ML Homework 3

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2017 10 22

Problem 1. *Prove:* $\sum_{k=0}^{d} C_n^k \leq \left(\frac{en}{d}\right)^d$

Proof.

$$\sum_{k=0}^{d} C_n^k \leq \sum_{k=0}^{d} \frac{n^k}{k!}$$

$$= \left(\frac{n}{d}\right)^d \sum_{k=0}^{d} \frac{d^k}{k!} \left(\frac{d}{n}\right)^{d-k}$$

$$\leq \left(\frac{n}{d}\right)^d \sum_{k=0}^{d} \frac{d^k}{k!}$$

$$\leq \left(\frac{n}{d}\right)^d \sum_{k=0}^{+\infty} \frac{d^k}{k!}$$

$$= \left(\frac{n}{d}\right)^d e^d$$

$$= \left(\frac{en}{d}\right)^d$$

$\square$

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