Math 160 – Project #1
Theoretical vs. Empirical Probability
(20 points)

Name (Last, First): _____

ID: _____

SCORE: _____ **CLASS/TIME:** _____

The study of probability can be divided into two areas:

Theoretical Probability is the probability of what we expect to happen.

or

Experimental probability is the observed probability calculated during experiments, direct observation, experience, or practice. The probability is still calculated the same way, using the number of possible ways an outcome can occur divided by the total number of outcomes.

Experiment:

Each person is to roll a pair of standard dice one hundred times, recording the sum for each outcome in the grid below:

Rolls 1 thru 20										
Rolls 21 thru 40										
Rolls 41 thru 60										
Rolls 61 thru 80										
Rolls 81 thru 100										

1) Create the following frequency distributions for the data from the grid on the prior page. (Check that your frequencies in **each** table sum to 20.)

Frequency distribution for rolls 1 thru 20.

x_i	2	3	4	5	6	7	8	9	10	11	12
Frequency											

Frequency distribution for rolls 21 thru 40.

x_i	2	3	4	5	6	7	8	9	10	11	12
Frequency											

Frequency distribution for rolls 41 thru 60.

x_i	2	3	4	5	6	7	8	9	10	11	12
Frequency											

Frequency distribution for rolls 61 thru 80.

x_i	2	3	4	5	6	7	8	9	10	11	12
Frequency											

Frequency distribution for rolls 81 thru 100.

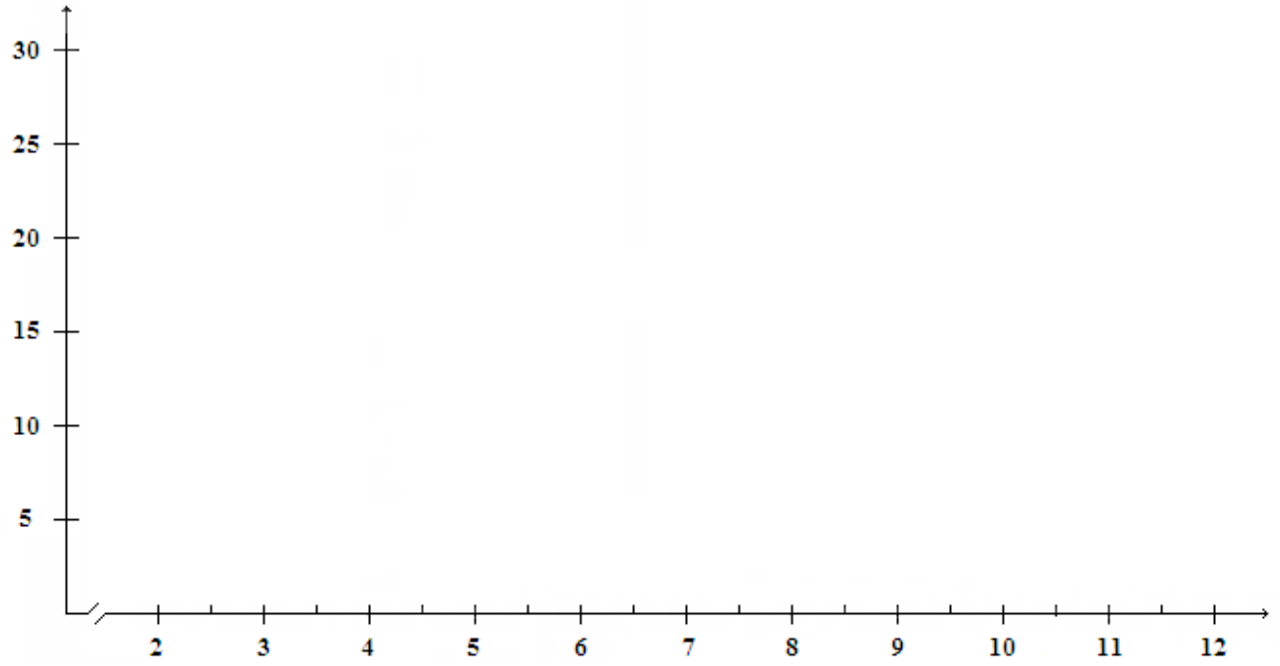
x_i	2	3	4	5	6	7	8	9	10	11	12
Frequency											

2) Create the following frequency distribution for the data from the 5 frequency distributions on the previous page. (Check that your frequencies sum to 100.)

Frequency distribution for rolls 1 thru 100.

x_i	2	3	4	5	6	7	8	9	10	11	12
Frequency											

3) Draw a frequency histogram for the 100 rolls of the dice.



4) From the frequency histogram in Problem #3 does the distribution of the data appear to be approximately normal, left-skewed, or right skewed?

5) The theoretical probabilities (or TP) have been given below. Compute your experimental probabilities (or EP) for your collection of data. Compute both the fraction and decimal equivalent for each trial. Round to the nearest ten-thousandths place or four decimal places, where appropriate.

x_i	Theoretical Probability	Experimental probability from 1 to 20 rolls	Experimental probability from 1 to 40 rolls	Experimental probability from 1 to 60 rolls	Experimental probability from 1 to 80 rolls	Experimental probability from 1 to 100 rolls
2	$\frac{1}{36} \approx .0278$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
3	$\frac{2}{36} \approx .0556$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
4	$\frac{3}{36} \approx .0833$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
5	$\frac{4}{36} \approx .1111$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
6	$\frac{5}{36} \approx .1389$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
7	$\frac{6}{36} \approx .1667$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
8	$\frac{5}{36} \approx .1389$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
9	$\frac{4}{36} \approx .1111$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
10	$\frac{3}{36} \approx .0833$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
11	$\frac{2}{36} \approx .0556$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$
12	$\frac{1}{36} \approx .0278$	$\frac{\quad}{20} =$	$\frac{\quad}{40} \approx$	$\frac{\quad}{60} \approx$	$\frac{\quad}{80} \approx$	$\frac{\quad}{100} =$

6) Compute the **absolute value** of the difference of the theoretical and experimental probabilities. (Make sure that all your entries are positive.)

x_i	Error at 20 rolls | TP – EP |	Error at 40 rolls | TP – EP |	Error at 60 rolls | TP – EP |	Error at 80 rolls | TP – EP |	Error at 100 rolls | TP – EP |
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Mean Error (÷11)					