STATISTICAL COMPUTATIONAL METHODS

Seminar Nr. 2

Computer Simulations of Discrete Random Variables; Discrete Methods; Discrete Inverse Transform Method

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

2. Using discrete methods and a Standard Uniform $U(0,1)$ 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 $B(n,p)$, with parameters $n \in \mathbb{N}, p \in (0,1) : X \begin{pmatrix} k \\ C_n^k p^k q^{n-k} \end{pmatrix}_{k=\overline{0,n}}$

c) Geometric Distribution $Geo(p)$, with parameter $p \in (0,1) : X \begin{pmatrix} k \\ pq^k \end{pmatrix}_{k \in \mathbb{N}}$

d) Negative Binomial Distribution $NB(n,p)$ with parameters $n \in \mathbb{N}, p \in (0,1)$: $X \begin{pmatrix} k \\ C_{n+k-1}^k p^n q^k \end{pmatrix}_{k \in \mathbb{N}}$

e) Poisson Distribution $\mathcal{P}(\lambda)$ with parameter $\lambda > 0 : X \begin{pmatrix} k \\ \frac{\lambda^k}{k!} e^{-\lambda} \end{pmatrix}_{k \in \mathbb{N}}$

<u>Optional</u>

f) Discrete Uniform Distribution $U(m)$ with parameter $m \in \mathbb{N} : X \begin{pmatrix} k \\ \frac{1}{m} \end{pmatrix}_{k=\overline{1,m}}$

3.

a) Use the DITM to generate a $Geo(p), p \in (0,1)$, variable.

b) Then use that to generate a $NB(n,p), n \in \mathbb{N}, p \in (0,1)$, variable.