Some formulas for the Course "Theory of Probability 1"

(for specialities 201.1.131)

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

$$P(B) = \sum_{k=1}^{n} P(A_k)P(B|A_k), \quad P(A_i|B) = \frac{P(A_i)P(B|A_i)}{\sum_{k=1}^{n} P(A_k)P(B|A_k)}$$

$$f_Y(y) = \sum_{k=1}^{n} f_X(h_k(y))|h_k'(y)|,$$

where $Y = g(X)$ and $h_k(y),\ k = 1, \ldots, n$ are the solutions of the equation $g(x) = y$.

$$EX = -\int_{-\infty}^{0} F_X(t)dt + \int_{0}^{\infty} [1 - F_X(t)]dt$$

$$E(g(X)) = \int_{-\infty}^{\infty} g(t)f_X(t)dt$$

$$Var(X) = \int_{-\infty}^{\infty} t^2 f_X(t)dt - (EX)^2$$

$$P(|X - EX| \geq b) \leq \frac{Var(X)}{b^2}, \quad P(|X - EX| < b) > 1 - \frac{Var(X)}{b^2}$$

$$f_Y(y) = \int_{-\infty}^{\infty} f_{X,Y}(x,y)dx, \quad f_X(x) = \int_{-\infty}^{\infty} f_{X,Y}(x,y)dy$$

$$E(g(X,Y)) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} g(x,y)f_{X,Y}(x,y)dxdy$$

$$Cov(X,Y) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} xyf_{X,Y}(x,y)dxdy - EXEY$$

$$\rho(X,Y) = \frac{Cov(X,Y)}{\sigma_X \sigma_Y}$$

$$f_{X|Y}(x|y) = \frac{f_{X,Y}(x,y)}{f_Y(y)}, \quad f_{Y|X}(y|x) = \frac{f_{X,Y}(x,y)}{f_X(x)}$$

$$E(X|Y = y) = \int_{-\infty}^{\infty} xf_{X|Y}(x|y)dx, \quad E(Y|X = x) = \int_{-\infty}^{\infty} yf_{Y|X}(y|x)dy$$

$$\lim_{n\to\infty} P\left(\frac{S_n - \mu n}{\sigma\sqrt{n}} \leq t\right) = \Phi(t), \quad \lim_{n\to\infty} P\left(\frac{\bar{X}_n - \mu}{\sigma/\sqrt{n}} \leq t\right) = \Phi(t),$$

where $S_n = \sum_{k=1}^{n} X_k, \quad \bar{X}_n = \frac{1}{n}S_n$