

Statistical Learning Theory, Exercise 2

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Membership Processes

Consider the membership process defined by the set of all intervals $[a, b] \subseteq \mathbb{R}$

1. Compute $N(t)$ for $t = 1, 2, 3, 4$.

Without loss of generality, we will assume that our questions are ordered. That is, $\forall x \geq 1, x_t > x_{t-1}$.

$$N(1) = 2$$

$$N(2) = 4$$

$$N(3) = 7$$

$$N(4) = 11$$

□

2. Find a general formula for $N(t)$.

After some mathematical manipulation, the formula for $N(t)$ appears to be:

$$N(t) = \frac{t^2}{2} + \frac{t}{2} + 1$$

□

3. Compare $N(t)$ to $\Phi(2, t)$.

$$\Phi(2, t) = \binom{t}{0} + \binom{t}{1} + \binom{t}{2} = \frac{1}{2}(t^2 + t + 2)$$

This is equal to the $N(t)$ that was computed above.

□