Lab Nr. 4, Probability and Statistics
Continuous Random Variables; CDF and Inverse CDF

1. Let X have one of the following distributions: $X \in N(\mu, \sigma)$ (normal), $X \in T(n)$ (Student), $X \in \chi^2(n)$, or $X \in F(m, n)$ (Fischer). For given values of $x_0, x_1, x_2 \in \mathbb{R}$ and $\alpha, \beta \in (0, 1)$, compute the following:

a) $P(X \leq x_0)$;

b) $P(X \geq x_0)$;

c) $P(x_1 \leq X \leq x_2)$ (for $x_1 < x_2$);

d) $P(X \leq x_1$ or $X \geq x_2)$ (for $x_1 < x_2$);

e) the value x_α such that $P(X < x_\alpha) = \alpha$;

f) the value x_β such that $P(X > x_\beta) = \beta$.

2. Normal approximation to the binomial distribution: For moderate values of p ($0.05 \leq p \leq 0.95$) and large values of n ($n \to \infty$),

$$\text{Bino}(n, p) \approx \text{ Norm}\left(\mu = np, \sigma = \sqrt{np(1-p)}\right).$$

Write a Matlab code to visualize how the binomial distribution gradually takes the shape of the normal distribution as $n \to \infty$.