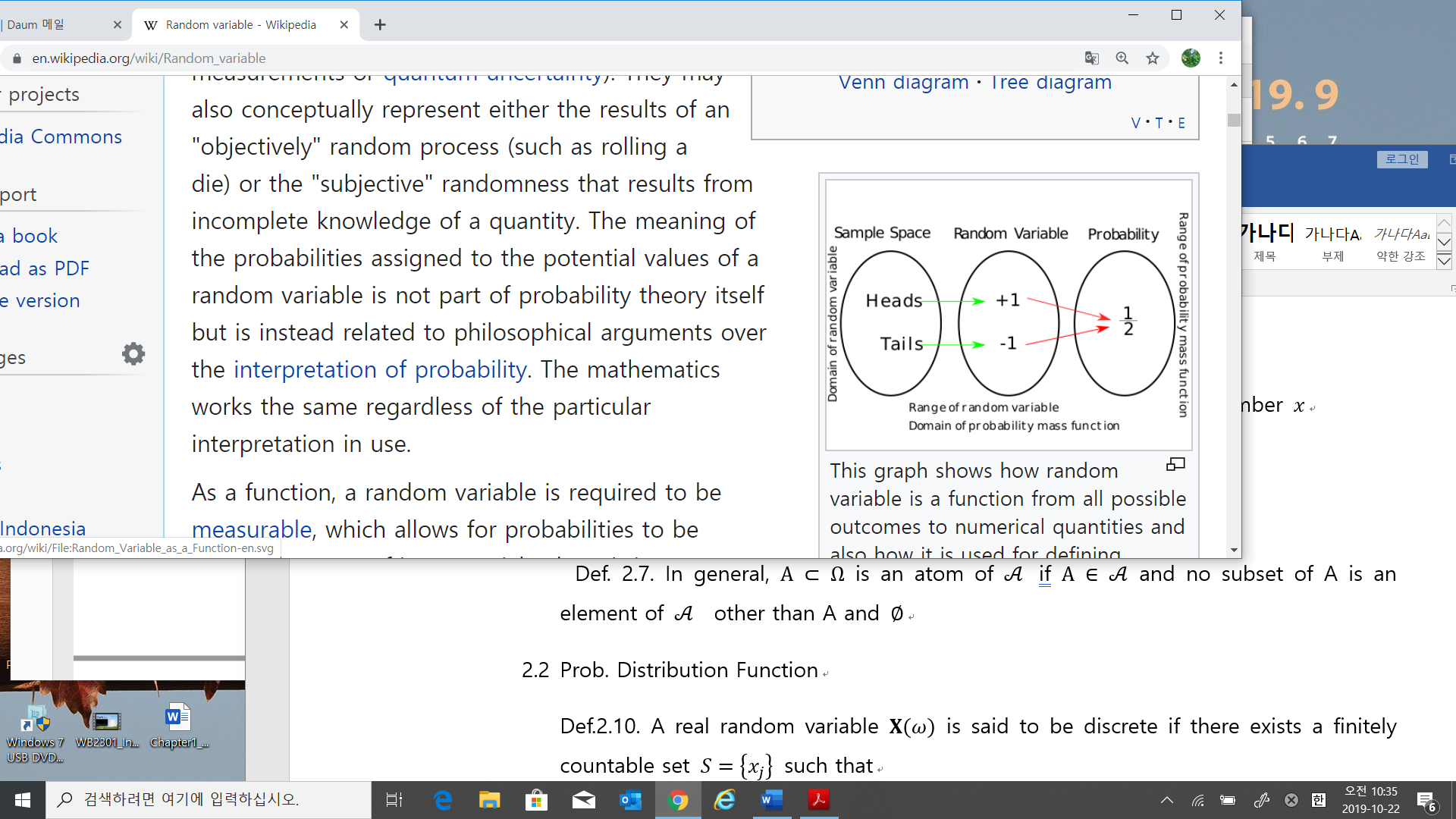
1. Random Variables and Stochastic Process
   1. Random Variables

Def. 2.1. Given a probability space,, a random variable is a real-(vector-) valued point function which carries a sample point, , into a point

in such a way that every sets, , of the form

is an element of the

* In the textbook, mis spelled. As
* Random variable
* is a function such that associates to a real number
* Wiki: <https://en.wikipedia.org/wiki/Random_variable>



Ex.2.4. The Experiment: two coins flips

The sample space

The Event: at least one Head:

A candidate random variable

We may call this as the Indicator random variable

Now the event generated by may be defined (as you like)

Probability graph in

0 1

3/4

1/4

%%% Kim’s comment:

What is in this case? Well

And

Hence we may calculate for any %%%%

Def. 2.7. In general, is an atom of if and no subset of A is an element of other than A and .

Hence are atoms of

%%% Kim’s comment :

See the notation , %%%

* 1. Prob. Distribution Function
* **Probability Distribution function**

Def.2.10. A real random variable is said to be discrete if there exists a finitely countable set such that

* 1. Prob. Density Function

Suppose such that

Then is **the probability density function**,

Proposition 2.12.

%%% Kim’s comment : in the limit notation

%%%

%%% kim’s comment on

One of the special function in mathematics is function. The definition of is

In the shift form

What is the value of ? It may be called as an impulse function. As you see

Now for any constant , which is as large as possible

So to satisfy (1), the magnitude of , which is not defined at the real number.So in fact the delta function is not a function. We may remember in the system theory, the Laplace transform of the delta function, i.e.,

%%%%

* Common (Probability) Distribution Functions for Random Variables

1. The uniform distribution function
2. The exponential distribution function
3. The Gaussian probability distribution(the normal distribution function)

A Gaussian random vector , the density is

where the mean vector,

the covariance matrix,

the determinant of