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CSTDS3 Applied Statistical Modelling
Assignment 1
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Q1

S_2 fails iff both components fail,

$$\mathbb{P}(S_2 \text{ fails}) = \mathbb{P}(x_1 \text{ fails and } x_2 \text{ fails})$$

Given,

$$\mathbb{P}(x_1 \text{ fails}) = \mathbb{P}(x_2 \text{ fails}) = \theta$$

Since x_1 & x_2 failing are independent,

$$\mathbb{P}(S_2 \text{ fails}) = \mathbb{P}(x_1 \text{ fails}) * \mathbb{P}(x_2 \text{ fails})$$

$$\theta_1 = \theta * \theta$$

$$\theta_1 = \theta^2$$

Q2

A -> Total number of observed failures

$$\theta = 0.08; n = 1000$$

Each system follows a bernoulli trial, with the two outcomes; Component failure (success in trial) or Not component failure (failure in trial). The given n systems can thus be modeled with a binomial distribution with a probability of $\theta_1 = \theta^2 = 0.8^2$, and thus $\theta_1 = 0.0064$.

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As stated in the **Probability Review II** notes under the section **Expectation and variance of random variables** for a binomial distribution,

Expectation,

$$\mathbb{E}[A] = n * \theta_1$$

$$\mathbb{E}[A] = 1000 * 0.0064$$

$$\mathbb{E}[A] = 6.4$$