TMA4265 Stochastic Processes
Exercise week 35-36

1: Exercise 3.8 from the book

2: Joint distribution
The joint probability mass function of two discrete random variables X and Y is given by

$$p(x,y) = \exp(-2\lambda)\frac{\lambda^{x+y}}{x!\,y!} \qquad \text{for } x,y \in \{0,1,\ldots\}$$

with $\lambda > 0$.

1. Compute the marginal probability mass functions $p_X(x)$ and $p_Y(y)$. Compute the covariance of X and Y.
2. Compute the conditional probability mass function of $X|X+Y$.
3. Compute the covariance of $X+Y$ and $X-Y$.

3: Exercise 3.24 from the book

4: Expectation
1. We roll a standard die over and over. What is the expected number of rolls until the first pair of consecutive sixes appears?

5: Changes in stock prices
Let Z be a random variable that denotes the price change for one stock in a specific company from the stock exchange closes one day till it closes the following day. Each day there may be multiple trades. One possible model is given by

$$Z = X_0 + X_1 + \ldots + X_N,$$

where $X_0, X_1, \ldots, X_N$ are independent random variables with normal distributions with mean 0 and variance σ^2, that are independent of N which has a Poisson distribution with rate ν. X_0 is the initial price change when the stock exchange opens, X_i, for $i > 0$, is the price change after trade i and N is the total number of trades while the stock exchange is open.

1. Calculate the variance of Z.