

Statistics Notes

First & Second Paper

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Part I

First Paper

Chapter 1

Introduction

Part II

Second Paper

Chapter 2

Probability

Trial. Definition.

Experiment. An act that can be repeated under some specific condition.

Random variable. A variable whose values are associated with probability..

Sample space. Set of all possible outcomes of a random experiment.

Sample point. Each outcome of a sample space.

Event. Any subset of a sample space.

Simple event. An event having a single outcome.

Compound/Composite event. An event having more than one outcome.

Impossible event. An event which cannot happen (If $P(A) = 0$, then A is an impossible event).

Certain event. An event which surely will or will not happen. ($P(A) = 0$ or 1).

Trial. Definition.

To be fetched from Rmd file...

2.1 Creative Questions

1. Events that do not depend on each other are called independent events, and events that cannot occur simulataneously are called disjoint events.

(a) Provide an example of disjoint events, using the set theory. 1

(b) Prove that $P(A \cap \bar{B}) = P(A) - P(A \cap B)$ 2

(c) If there are k mutually and exhaustive events, prove $\sum_{i=1}^k P(A_i) = 1$ 3

(d) Prove that two events cannot be simulataneously independent and mutually exclusive. 4

Chapter 3

Random Variable and Probability Distribution

3.1 Terms

Random variable. A variable which is associated with probability.

Probability distribution A distribution shows how the probability is distributed among the possible values or outcomes. It gives us a pattern of the data.

3.2 Concepts

- Recall a histogram
- We could plot relative frequencies instead of frequencies
- Relative frequencies are nothing but probabilities

Example:

3.2.1 Examples of distribution

If a biased coin is tossed once, the following may occur:

x	H	T
P(x)	1/3	2/3

This is one of the simplest kind of probability distribution.

****Now****, if we toss a coin twice, we get the following sample space.

First Toss →	H	T
Second Toss ↓	H T	HH TH HT TT

If we now define

X = no. of heads

then we can construct the following probability distribution.

x	0	1	2
P(x)	1/4	1/2	1/4

Since 1 head can appear in two ways (HT, TH), so $P(1H) = \frac{2}{4} = \frac{1}{2}$.

Similarly, $P(2H) = \frac{1}{4}$, and no head (0) can appear in 1 way, so $P(0) = \frac{1}{4}$

These are tabular distribution. A distribution can also be expressed in a functional form.

$$P(x) = \frac{x+k}{14}; x = 1, 2, 3, 4$$

is a **discrete distribution**, since values of x are specific and isolated. The distributions involving a discrete random variable is called a probability (mass) function (pmf), and are denoted by $P(x)$.

The following is a **continuous distribution**.

$$f(x) = 6x(1-x); 0 \leq x \leq 1$$

3.3 Problems related to distribution

Problem 1. A probability density function is given below:

$$P(x) = \frac{x+k}{14}; x = 1, 2, 3, 4$$

1. Find k
2. $P(X > 2)$
3. $P(X \leq 2)$
4. $P(X \geq 3)$
5. $P(X = 2)$
6. $P(2 \leq X \leq 4)$

Solution:

Class work

Problem 2. A joint probability density function is given below:

$$f(x) = x + \frac{3}{2}y^2; 0 \leq x \leq 1, 0 \leq y \leq 1$$

Conclusion

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