Name:________________________________________

**MA 5230 Test 2**

1. Use the following data for this exercise:

$$2, 2, 3, 3, 5$$

   (a) Find $\bar{x}$ and $s$.

   (b) Compute the 95% confidence interval.

   (c) Use $H_0 : \mu = 4.0$ as your null hypothesis and run the hypothesis test.

   (d) Compute the P-Value for $\mu = 4.0$.

2. Roll a four-sided die 20 times to test the probability that 1 comes up with $\frac{1}{4}$ probability. So our null hypothesis is

$$H_0 : p = \frac{1}{4}.$$

We will reject the null hypothesis if we get $N < 3$ or $N > 7$ where N is the number of 1's. $H_0$: $p = \frac{1}{4}$.
$H_a$: $p = \frac{1}{2}$.

(a) Compute the percentage confidence of our interval.

(b) Compute the Type I error.

(c) Compute the Type II error.

3. We will rerun the experiment from Problem 2. Assume we roll the die 20 times and we get the following result

| Face showing | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Number of rolls | 6 | 8 | 4 | 2 |

Run the Chi squared test to test the hypothesis that the die is fair.

4. Consider the following data.

| | number | mean | standard deviation |
|---|---|---|---|
| 1 | $n_1 = 15$ | $\bar{x}_1 = 7$ | $\sigma_1 = 11$ |
| 2 | $n_2 = 13$ | $\bar{x}_2 = 3$ | $\sigma_2 = 9$ |

Test the hypothesis that $\mu_1 = \mu_2$.

5. Assume we flip a coin 40 times and observe 25 heads. We will examine the question of the fairness of the coin?

   (a) Compute a 95 % confidence interval.

   (b) Do you accept or reject the hypothesis (what is your null hypothesis)?

   (c) Compute the p-Value.

6. This question refers to the Problem 5

   (a) For the same coin flipping experiment (40 coin flips with Null Hypothesis $p = 1/2$) compute a 90 % one-sided confidence interval.

   (b) Redesign the original coin flipping experiment where we want the margin for the 95 % Confidence Interval to be $m = 0.010$. Find the number of coin flips needed.

- $SE = \sigma/\sqrt{n}$
  $m = z^* SE$
  $z = \frac{\mu - \bar{x}}{SE}$

- $SE = s/\sqrt{n}$
  $m = t^* SE$
  $z = \frac{\mu - \bar{x}}{SE}$

- $SE = \sqrt{\frac{\hat{p}(1-\hat{p}}{n}}$
  $m = z^* SE$
  $z = \frac{\mu - \bar{x}}{SE}$
  $n = \frac{1}{4}(\frac{z^*}{m})^2$

- $\sum \frac{(Observed - Expected)^2}{Expected}$
  $df = (r-1)(c-1)$

- $\mu_D = \bar{x_1} - \bar{x_2}$
  $SE_D^2 = \frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}$