

VE401 Assignment 2

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Exercise 1. Discrete Uniform Distribution

1. **Solution.** With the parameter n , we have

$$\begin{aligned} m_x(t) &= E(e^{xt}) = \sum_{k=1}^n e^{x_k t} \frac{1}{n} \\ &= \frac{1}{n} \sum_{k=1}^n e^{x_k t} \end{aligned}$$

□

2. **Solution.** From the moment generating function we get that

$$\begin{aligned} E[X] &= \frac{d}{dt} m_x(t) \Big|_{t=0} \\ &= \frac{1}{n} \sum_{k=1}^n \left[\frac{d}{dt} e^{x_k t} \Big|_{t=0} \right] \\ &= \frac{1}{n} \sum_{k=1}^n x_k \end{aligned}$$

and

$$\begin{aligned} E[X^2] &= \frac{d^2}{dt^2} m_x(t) \Big|_{t=0} \\ &= \frac{1}{n} \sum_{k=1}^n \left[\frac{d^2}{dt^2} e^{x_k t} \Big|_{t=0} \right] \\ &= \frac{1}{n} \sum_{k=1}^n x_k^2 \end{aligned}$$

And hence the variance is given by

$$Var[X] = E[X^2] - E[X]^2 = \frac{1}{n} \sum_{k=1}^n x_k^2 - \frac{1}{n^2} \left(\sum_{k=1}^n x_k \right)^2$$

□