Formula Sheet

- Sample mean and variance:

$$\bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i, \quad s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(y_i - \bar{y})^2$$

- Median:

$$(0.5)(n+1)$$

- Addition rule:

$$P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$$

- Multiplication rule:

$$P(E_1 \cap E_2) = P(E_1) \times P(E_2|E_1)$$

- Conditional probability:

$$P(E_2|E_1) = \frac{P(E_1 \cap E_2)}{P(E_1)}$$

- Rules of total probability:

$$P(E_1) = P(E_2) \times P(E_1|E_2) + P(E_2^C) \times P(E_1|E_2^C)$$

- Expected value:

$$\mu_Y = \sum y_i P(Y = y_i)$$

- Variance:

$$\sigma_Y^2 = \sum (y_i - \mu_Y)^2 P(Y = y_i)$$

- Linear combinations of random variables:

$$\mu_{aX+b} = a\mu_X + b, \quad \sigma_{aX+b}^2 = a^2\sigma_X^2$$

- Binomial $B(n, p)$:

  * $$P(Y = j) = \binom{n}{j} p^j (1-p)^{n-j},$$

    where

    $$\binom{n}{j} = \frac{n!}{j!(n-j)!} \text{ and } n! = n(n-1)\cdots 1$$

  * $$\mu_Y = np, \quad \sigma_Y^2 = np(1-p)$$

- Standardization:

$$Z = \frac{1}{\sigma_Y}(Y - \mu_Y)$$