Course 2

experiment试验: An experiment is any action or process whose outcome is subject to uncertainty

sample space样本空间: the set S of all possible outcomes of that experiment

Example: Filp a fair coin 3 times is an sample space S, the coin has 2 status H(head) and T(tail)

$$S = \{HHH, HHT, HTH, THH, THT, TTH, HTT, TTT\}$$

event事件: $E \in S$ 事件就是样本空间内的元素

- simple event(elementary event)简单/基本事件: An event consists of exactly one outcome
- compound event复合事件:

set theory集合理论

- Union并

$$A \cup B = \{x | x \in A \text{ or } x \in B\}$$

- Intersection交

$$A \cap B = \{x | x \in A \text{ and } x \in B\}$$

  - If $A \cap B = \emptyset$, it is called *disjoint events/mutually exclusive*互斥事件
- complement补

$$A' = \bar{A} = \{x \in U | x \notin A\}$$

probability概率:

- $P(A) \geq 0$样本中任意事件的发生概率不为负数
- $P(S) = 1$总体的发生概率为1
- If $A_1, A_2, \ldots$ are *disjoint/mutual exclusive* each other, $P(A_1 \cup A_2 \cup \cdots \cup A_n) = \sum P(A_i)$互斥事件的概率满足该规律
- $P(\emptyset) = 0$
- $\lim\limits_{n \to \infty} \dfrac{n(A)}{N} = P(A)$用频率估计概率，蒙特卡洛算法
- $P(A) = 1 - P(\bar{A})$
- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$, if A and B are disjoint, then $P(A \cup B) = P(A) + P(B)$

equally likely outcomes等概率事件: $p = P(E_i)$ for every i, then

$$1 = \sum_{i=1}^{N} P(E_i) = \sum_{i=1}^{N} p \to p = \frac{1}{N}$$

$$P(A) = \frac{N(A)}{N(S)}$$

permutation排列

- $P_{n,r} = \dfrac{n!}{(n-r)!} (0 \leq r \leq n) = n \times (n-1) \times \cdots \times (n-r+1)$
- $P_{n,n} = n!$

combination组合

- $C_{n,r} = \dbinom{n}{r} = \dfrac{P_{n,r}}{r!} = \dfrac{n!}{r!(n-r)!} = \dfrac{n \times (n-1) \times \cdots \times (n-r+1)}{r!}$
- $C_{n,r} \subset P_{n,r}$

counting techniques计数原理:

- Addition principle加法原理: 单步多方式处理问题

- Multiplication principle乘法原理: 多步骤处理问题

Homework

Section 2.1 2, 4, 9
Section 2.2 12, 18, 27
Section 2.3 30, 38, 40