STATISTICAL COMPUTATIONAL METHODS

Seminar Nr. 2

Computer Simulations of Discrete Random Variables; Discrete Methods

1. Function **rnd** in Statistics Toolbox; special functions **rand** and **randn**.

2. Using a $\mathcal{U}(0,1)$ (standard uniform) random number generator, write Matlab codes that simulate the following common discrete probability distributions:

a. Bernoulli Distribution $Bern(p)$, with parameter $p \in (0,1)$:

$$X \begin{pmatrix} 0 & 1 \\ 1-p & p \end{pmatrix}$$

b. Binomial Distribution $Bino(p)$,with parameters $n \in \mathbb{N}, p \in (0,1)$:

$$X \begin{pmatrix} k \\ C_n^k p^k q^{n-k} \end{pmatrix}_{k=\overline{0,n}}$$

Hint: A Binomial $Bino(n,p)$ variable is the sum of n independent $Bern(p)$ variables;

c. Geometric Distribution $Geo(p)$, with parameter $p \in (0,1)$:

$$X \begin{pmatrix} k \\ pq^k \end{pmatrix}_{k\in\mathbb{N}}$$

Hint: A Geometric $Geo(p)$ variable represents the number of failures (i.e. the number of Bernoulli trials that ended up being failures) needed to get the first success;

d. Negative Binomial Distribution $NB(n,p)$ with parameters $n \in \mathbb{N}, p \in (0,1)$:

$$X \begin{pmatrix} k \\ C_{n+k-1}^k p^n q^k \end{pmatrix}_{k\in\mathbb{N}}$$

Hint: A Negative Binomial $NB(n,p)$ variable is the sum of n independent $Geo(p)$ variables;

e. Poisson Distribution $Poiss(\lambda)$ with parameter $\lambda > 0$:

$$X \begin{pmatrix} k \\ \dfrac{\lambda^k}{k!}e^{-\lambda} \end{pmatrix}_{k\in\mathbb{N}}$$