Equitable Equations: *Introduction to hypothesis testing*

Instructions

For each of the following problems,

(a) Write null and alternative hypotheses appropriate to this study.

(b) Compute the z-score of the sample mean.

(c) Compute the p-value of the sample mean.

(d) Are the results statistically significant at level $\alpha = .05$?

(e) What conclusions, if any, can be drawn from this study? Answer in ordinary human language.

Problem 1

A medical school advertises that the mean starting salary of its graduates is \$89,000. Concerned that it may actually be less, a group of first-years surveys 38 recent graduates, finding a sample mean of \$85,500. Assume $\sigma = \$8000$.

Problem 2

A laptop manufacturer claims that the mean life of the battery for a certain model of laptop is 6 hours. In a simple random sample of 80 laptops, the mean battery life is 5.9 hours. Assume $\sigma = 1.3$ hours. Is the company's claim reasonable?

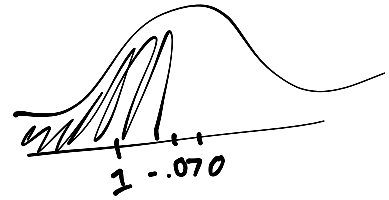
Problem 3

A soft drink manufacturer claims that the mean calorie content of one of its sports drinks is 150 calories per bottle. In a simple random sample of 95 bottles, the mean is 158 calories. Is there sufficient evidence to conclude that the mean is actually more than 150 calories/bottle? Assume $\sigma = 20$ calories.

1) a) $H_0 = \mu = 89{,}000$

$H_a = \mu < 89{,}000$

b) $z_{\bar{x}} = \dfrac{85{,}500 - 89{,}000}{\frac{8000}{\sqrt{38}}} = -0.07$



c) $P(x < z) = pnorm(z) = 47.2\%$

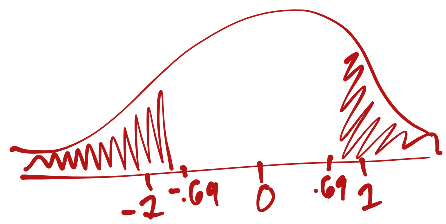
d) $p > \alpha = 0.05$ so the results are statistically significant

e) There is enough evidence to support that the mean salary of graduates is \$89,000.

2) a) $H_0 = \mu = 6$

$H_a = \mu < 6$ $\quad H_a = \mu \neq 6$

b) $z = \dfrac{5.9 - 6}{\frac{1.3}{\sqrt{80}}} = -0.69 = -z$



c) $P(x < z) = \text{pnorm}(z) = 0.25$
$P(-z < x < z) = 2 * \text{pnorm}(-z) = 0.49$

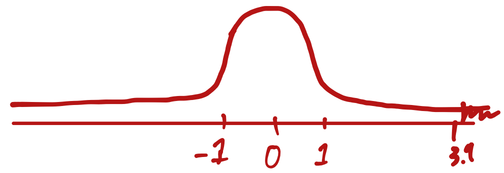
d) $p > \alpha = 0.05$ so the results are statistically significant

e) There is sificient evidence to conclude that 6 hours is a reasonable mean battery life

3) a) $H_0 = \mu = 150$

$H_a = \mu \neq 150$ $H_a = \mu > 150$

b) $z = \dfrac{158-150}{\frac{20}{\sqrt{95}}} = 3.9$



c) $P(-z < x < z) = 2 * \text{pnorm}(-z) = 9.7 \times 10^{-5}$

$P(x > z) = 1 - \text{pnorm}(z) = 4.84 \times 10^{-5} = .0000484$

d) $p < \alpha = 0.5$ so it is not statistically significant

e) There is enough evidance to conclude that there is not a mean of 150 calories in each drink There may be more calories in each drink.