Exam 3 (take home, due Apr 28^{th} in class)

1) Compute the probability of getting anywhere from 17 to 21 heads in 40 flips of a fair coin.

(a) using the Binomial distribution

Hint: you can use R for evaluation. Please supply any code you use. Same for other problems.

(b) using normal approx without continuity correction.

(c) using normal approx with continuity correction.

2) Nine randomly selected dogs had the following tail lengths in inches:

$\{3.5, 3.7, 4.5, 3.9, 3.9, 4.1, 4.3, 4.6, 3.8\}$

Find (a) a point estimate for the population mean tail length for dogs of this breed.

(b) .94 confidence interval for the mean

(c) .99 confidence interval for the mean

3) An industrial engineer timed 64 technicians in constructing a special circuit board. He found a mean of 15.5 min and std dev of 3.2 min. What can he assert about the possible size of error in estimating the mean time to be 16 min for this task, with .93 confidence?

4) Suppose an employment agency conducts 500 pt stat examinations to determine good candidates. To evaluate the variability of applicant performance, the agency randomly selects 99 scores and obtains $s^2 = 127$. Form a 98% CI for σ, the standard deviation of all test scores.

5) Of a random sample of 20 foreign language learners, 8 are taught using a book and 12 with an online course. The learners are then tested with a 100pt final exam. Suppose those using online course have mean 76.9 and std deviation 4.85. Those using the printed book have mean 72.7 and std deviation 6.35. Construct a 90% CI for the mean difference in test scores amongst the two groups. Is there statistical basis to assume that the online course yields an avg test score at least 1pt higher at .01 confidence level? Justify your answer.

6) Let a normal population of chocolate bar eaters be normal with known variance $\sigma^2 = .25$ bars per day and unknown mean m. Suppose the following test is conducted:

H_0 : mean consumption = 1 bar / day

H_1 : mean consumption = 2 bars / day

Suppose a random sample of size 9 of chocolate bar eaters is used. Use the decision rule:

Reject Ho when $\bar{x} > 2$ or $\bar{x} < .6$

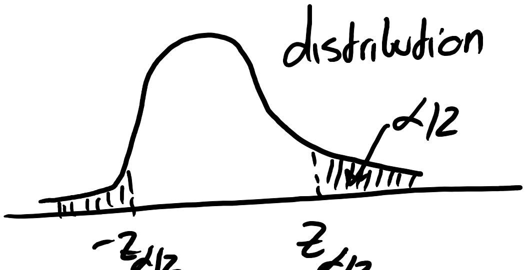
Find probabilities of type I, type II errors and the power of the test.
(a) (b) (c)

Helpful R commands you can use (you may also use the posted tables)

Ex) Find $z_{\alpha/2}$ and $t_{\alpha/2,18}$ for 90% CI. (from HW8)

$\Rightarrow \alpha = 0.1 \quad \Rightarrow \alpha/2 = 0.05$

area to left of $z_{\alpha/2}$ is $1-\alpha/2$.



CDF function

looking for $z_{\alpha/2}$ s.t. $P(z \le z_{\alpha/2}) = 1 - \alpha/2$

we want the $z_{\alpha/2}$ value so we use the inverse CDF functions in R:

area to left of $z_{\alpha/2}$ value above

$z_{\alpha/2} = \text{qnorm}(1-0.05)$

$t_{\alpha/2,18} = \text{qt}(1-0.05,\ df=18)$

area to left of $t_{\alpha/2}$ value for a t distribution with 18 deg. of freedom.

Ex) Let $B \sim \text{Binomial}(n,p)$ with $n=10$, $p=0.5$

Evaluate $P(B \le 5)$

$\Rightarrow$ use $\text{pbinom}(5, 10, 0.5) \approx 0.62 = P(B \le 5)$

Note that $\text{dbinom}(\ldots) \approx 0.25 = P(B=5)$