The topics for the final.

In addition to the topic for midterm 1 and midterm 2 the following topic will be tested.

(1) Biased and unbiased estimators
(2) Minimum Variance Estimators
(3) Method of moments
(4) Method of maximum likelyhood
(5) Large sample confidence interval for population mean: $\bar{X} \pm z_{\alpha/2}\frac{s}{\sqrt{n}}$
(6) Sample size needed to achive a given confidence interval width $n = \left(\frac{2z_{\alpha/2}s}{w}\right)^2$.
(7) Large sample upper and lower confidence bounds for population mean:

$$\mu < \bar{X} + z_\alpha \frac{s}{\sqrt{n}} \text{ and } \mu > \bar{X} - z_\alpha \frac{s}{\sqrt{n}}$$

(8) Score confidence interval for proportion

$$\frac{\hat{p} + z_{\alpha/2}^2/2n}{1 + z_{\alpha/2}^2/n} \pm z_{\alpha/2}\frac{\sqrt{\hat{p}(1-\hat{p})/n + z_{\alpha/2}^2/4n^2}}{1 + z_{\alpha/2}^2/n}$$

where $\hat{p} = \frac{X}{n}$.

(9) Score upper and lower confidence bounds for proportion

$$p < \frac{\hat{p} + z_\alpha^2/2n}{1 + z_\alpha^2/n} + z_\alpha\frac{\sqrt{\hat{p}(1-\hat{p})/n + z_\alpha^2/4n^2}}{1 + z_\alpha^2/n} \text{ and } p > \frac{\hat{p} + z_{\alpha/2}^2/2n}{1 + z_{\alpha/2}^2/n} - z_\alpha\frac{\sqrt{\hat{p}(1-\hat{p})/n + z_\alpha^2/4n^2}}{1 + z_\alpha^2/n}.$$

(10) Confidence interval for mean in normal population $\bar{X} \pm t_{\alpha/2,n-1}\frac{s}{\sqrt{n}}$
(11) Upper and lower confidence bounds for mean in normal population

$$\mu < \bar{X} + t_{\alpha,n-1}\frac{s}{\sqrt{n}} \text{ and } \mu > \bar{X} - t_{\alpha,n-1}\frac{s}{\sqrt{n}}$$

(12) Prediction interval for normal population $\bar{X} \pm t_{\alpha/2,n-1}s\sqrt{1+\frac{1}{n}}$
(13) Type I and type II errors
(14) Large sample hypothesis testing. Rejection regions:
- $\mu = \mu_0$ vs $\mu > \mu_0$: $\frac{\bar{X}-\mu_0}{s/\sqrt{n}} > z_\alpha$.
- $\mu = \mu_0$ vs $\mu < \mu_0$: $\frac{\bar{X}-\mu_0}{s/\sqrt{n}} < -z_\alpha$.
- $\mu = \mu_0$ vs $\mu \neq \mu_0$: $\left|\frac{\bar{X}-\mu_0}{s/\sqrt{n}}\right| > z_{\alpha/2}$.

(15) Large sample hypothesis testing. Type II error:
- $\mu = \mu_0$ vs $\mu > \mu_0$: $\Phi\left(z_\alpha + \frac{\mu_0-\mu'}{s/\sqrt{n}}\right)$
- $\mu = \mu_0$ vs $\mu < \mu_0$: $1 - \Phi\left(-z_\alpha + \frac{\mu_0-\mu'}{s/\sqrt{n}}\right)$
- $\mu = \mu_0$ vs $\mu \neq \mu_0$: $\Phi\left(z_{\alpha/2} + \frac{\mu_0-\mu'}{s/\sqrt{n}}\right) - \Phi\left(-z_{\alpha/2} + \frac{\mu_0-\mu'}{s/\sqrt{n}}\right)$

(16) Hypothesis testing for normal population. Rejection regions:
- $\mu = \mu_0$ vs $\mu > \mu_0$: $\frac{\bar{X}-\mu_0}{s/\sqrt{n}} > t_{\alpha,n-1}$.
- $\mu = \mu_0$ vs $\mu < \mu_0$: $\frac{\bar{X}-\mu_0}{s/\sqrt{n}} < -t_{\alpha,n-1}$.
- $\mu = \mu_0$ vs $\mu \neq \mu_0$: $\left|\frac{\bar{X}-\mu_0}{s/\sqrt{n}}\right| > t_{\alpha/2,n-1}$.

(17) P-values