Project II Formula Sheet

Hypergeometric Distribution:

- $\frac{n_A}{n_S} = \frac{\binom{r}{y} \times \binom{N-r}{n-y}}{\binom{N}{n}}$
- $\mu = E(Y)$
- $V(Y) = n(\frac{r}{N})(\frac{N-r}{n-y})(\frac{N-n}{N-1})$

Poisson Distribution:

- $p(y) = \frac{\lambda^y}{y!} e^{-x}$
- $E[Y] = V[Y] = \lambda$

ChebyShev's Theorem:

- $P(|Y - \mu| < k\sigma) \geq 1 - \frac{1}{k_2}$

Cumulative Distribution Function:

- $F(y) = P(Y \leq y)$
- $f(y) = \frac{dF(y)}{dy}$

Interval Probabilities:

- $P(a \leq x \leq b) = \int_a^b f(x)dx$

Uniform Distribution:

- $f(x) = \{\frac{1}{b-a}, a \leq x \leq b; 0, otherwise\}$
- $P(c \leq x \leq d) = \frac{d-c}{b-a}$

Expected for Continuous Random variables:

- $E(Y) = \int_{-\infty}^{\infty} yf(y)dy$
- $E(g(Y)) = \int_{-\infty}^{\infty} g(y)f(y)dy$
- $E(c) = c$
- $V(Y) = E(Y^2) - [E(Y)]^2$

Discrete Bivariate Distributions:

- $p(x, y) = P(X = x, Y = y)$

Marginal and Conditional Probability Distributions:

- $p_1(x) = \sum_{all\ y} p(x, y)$ Definition 5.4 a
- $p_2(y) = \sum_{all\ x} p(x, y)$
- $f_1(x) = \int_{-\infty}^{\infty} f(x,y)dy$ Definition 5.4 b
- $f_2(y) = \int_{-\infty}^{\infty} f(x,y)dx$
- $p(x|y) = P(X = x|Y = y) = \frac{p(x,y)}{p_2(y)}$ Definition 5.5
- $F(x|y) = P(X \leq x|Y = y)$ Definition 5.6
- $f(x|y) = \frac{f(x,y)}{f_2(y)}$ Definition 5.7
- $f(y|x) = \frac{f(x,y)}{f_1(x)}$

Independent Random Variables:

- $F(x, y) = F_1(x)F_2(y)$ Definition 5.8
- $p(x,y) = p_1(x)p_2(y)$ Theorem 5.4
- $f(x,y) = g(x)h(y)$ Theorem 5.5