Statistics Exam – Formula Sheet Included

Formulas Provided

1. Mean, Variance, Standard Deviation

$$\bar{x} = \frac{\sum x_i}{n}, \quad Var(X) = \frac{\sum (x_i - \bar{x})^2}{n-1}, \quad SD = \sqrt{Var(X)}$$

2. Confidence Intervals

- Mean, known σ:

$$CI = \bar{x} \pm z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$$

- Mean, unknown σ:

$$CI = \bar{x} \pm t_{\alpha/2, n-1} \cdot \frac{s}{\sqrt{n}}$$

- Proportion:

$$CI = \hat{p} \pm z_{\alpha/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

3. Hypothesis Testing

- Z-test (known σ):

$$z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

- T-test (unknown σ):

$$t = \frac{\bar{x} - \mu_0}{s / \sqrt{n}}$$

- P-value rule:

$$\text{Reject } H_0 \text{ if } p \leq \alpha$$

4. Probability Distributions

- **Binomial:**

$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}, \quad E(X) = np, \quad Var(X) = np(1-p)$$

- **Poisson:**

$$P(X = k) = \frac{\lambda^k e^{-\lambda}}{k!}, \quad E(X) = Var(X) = \lambda$$

- **Uniform (continuous):**

$$f(x) = \frac{1}{b-a}, \quad P(c \leq X \leq d) = \frac{d-c}{b-a}$$

- **Exponential:**

$$f(x) = \lambda e^{-\lambda x}, \quad E(X) = \frac{1}{\lambda}, \quad P(X > x) = e^{-\lambda x}$$

- **Normal:**

$$Z = \frac{X - \mu}{\sigma}, \quad P(a \leq X \leq b) = P\left(\frac{a-\mu}{\sigma} \leq Z \leq \frac{b-\mu}{\sigma}\right)$$

5. Conditional Probability & Independence

$$P(A|B) = \frac{P(A \cap B)}{P(B)}, \quad P(A \cap B) = P(A)P(B) \text{ if independent}$$

6. Chi-Square Goodness of Fit

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}, \quad df = k - 1$$