2E+F Cond Prob and Indep

Contents

2E Conditional Probability and Independence

[ToC]

E.1 Conditional Probability

- Probability of A given B.

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

- Only defined when $P(B) > 0$.
- Can also be written in **multiplication form**

$$P(A \cap B) = P(A|B)P(B)$$

E.2 Ex: Defective/Non-defective

	Defective	non defective
factory A	22	128
factory B	28	72

You select a product randomly

- $P(Defective)$

- $P(Defective|A)$

E.3 Independence

- Two events A and B are independent if

$$P(A|B) = P(A), \qquad \text{or} \qquad P(A \cap B) = P(A) \cdot P(B).$$

  Events are said to be dependent otherwise.

- This turns Inclusion-Exclusion formula to:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$= P(A) + P(B) - P(A)P(B)$$

- Mutually exclusive events cannot be independent.

E.4 Complements are also independent

Given

- $P(A \cap B) = P(A)P(B)$ and
- $P(A \cup B)$,
- events A^c and B are also independent.

E.5 How the table look under independence

	Defective	non defective	total
factory A	22	128	150
factory B	28	72	100
total	50	200	200

- How should the table look like if they are independent?

	Defective	non defective	total
factory A			150
factory B			100
total	50	200	200

E.6 Ex: Aircraft Seam

- An aircraft seam requires 25 rivets. The seam will have to be reworked if any of these rivets is defective. Suppose rivets are independent of each other.
- If only 1% of all rivets needs to be reworked, what is the probability that a seam needs to be reworked.

E.7 Ex: Free-Throws

- If your chance of making a Free-Throw is 80%, then what is the probability of making F-T 5 in a row? (Assume independence.)

- If you flip a coin 7 times, what is the probability of having 7 H?