MacEwan University

STAT 151

Formula Sheet Midterm Exam

Descriptive Statistics

- Relative Frequency: $\text{rel. freq.} = \dfrac{\text{number of occurences}}{\text{sample size}}$
- Sample Mean : $\bar{x} = \dfrac{\sum_{i=1}^{n} x_i}{n} = \dfrac{\sum x}{n}$
- Sample Variance: $s^2 = \dfrac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1} = \dfrac{\sum_{i=1}^{n} x_i^2 - \frac{(\sum_{i=1}^{n} x_i)^2}{n}}{n-1}$
- Sample Standard Deviation: $s = \sqrt{\text{Sample Variance}} = \sqrt{s^2}$
- Median: Order the data from smallest to largest. The median M is either the unique middle value or the mean of the two middle values.
- Lower Quartile: Order the data from smallest to largest. The lower quartile Q_1 is the median of the smaller half of the values.
- Upper Quartile: Order the data from smallest to largest. The upper quartile Q_3 is the median of the upper half of the values.
- Interquartile Range (IQR) = Upper Quartile – Lower Quartile $= Q_3 - Q_1$
- Outliers: lower fence $= Q_1 - 1.5IQR$ and upper fence$= Q_3 + 1.5IQR$

Probability Theory

- Addition Rule: $P(A \text{ or } B) = P(A) + P(B) - P(A\&B)$
- Complement Rule: $P(\text{A does not occur}) = P(A^c) = 1 - P(A)$
- General Multiplication Rule: $P(A \text{ and } B) = P(A\&B) = P(A|B)P(B)$
- Multiplication Rule for **Independent** Events:
  If A and B are **independent**, then $P(A \text{ and } B) = P(A\&B) = P(A)P(B)$
- Conditional Probability of A given B, if $P(B) > 0$: $P(A|B) = \dfrac{P(A\&B)}{P(B)}$
- Permutations: ${}_nP_r = \dfrac{n!}{(n-r)!}$
- Combinations: ${}_nC_r = \dfrac{n!}{r!(n-r)!}$

Probability Distributions

- $p(x) = P(X = x)$
- The mean (expected value) of a discrete random variable: $\mu = \sum x\ p(x)$.
- The variance of a discrete random variable: $\sigma^2 = \sum (x - \mu)^2 p(x)$
- The standard deviation of a discrete random variable: $\sigma = \sqrt{\sigma^2}$

Binomial Distribution

- Repeat n independent trials, p = probability for Success in an individual trial, X = number of Successes in n trials, then $X \sim bin(n, p)$
- Probability to observe k successes in n independent trials:
  $p(k) = P(X = k) = {}_nC_k\ p^k(1-p)^{n-k}$
- Mean and standard deviation of a binomial distribution:
  $\mu = np$ and $\sigma = \sqrt{np(1-p)}$

Sampling Distributions

- Sampling Distribution of a Sample Mean, $\bar{X}$:

$$\mu_{\bar{X}} = \mu, \quad \sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$$