1. When the data is drawn from a population that has a normal distribution and $\sigma$ is unknown, use a t-test. To test:

$$H_0 : \mu = \mu_0$$
$$H_A : \mu \neq \mu_0$$

at the $100 * \alpha\%$ level based on a sample of size $n$, use one of the following methods:

- Using the rejection region method, determine the value $t_{(n-1,\alpha/2)}$ so that:

$$P(-t_{(n-1,\alpha/2)} \leq t \leq t_{(n-1,\alpha/2)}) = 1 - \alpha.$$

Then compute $t_{obs} = \frac{\bar{x}-\mu_0}{\frac{s}{\sqrt{n}}}$. Reject the null if $t_{obs} < -t_{(n-1,\alpha/2)}$ or $t_{obs} > t_{(n-1,\alpha/2)}$.

- Using the p-value method, compute

$$p - value = P(t_{(n-1)} < -|t_{obs}|) + P(t_{(n-1)} > |t_{obs}|).$$

Reject if p-value$< \alpha$.

2. When the data is drawn from a population that has a normal distribution and $\sigma$ is known, the sample size $n$ required to achieve power $1 - \beta$ for a test of $H_0 : \mu = \mu_0$ vs. $H_A : \mu \neq \mu_0$ when the real $\mu$ is $\mu_A$ at level $\alpha$ is approximately:

$$n = (\frac{\sigma(z_{\alpha/2}+z_\beta)}{\mu_0-\mu_A})^2.$$

3. When the data is not normal and $n$ is too small to use the CLT, use sign test to test the population median. If $M$ is the population median, test:

$$H_0 : M = M_0$$
$$H_A : M > M_0$$

by computing $b =$ the number of observations strictly larger than $M_0$. If any observations are equal to $M_0$, remove them. The p-value is then $P(B \geq b)$, where $B \sim Bin(n, 0.5)$.

4. When making a test about population proportion $\pi$ based on a sample of size $n$, if $n(\pi_0) > 5$ and $n(1-\pi_0) > 5$, then test:

$$H_0 : \pi = \pi_0$$
$$H_A : \pi \neq \pi_0.$$

by computing the sample proportion $p$, and then finding:

$$z_{obs} = \frac{(p-\pi_0)}{\sqrt{\frac{\pi_0(1-\pi_0)}{n}}}.$$

Then the p-value is $P(Z < -|z_{obs}|) + P(Z > |z_{obs}|)$. Reject if p-value $< \alpha$.