Re: Simple question on Shannon's 1948 paper

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- *Date*: 29 Dec 2006 03:35:52 −0800

Michael wrote:

> I am interested in the second unnumbered equation in
> Part 1 of the paper:
>
> N(t) = N(t−t_1) + N(t−t_2) + ... N(t−t_n)
>
> How do I see that the above equation does what it says
> it does, and what are the conditions on N(t)?

A couple lines before and after define terms. I'll paraphrase:

We are interested in sequences of the symbols S1, ..., Sn. Each symbol
Si takes t_i time to transmit.

N(t) = number of sequences of duration t
= number of sequences of duration t that end in S1 + number of
sequences of duration t that end in S2 + . . . + number of sequences of
duration t that end in Sn
= number of sequences of duration t − t_1 * 1 + number of
sequences of duration t − t_2 * 1 + . . . + number of sequences of
duration t − t_n * 1
= N(t−t_1) + N(t−t_2) + ... N(t−t_n)

The third step is the doosy. Basically, we want to show that, for all
i
number of sequences of duration t that end in Si = number of sequences
of duration t − t_i * 1

Well, basically, we could write out all the sequences:
SS...SSi
where S is some symbol (any symbol), and the last symbol is Si. There
could be a bunch of these:
S1Si
S2Si
S1S2S3S4Si
whatever.

> The total number is (# of sequences SS...S) * 1, i.e., the last element
> of the sequence is fixed as Si.
>
> Si takes t_i time. Let's suppose we can transmit SS...S in t−t_i time.
> Then we can transmit SS...SSi in (t−t_i) + t_i = t time. In fact,
> that's if and only if (details left for you).

Thanks Michael.

You have made it beautifully clear.

I have (if you don't mind) one last question.

I assume N(t−t_i) = 0 if t−t_i <0.

My question is what to assume about N(0).
If t_1 is the smallest of the t_i's and I choose
t=t_1 then I would expect that N(t_1)=1.

Plugging this into the formula Shannon derived,
I get N(t_1)=N(0) +0 + 0 + ...

So I evidently need to take N(0)=1. Is this correct
and if so what is its interpretation?

Thanks again.

Inf.

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