confidence level	90%	95%	99%
$z_{\alpha/2}$	1.645	1.96	2.575

STA 291, Section 001-006, Prof. Zhou, Spring 2010
Formulas for Final Exam

- Test statistic for one sample mean, $H_0 : \mu = \mu_0$

$$z_{obs} = \frac{\bar{X} - \mu_0}{\frac{\sigma}{\sqrt{n}}} \qquad or \qquad t_{obs} = \frac{\bar{X} - \mu_0}{\frac{s}{\sqrt{n}}}$$

- Test statistic for 2 sample means, $H_0 : \mu_1 = \mu_2$

$$t_{obs} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

- Test statistic for one sample proportion, $H_0 : p = p_0$

$$z_{obs} = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

- Test statistic for 2 sample proportions, $H_0 : p_1 = p_2$

$$z_{obs} = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\hat{p}(1-\hat{p})}{n_1} + \frac{\hat{p}(1-\hat{p})}{n_2}}}$$

- Computation of p-value:

	lower side $H_A :\ ? <?$	upper side $H_A :\ ? >?$	Two sided $H_A :\ ? \neq ?$
p-value =	$P(Z < z_{obs})$	$P(Z > z_{obs})$	$2P(Z > \lvert z_{obs} \rvert)$

- Sample size n necessary for margin of error B when estimating a population ...

...mean: $n = \sigma^2 \cdot \left(\frac{z}{B}\right)^2$ ...proportion: $n = \hat{p} \cdot (1 - \hat{p}) \cdot \left(\frac{z}{B}\right)^2$

The value z above is determined by confidence level: (e.g. 95% confidence $\Longrightarrow z = 1.96$)

- Large sample confidence interval for the population proportion p:

$$\hat{p} \pm z \cdot \frac{\sqrt{\hat{p} \cdot (1 - \hat{p})}}{\sqrt{n}}$$

- Confidence interval for the population mean, μ: when σ is ...

...known: $\bar{X} \pm z \cdot \frac{\sigma}{\sqrt{n}}$ ...unknown: $\bar{X} \pm t \cdot \frac{s}{\sqrt{n}}$

- z-Score for an individual observation

$$z = \frac{x - \mu}{\sigma} \qquad x = \mu + z \cdot \sigma$$

- Standard Deviation for a sample mean (standard Error)

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

- Additive law of probability

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

- Conditional probability

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

- Independence of A, B:

$$P(A|B) = P(A) \qquad \text{or} \qquad P(A \cap B) = P(A) \cdot P(B)$$

- Sample mean $\bar{x}$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{x_1 + x_2 + \cdots + x_n}{n}$$

- Sample variance s^2

$$s^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1} = \frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \cdots + (x_n - \bar{x})^2}{n-1}$$

- Sample standard deviation s

$$s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}} = \sqrt{\text{sample variance}}$$

- If n observations are ordered in ascending order, median is the $\frac{n+1}{2}$th observation.
- Population mean μ

$$\mu = \frac{\sum_{i=1}^{N} x_i}{N} = \frac{x_1 + x_2 + \cdots + x_N}{N}$$

- Population variance σ^2

$$\sigma^2 = \frac{\sum_{i=1}^{N} (x_i - \mu)^2}{N} = \frac{(x_1 - \mu)^2 + (x_2 - \mu)^2 + \cdots + (x_N - \mu)^2}{N}$$

- Population standard deviation σ

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N} (x_i - \mu)^2}{N}} = \sqrt{\text{population variance}}$$