2.3) $H_0: \mu = \mu_0$ vs $H_1: \mu \neq \mu_0$

a) $Z_0 = 2.25$

$2 \times P(Z_1 > Z_0)$

$2 \times (1 - P(Z_1 < 2.25))$

$2 \times (1 - .9878)$

$\boxed{P_{val} = .02445}$

b) $Z_0 = 1.55$

$2 \times (1 - P(Z_1 < 1.55))$

$2 \times (1 - .9394)$

$\boxed{P_{val} = .12114}$

c) $Z_0 = 2.10$

$2 \times (1 - P(Z_1 < 2.10))$

$2 \times (1 - .9821)$

$2 \times .0179$

$\boxed{P_{val} = .03573}$

d) $Z_0 = 1.95$

$2 \times (1 - P(Z < 1.95))$

$2 \times (1 - .9744)$

$\boxed{P_{val} = .0512}$

e) $Z_0 = -.10$

$2 \times (1 - P(Z < .10))$

$2 \times (1 - .5398)$

$2 \times .4602$

$\boxed{P_{val} = .92034}$

2.6) $H_0: \mu_1 = \mu_0$ vs $H_0: \mu_1 > \mu_2$

$n_1 = n_2 = 10$

$\sigma_1^2 = \sigma_2^2$

a) $t_0 = 2.31$

df: $n_1 + n_2 - 2 = 10 + 10 - 2 = \underline{18}$

p-value $= \boxed{.0165}$ between .01 & .025

b) $t_0 = 3.60$

df: $n_1 + n_2 - 2 = 18$

$P = \boxed{.0010}$ between .0005 & .001

c) $t_0 = 1.95$

df: $n_1 + n_2 - 2 = 18$

$\boxed{P = .0335}$ between .025 & .05

d) $t_0 = 2.19$

df: $n_1 + n_2 - 2 = 18$

$\boxed{P = .0210}$ between .01 & .025

2.7) $\bar{x} = (9.37 + 13.04 + 11.69 + 8.21 + 11.18 + 10.41 + 13.15 + 11.51 + 13.21 + 7.75)/10$

$= \frac{109.52}{10} = 10.952$

Given mean μ & standard dev $\sigma/\sqrt{N}$ of sample size is approach a Normal Distribution, yes it is likely the data comes from a normal dist.

Let $H_0: \mu = 10$, $N = 10$, $\sigma^2 = \sum_{i=1}^{10} \frac{(x_i - \bar{x})^2}{10}$

$$\Rightarrow \sigma^2 = \big((9.37-10.95)^2 + (13.04-10.95)^2 + (11.69-10.95)^2 + (8.21-10.95)^2 + (11.18-10.95)^2 + (10.41-10.95)^2 + (11.51-10.95)^2 + (13.15-10.95)^2 + (13.21-10.95)^2 + (7.75-10.95)^2\big)/10$$

$\sigma^2 = 3.5765 \qquad \sigma = 1.8912$

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{N}} = \frac{10.952 - 10}{1.8912/\sqrt{10}} = 1.5918$$

Since $1.5918 < 1.96$, we do not reject H_0

Solving for the CI, the population mean is between $(10.952 - 1.1721, 10.952 + 1.1721)$

AKA $(9.77, 12.12)$

Yes, there is enough evidence that population mean is 10.

2.15)

a) Yes, the null hypothesis can be rejected since the pvalue is smaller than .05 $(.001 < .05)$

b) This is a two-sided test.

c) Yes, because the 95% CI $(-3.6955, -.97135)$ does not have 2.

d) Yes, the null hypothesis would be rejected at .05 interval. No additional calculations are needed. This is because the difference -2.333 has already been rejected and what is being tested is further away numerically in terms of difference.

e) $\bar{y}_1 - \bar{y}_2 + t_{\alpha/2,\, n_1+n_2-2}\, S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$

$= \boxed{-1.199}$ (Math done in R studio)

f) $H_0: \mu_1 - \mu_2 = 2$

$H_1: \mu_1 - \mu_2 \neq 2$

$$\frac{\bar{y}_1 - \bar{y}_2 - (\mu_1 - \mu_2)}{S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{50.19 - 52.52 + 4.33}{2.1277\left(\sqrt{1/20 + 1/20}\right)}$$

$= \boxed{2.97}$

2.16) ≥ 150 psi $y_1 = 145$, $y_2 = 153$

$\sigma = 3$ psi $y_3 = 150$, $y_4 = 147$

$n = 4$ samples

sample mean $= \frac{145+153+150+147}{4}$

$= 148.75$

a) $H_0: \mu \geq 150$ psi

$H_1: \mu < 150$ psi

(whether or not it takes 150 psi or more to break)

b) $\alpha = .05$ $z = \frac{\bar{y} - \mu}{\sigma / \sqrt{n}}$

$= \frac{148.75 - 150}{3/\sqrt{4}} = -.8333$

$Z_{0.05} = 1.645$ (not in α region)

$\boxed{\text{should not reject hypothesis}}$

c) Solving for p-value above.

$p = 1 - ((2/3)(.7995 - .7967) + .7967)$

$= 1 - .7985$

$= .2014$

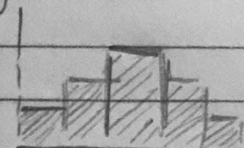
d) 95% Conf. Interval: $\bar{y} - z_{\alpha/2}\frac{\sigma}{\sqrt{n}} \leq \mu < \bar{y} + z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$

$148.75 - 1.96(3/2) \leq \mu \leq 148.75 + 1.96(3/2)$

95% CI: $\boxed{145.81 \leq \mu \leq 151.69}$

2.30)

a) After coding the histogram for the data in Rstudio, I created a graph that looked like:



Yes, it can be assumed that the difference in score being normally distributed is reasonable.

b) 95% CI:

$-.051 \pm 2.262 \left(.4409/\sqrt{10}\right)$

$(-.3663, .2643)$

Because zero is included in the CI, we do not reject H_0. Thus, there is no evidence mean score depends on birth order.

c) Let $t = \frac{\bar{d}}{S_d/\sqrt{n}}$

$= \frac{-.051}{.13942} = -.36$

where $\alpha = .05$.

Solving for p-value,

$P_{val} = .7272$

$.7272 > .05$, thus we do not reject the null hypothesis.