
STA 237 NOTES

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Chapter 1: Week 1

1 Lec 1: Outcomes, Events. and Probability

1.1 Introduction

Definitions

1. Probability

- (a) numeric value of certainty/uncertainty

2. (Random) Experiment

- (a) mechanism/phenomenon that results in random or unpredictable outcomes

3. Sample Space

- (a) Set of all outcomes from an experiment
- (b) denoted Ω

4. Event

- (a) Subset of Sample Space
- (b) Relations between events
 - i. INtersect
 - ii. Union
 - iii. Complement

Example 1.1. Neither A not B is denoted $(A \cup B)^c \Rightarrow A^c \cap B^c$

Theorem 1.2. De Morgan's Law states for any events A and B

1. $(A \cup B)^c = A^c \cap B^c$
2. $(A \cap B)^c = A^c \cup B^c$

Example 1.3. Exactly one of A and B is denoted as

$$A \cup B \cap (A \cup B)^c = A \cup B \cap (A^c \cup B^c)$$

More Definitions:

1. Disjoint(mutually exclusive)

- (a) $A \cap B = \emptyset$
- 2. A implies B
 - (a) $A \subset B$
 - (b) $A \cap B = A$

1.2 Probability Function

1.2.1 Definition

Definition 1.4. Probability func P defined on a finite sample space Ω assigns each event $A \in \Omega$ a number $P(A)$ s.t.

1. $P(A) \geq 0$
2. $P(\Omega) = 1$
3. $P(A \cup B) = P(A) + P(B)$
 - (a) if A and B disjoint.

where $P(A)$ is the probability that event A occurs.

1.2.2 Calculating by Counting

Calculating by counting only applies when

1. All outcomes of Ω are equally likely
 - (a) Ω is finite

Then,

$$P(A) = \frac{\text{number of outcomes belonging to } A}{\text{Total number of outcomes in } \Omega}$$

Chapter 2: Summation of Definitions and theorems

2 Definitions

1. Event

- (a) Subset of Sample Space
- (b) Relation between events
 - i. Intersect
 - A. denoted $A \cap B$
 - ii. Union
 - A. denoted $A \cup B$
 - iii. Complement
 - A. denoted A^c

2. Event

- (a) Subset of sample space

3. (Random) Experiment

- (a) Mechanism/Phenomenon that results in random or unpredictable outcomes

4. Probability

- (a) Numeric Value of certainty/uncertainty

5. Sample Space

- (a) Set of all possible outcomes (from experiment)
- (b) Denoted Ω

3 Theorems