Prob & Stats

Kyoshiro Kamura

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1 Introduction

Prob & Stats is Not New.
The concept of chance of uncertainty.

2 Sets and Elements

A **“set”** is clealy defined collection of **“elements”**.
Sets are clealy defined, but not nessesarily finite.

2.1 Symbols

When element “a” belongs to set “A”, we write

$$a \in A$$

That means “a is an element of A.”.
If element “b” is outside set “A”, we write

$$b \notin A$$

If the elements of set B are contained within set A

$$B \subset A$$

That means “B is subset of A.”.
A set containing no elements is called **“null set”** and witten as "$\emptyset$”.

<u>Let’s consider 2 sets A and B</u>

The set created by the elements belonging to both A & B is called the **“intersection”**.

$$A \cap B$$

The set created by all the element of A & B is called the **“union”**

$$A \cup B$$

All elements outside both A & B from the "complementary" set.

$$\overline{A \cup B} = U - (A \cup B)$$

> Note
>
> In some textbook, this symbol, "U" means **"Everything"**.

<u>Practice Excercise</u>

$$U = \{1, 2, 4, 8, 10\}, A = \{4, 8\}$$

Note : "U" is the "entire universe", and A is a subset of U.

1. $A \cap U = \{4, 8\}$
2. $A \cup U = \{1, 2, 4, 8, 10\}$
3. $B = \overline{A} = \{1, 2, 10\}$
4, $A \cap B = \emptyset$
5, $A \cup B = \{1, 2, 4, 8, 10\}$

2.2 Rules

For calucalations with sets, the following equations **"rules"** are useful.

- Commutative Rule : $A \cup B = B \cup A$, $A \cap B = B \cap A$
- Associative Rule : $A \cup (B \cup C) = (A \cup B) \cup C$, $A \cap (B \cap C) = (A \cap B) \cap C$
- Distributive Rule : $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$, $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
- De Morgan's Rule : $\overline{A \cap B} = \overline{A} \cup \overline{B}$, $\overline{A \cup B} = \overline{A} \cap \overline{B}$

<u>Practice Excercise</u>

·Use Venn's Diagram to show De Morgan's Rule 1.

·Use Venn's Diagram to show De Morgan's Rule 2.

Two Basic Rules

$$\overline{(\overline{A})} = A, \ A \cap \overline{A} = \emptyset$$

2.3 How to count the number of elements

$n(A)$:number of elements in finite set A

$n(B)$:number of elements in finite set B
$n(A \cup B)$:number of elements in sets A and B

The way to count the number of elements.

If ther is on overlap.

$$n(A \cup B) = n(A) + n(B)$$

but, in case of some counted twice,

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

$A \times B$:**"direct product"** or **"cartesian product"** means set of all possible ordered pairs.

$$A \times B = \{(a,\ b) | a \in A,\ b \in B\}$$

$$n(A \times B) = n(A).n(B)$$