

HOMEWORK (BOGNAR)
INTRODUCTION TO MATHEMATICAL STATISTICS II (STAT:3101)

1. A student claimed that he rolled a die 25 times and got the following sequence of heads and tails.

$H T T T T T H H H T T T H H H H H T H H T T T T T$

Suppose we wish to test H_0 : the sequence is random vs H_a : the sequence is not random using the runs test.

- Using the runs test applet on our website, find the p -value for the test. *Hint: Let $n_1 = 11$ and $n_2 = 14$.*
 - At the $\alpha = 0.05$ significance level, is there evidence that the student did not perform the experiment like he claimed? Why?
 - Use the runs test applet on our website to help determine the critical region when $\alpha = 0.05$, i.e. find $C = \{r : r = \quad\}$.
 - Approximate the p -value for the test using the normal approximation with continuity correction.
2. A roulette wheel was spun 30 times. When the ball landed in black, a “1” was recorded; when the ball did not land in black, a “0” was recorded. The sequence of spins is below.

$1 0 0 1 1 0 1 1 0 1 0 1 0 0 1 0 0 1 0 0 0 0 1 0 1 0 1 1 1 0$

Suppose we wish to test H_0 : the sequence is random vs H_a : the sequence is not random using the runs test.

- Using the runs test applet on our website, find the p -value for the test. *Hint: Let $n_1 = 14$ and $n_2 = 16$.*
 - At the $\alpha = 0.05$ significance level, is there evidence that the sequence of spins is not random? Why?
 - Use the runs test applet on our website to help determine the critical region when $\alpha = 0.05$, i.e. find $C = \{r : r = \quad\}$.
 - Approximate the p -value for the test using the normal approximation with continuity correction.
3. For textbook Exercise 8.4-12, let X denote the of number of miles traveled per day for 48-passenger busses ($F(x)$ is the cdf of X), and let Y denote the number of miles traveled per day for 38-passenger busses ($G(y)$ is the cdf of Y). Suppose we wish to test $H_0 : F(z) = G(z) \forall z$ (distributions are the same) vs H_a : not H_0 (distributions are not the same) using the runs test.
- Using the runs test applet on our website, find the p -value for the test.
 - At the $\alpha = 0.05$ significance level, is there evidence that the distributions differ? Why?
 - Use the runs test applet on our website to help determine the critical region when $\alpha = 0.05$, i.e. find $C = \{r : r = \quad\}$.
 - Approximate the p -value for the test using the normal approximation with continuity correction. This approximated p -value probably won't be very good. Our $n_1 = 9$ and $n_2 = 11$; the large sample approximation will likely be crude with such small sample sizes.
4. For textbook Exercise 8.4-18, let X denote plant growth in normal air ($F(x)$ is the cdf of X), and let Y denote plant growth in enriched air ($G(y)$ is the cdf of Y). Suppose we wish to test $H_0 : F(z) = G(z) \forall z$ (distributions are the same) vs H_a : not H_0 (distributions are not the same) using the runs test.
- Using the runs test applet on our website, find the p -value for the test.
 - At the $\alpha = 0.05$ significance level, is there evidence that the distributions differ? Why?
 - Use the runs test applet on our website to help determine the critical region when $\alpha = 0.05$, i.e. find $C = \{r : r = \quad\}$.