

Homework #0 Solution B

Spring 2020, CSE 446/546: Machine Learning

Jiahui Xi

Due: 4/8/20 11:59 PM

A: 37 points. B: 3 points

April 2020

B.1 Solution:

$$E[Y] = \frac{n}{1+n}$$

B.2 Solution:

AB is an $n \times n$ matrix and BA is an $m \times m$ matrix.

$$(AB)_{ii} = \sum_{j=1}^m A_{ij} B_{ji} \text{ and}$$

$$(BA)_{ii} = \sum_{j=1}^n B_{ij} A_{ji}$$

For the trace,

$$\text{Tr}(AB) = \sum_{i=1}^n \sum_{j=1}^m A_{ij} B_{ji}$$

$$\text{Tr}(BA) = \sum_{i=1}^m \sum_{j=1}^n B_{ij} A_{ji}$$

So $\text{Tr}(AB) = \text{Tr}(BA)$.

B.3 Solution:

- a. $\min(\text{rank})=1$ and $\max(\text{rank})=d$
- b. $\min(\text{rank})=1$ and $\max(\text{rank}) = \min \{n, d\}$
- c. $\min(\text{rank})=0$ (if $Av=0$) and $\max(\text{rank})=D$
- d. $\min(\text{rank})=0$ and $\max(\text{rank}) = \min \{n, D\}$
if V is of rank d, $\min(\text{rank})=1$ because AV can't be 0, $\max(\text{rank})=d$.