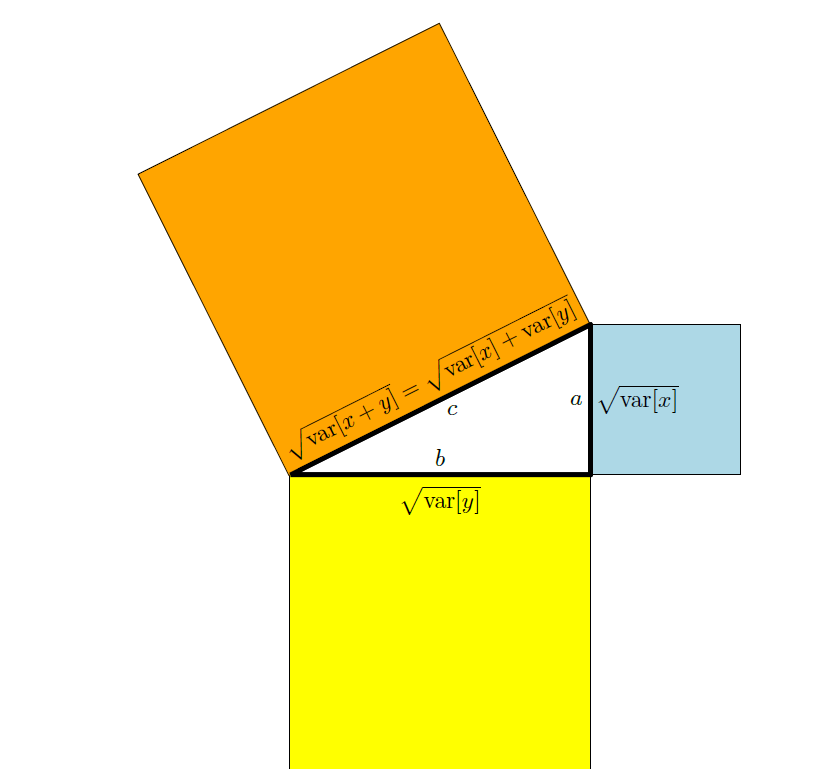


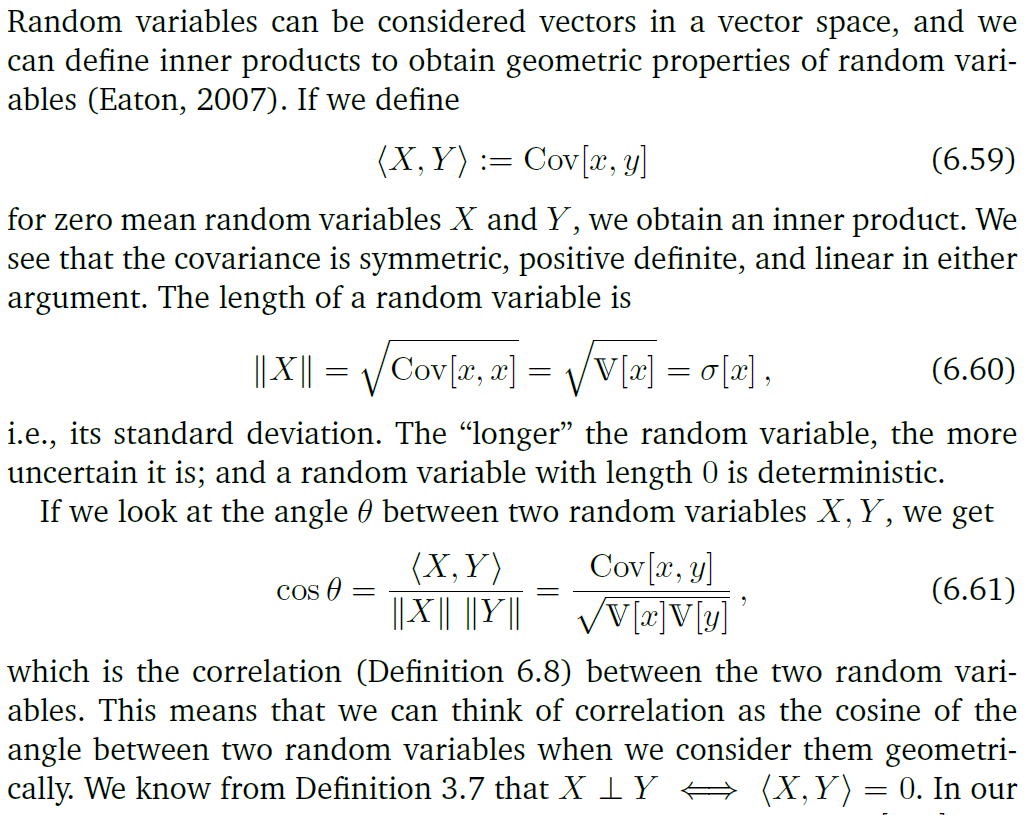


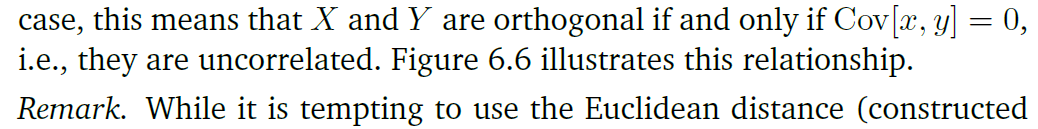












**Gaussian Distribution**

