Math 5301 Homework 9

Do the following problems using R.

1. In a sample of 10 parts produced by a machine, 4 were defective. Let $p$ be the proportion of defective parts produced by the machine, and consider the testing problem

$$ H_0 : p \leq 0.05 \text{ vs. } H_1 : p > 0.05, $$

where $\alpha = 0.05$.

(a) Find the critical region for this test and the $p$-value using Table A3.

(b) Find the $p$-value using the `pbinom` command.

(c) Find the $p$-value using the `binom.test` command. Note that you will need to provide arguments for $p$ and `alternative`.

(d) Find the exact 95% confidence interval for $p$ using Table A4.

(e) Find the exact 95% confidence interval for $p$ using the `binom.test` command (don’t provide an argument for `alternative` on this problem, because that will give you a one-sided confidence interval).

(f) Find the power for this test for $p = 0.00, 0.01, 0.02, 0.03, \ldots, 0.99, 1.00$. Use these values to sketch a curve of power vs. $p$.  \(^1\)

(g) Plot the power curve when $n = 100$ and $n = 1000$, and plot all three power curves in the same graph. \(^2\)

2. Use the `mcnemar.test` command to perform the test in Example 1 on p. 168. To do this, store the given $2 \times 2$ table in a matrix $A$, and then use the command `mcnemar.test(A)`.

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\(^1\)Hints: First, create the vector $p = \text{seq}(\text{from } = 0, \text{ to } = 1, \text{ by } = 0.01)$. For this problem, the critical region is $[T > 2]$, so the power for any given value of $p[i]$ is $P(T > 2 \mid p[i])$, calculated in R as $1 - \text{pbinom}(2, \text{size}=10, \text{prob}=p[i])$. Given two vectors $x$ and $y$, a plot of $y$ vs. $x$ connected by solid lines is obtained with the command `plot(x,y,type='l')`.

\(^2\)Hint: If you have a plot open in R, the command `lines(x,y)` will add the plot of $y$ vs. $x$ connected by solid lines to the existing plot.