# MTH 370-01

Exam 2– Winter 2010 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**You must show your work to receive full credit.**

1. [16 pts] Suppose that a random variable  has a probability mass function  as illustrated in the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 3 | 4 | 5 |
|  | 0.1 | 0.2 | 0.3 | 0.4 |

a. [6 pts] Sketch a graph of the cumulative distribution function  and give its  
(piecewise-defined) formula.

b. [10 pts] Compute the mean and standard deviation of .

2. [6 pts] Let  denote the number of girls in a family of four children. Assuming that births of girls and boys are equally likely, find the probability mass function  of  and sketch a probability histogram.

3. [12 pts] Fill in the blanks:

a. In six rolls of a fair die, we’d expect \_\_\_\_ 1s, give or take about \_\_\_\_\_.

b. In 600 rolls of a fair die, we’d expect \_\_\_\_ 1s, give or take about \_\_\_\_\_.

4. [12 pts] A particular telephone number is used to receive both voice calls and fax messages, and 25% of the incoming calls involve fax messages. Consider a sample of 25 randomly selected incoming calls. Find the probabilities that:

a. at most 6 of the calls involve a fax message,

b. exactly 6 of the calls involve a fax message,

c. at least 6 of the calls involve a fax message,

d. more than 6 of the calls involve a fax message.

5. [20 pts] Suppose that a random variable  has a uniform distribution on the set .

a. [5 pts] Draw a probability histogram for .

b. [15 pts] Compute ,  and .

6. [12 pts] Suppose there are two four-sided dice in a box, one fair and one that is “loaded” so that the probability of rolling a 4 is 1/2. You pick one of the dice and roll it 12 times and count the number of 4s rolled (which should be about three, for the fair die). Suppose you decide to test the null hypothesis that the die is fair against the alternative hypothesis that it is the loaded die using the decision rule that H0 will be rejected if five or more 4s are rolled. Find the Type I and Type II errors.

7. [12 pts] The table below shows data on cholesterol-synthesis rates for nine diabetic subjects: Use a sign test with 0.05 significance level to determine whether the mean cholesterol-synthesis rate differs significantly for the two sources of carbohydrates.  
[Construct the alternative hypothesis based on the data.]

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **Potato** | 1.88 | 2.60 | 1.38 | 4.41 | 1.87 | 2.22 | 2.89 | 3.96 | 2.31 |
| **Rice** | 1.70 | 3.84 | 1.13 | 4.97 | 0.86 | 2.22 | 1.93 | 3.36 | 2.15 |

8. [10 pts] Use the following data and a binomial test to determine if there is significant evidence that men are more likely to attend private school than school in general .

|  |  |  |
| --- | --- | --- |
|  | **Public** | **Private** |
| **Male** | 77 | 20 |
| **Female** | 91 | 12 |