Math 152, Fall 2022
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WU # 17
Tuesday 11/8/22

Your name: _____

Names of people you worked with: _____

Task: Consider the following two simple hypotheses (e.g., trying to figure out if the coin you picked from the jar is one of the fair coins or one of the 40% heads coins).

$H_0 : \theta = 0.5$
$H_1 : \theta = 0.4$

Assume the data are distributed $X \sim Bin(n = 20, \theta)$. Assess the test

$$\delta = \{\text{reject } H_0 \text{ if } X \leq 9\}$$

by computing the following (feel free to use either `pbinom` or the normal approximation and `pnorm` in R):

1. The size of the test: $\alpha(\delta)$.
2. The power of the test under H_1: $1 - \beta(\delta)$.
3. The power function of the test for all possible values of θ: $\pi(\theta|\delta)$.

Do you think δ is good test? Why or why not?

Solution:

1. $\alpha(\delta) =$ `pbinom(9, 20, 0.5)` $= 0.412$.
2. $1 - \beta(\delta) =$ `pbinom(9, 20, 0.4)` $= 0.756$.
3. $\pi(0.5|\delta) = 0.412$, $\pi(0.4|\delta) = 0.756$.

The test does great job rejecting the null hypothesis when the coin is a 40% coin. But it is a **terrible** test when the null hypothesis is true! No one would ever trust our scientific judgement if we went around rejecting true null hypotheses 41.2% of the time. This particular test is not one that should be used.