Statistics Notes

First & Second Paper

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Introduction

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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 occurr 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.
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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