On the homework of the 3rd week

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⋓ **1.**

1. *We now observe the form* $0.ab$*. There is a way to reach the meaning of the number* 10^2*, which is the number of all decimal numbers in this form: We have two decimal places, each of which has 10 choices, and then we get* 10^2 *choices. Similarly, when it comes to the form* $0.abc$*, we might choose the digits thrice, hence we get* 10^3*. For* $0.a_1a_2...a_n$*, we get* 10^n*. If we view exponentiation as choices like previous forms on decimals, and if we denote the "number" (cardinality) of the set of the whole natural numbers by* $\aleph$*, we will find that the "number" of the whole real number is* $10^{\aleph}$*. (We have reason to believe that after excluding those whcih are in the form* $0.a_1...a_k99999....$*, the number remains the same.)*

2. *According what is discussed before, we might view a decimal* $\alpha = 0.a_1...a_n$ *as a series of choices on its own decimal places. To be more clear,*

For 1, it is assigned to the first place a_1*.*

For 2, it is assigned to the second place a_2*.*

$\vdots$

For n*, it is assigned to the* n*th place* a_n*.*

If we hope to express the assignment by ordered pairs, we can write

$$\alpha \sim \{(1, a_1), (2, a_2), ..., (n, a_n)\}$$

which indicates the functional correspondence. In fact, it represents a function

$$f : \{1, 2, 3, ..., n\} \to \{1, 2, 3, ..., 9\} \qquad j \mapsto a_j$$

We're now inspired to interpret A^B *throught a similar way, i.e.* A^B *represents all mappings from* B *to* A*. Written in the form of pairs, we get*

$$\begin{array}{cc} \{(1,0),(2,0),(3,0)\} & \{(1,0),(2,0),(3,1)\} \\ \{(1,0),(2,1),(3,0)\} & \{(1,0),(2,1),(3,1)\} \\ \{(1,1),(2,0),(3,0)\} & \{(1,1),(2,0),(3,1)\} \\ \{(1,1),(2,1),(3,0)\} & \{(1,1),(2,1),(3,1)\} \end{array}$$

Briefly, A^B *means*

$$\{\ \{(1,m),(2,n),(3,p)\}\ |m,n,p \in \{0,1\}\}$$

3. *All its subsets are:* $\varnothing$, $\{1\}$, $\{2\}$, $\{3\}$, $\{1,2\}$, $\{2,3\}$, $\{1,3\}$, $\{1,2,3\}$. *In fact, there is an one one correspondence between* $\wp(B)$ *and* A^B. *The following is a simple illustration.*

$$\begin{array}{rcl} \{2,3\} & \leftrightarrow & \{(1,0),(2,1),(3,1)\} \\ \{1,2\} & \leftrightarrow & \{(1,1),(2,1),(3,0)\} \\ \{1\} & \leftrightarrow & \{(1,1),(2,0),(3,0)\} \end{array}$$

i.e. what is chosen in a given subset of B *might be assigned to* 1 *in the form of pairs, while the others are assigned to* 0.

4. *From (3), we find that* A^B *has the same number of elements as* $\wp B$ *does, and the former contains* 2^n *elements. Moreover , the number of the later ist*

$$C_0^n + C_1^n + ... + C_n^n$$

The meaning is clear.

5. *As what I emphasize previously,* $10^{\mathbb{N}}$ *can be viewed as mapping from* $\mathbb{N}$ *to* $\{0,1,2,...,9\}$. *THis means, if* $f \in 10^{\mathbb{N}}$, *i.e.* f *is such a mapping, then* $f_1, f_2, ...$ *can be viewed as a decimal*

$$0.f_1 f_2 f_3 ....$$

Cantor's diagonal method will help us on this proof.

6. *A real number can be expressed either by Decade or by Binary place. Both can be viewed as a set of mappings* X^Y, *and can be shown equinumerous through Cantor's diagonal method.*

$\Cup$ **2.** *When a person is "sensitive" in some area, say science, math, classical music, and so on, he/she might feel toughed when immersed in these areas. There're many examples. I mean, we can compare the following individuals, Tom and Kyle. Suppose that Tom is good at physics, but Kyle is not so adept as Tom in physics. The greatest difference between the two person is, Kyle feels touched while knowing new knowledge on physics, and deeply desires to know what is behind those exposed evidences, while Tom only cares about answers on exams. Although Kyle has a very poor grade on standard courses, I will declare Kyle's sensitivity because there are tremendous hopes on him . Sensativity produces enjoyment, which is the greatest treasure of everybody's life. With all these beautiful experences, people has their own believes, and with these believes, one knows what to do no matter what happens to him. Everything he does is not motivated by others, but by his mind.*

$\Cup$ **3.** *(Omitted)*

$\Cup$ **4.** *(Omitted)*