

MISSOURI S&T MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Chapter 2

Probability

- 2.1 Sample Spaces and Events
- 2.2 Axioms, Interpretations, and Properties of Probability
- 2.3 Counting Techniques
- 2.4 Conditional Probability
- 2.5 Independence**

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Independence

Two events A and B are called **independent** if

$$P(A|B) = P(A).$$

Otherwise they are called **dependent**.

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Example

An urn contains 2 black balls, numbered 1 and 2, and 2 white balls, numbered 3 and 4. Consider the following events: 'A black ball is selected' (event A), 'an even numbered ball is selected' (event B), 'a ball with a number bigger than 2 is selected' (event C).

- a) Are events A and B independent or dependent?
- b) Are events A and C independent or dependent?

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Independence

Two events A and B are **independent** if and only if

$$P(A \cap B) = P(A) \cdot P(B).$$

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Example

It is known that 30% of a certain company's laser printers require service while under warranty, whereas only 10% of that company's inkjet printers need service while under warranty. If someone purchases both a laser printer and an inkjet printer of that company, what is the probability that both printers need warranty service (assuming that both machines function independently of one another)?

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Independence

If two events A and B are independent, then also

1. A' and B are independent,
2. A and B' are independent,
3. A' and B' are independent.

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Example

It is known that 30% of a certain company's laser printers require service while under warranty, whereas only 10% of that company's inkjet printers need service while under warranty. If someone purchases both a laser printer and an inkjet printer of that company, what is the probability that neither printer need warranty service (assuming that both machines function independently of one another)?

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Independence of More than Two Events

n events are called **mutually independent** if the probability of the intersection of any subset of the n events is equal to the product of the individual probabilities.

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Example

Assuming that each of the identical cells work independently and that the probability that a cell lasts more than T hours is 0.8 , what is the probability that the series-parallel system below is lasting more than T hours?

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Example

Assuming that each of the identical cells work independently and that the probability that a cell lasts more than T hours is 0.8 , what is the probability that the total-cross-tied system below is lasting more than T hours?

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