Final

Stat 243 Spring 2019 EOU Name: _____

Show all work. This book is closed book and closed note. Calculators are allowed. The time limit is 2 hours. There are normal curve and χ^2 tables on the last page, as well as some useful formulas.

1. Compute the average and standard deviation for the following list: (6 pts)

$$11,\ 18,\ 20,\ 11,\ 9,\ 3$$

2. You are looking at a computer printout of 100 test scores which have been converted to **standard units**. The first 10 entries are:

$$-5.8 \quad 4.1 \quad 1.3 \quad 8.3 \quad -2.8 \quad 6.1 \quad -6.1 \quad 1.0 \quad 4.1 \quad -2.3$$

You immediately notice that something is wrong. How can you tell? (5 pts)

3. Three hundred draws are going to be made at random with replacement from the box:

$$\boxed{1}\ \boxed{2}\ \boxed{3}\ \boxed{4}\ \boxed{5}\ \boxed{6}\ \boxed{7}$$

Fill in the blanks in the following statement: "We expect the sum of the tickets to be about _____, give or take _____". (6 pts)

4. True or False (1 pt each, just circle T or F):

(a) **T** **F** The standard deviation of the box $\boxed{0}\ \boxed{2}$ is 1.

(b) **T** **F** If you flip a fair coin five times, then the chance of getting the sequence HHHHH is the same as the chance of getting THTTH.

(c) **T** **F** The area between $z = -2$ and $z = 2$ under the normal curve is about 95%.

(d) **T** **F** If you draw 300 times with replacement from the box $\boxed{0}\ \boxed{1}\ \boxed{2}$, exactly 100 2s will come up.

(e) **T** **F** The χ^2 test statistic can never be negative.

(f) **T** **F** If you add 7 to every number on a list, the average increases by 7.

(g) **T** **F** If you multiply each number of a list by 3, the SD also is multiplied by 3.

(h) **T** **F** Standard unit scores greater than 5 or less than 5 are impossible.

(i) **T** **F** If you draw 400 times with replacement from a box with average 30 and SD 5, you expect the average to be about 30, give or take 5.

(j) **T** **F** If you flip a fair coin 100 times, the chance that exactly 50 heads will come up is 25%.

5. In a split bet in roulette, you bet on two numbers, so your chance of winning is 2/38. If you bet \$1 and win, you get your dollar back plus \$17. If you lose, you are out your \$1. Suppose you plan to place 50 \$1 split bets.

   (a) Draw a box model that you can use to simulate these bets. (2 pts)

   (b) Find the expected value and standard error for your net gain in 50 \$1 split bets. (5 pts)

   (c) What is the probability that after these 50 bets your net gain will be greater than \$10? (5 pts)

6. A simple random sample of 900 people is taken to estimate the percentage of Democrats among the 50,000 eligible voters in a certain city. 397 of the people in the sample are Democrats. Find a 95% confidence interval for the percentage of Democrats among all eligible voters in the city. (6 pts)

7. A die is rolled 60 times in order to test whether or not it is fair. The following table gives the observed frequencies for each number out of 60 rolls. Could the die be fair? (8 pts)

Number	Frequency
1	12
2	8
3	10
4	6
5	5
6	19

8. In a random sample of 100 Canadian women, the average height was 63.2 inches with an SD of 2.7 inches. Use this information to test the hypotheses that the average height of all Canadian women is 62.9 inches. (10 pts)

   (a) Formulate the null and alternative hypotheses.

   H_0:

   H_1:

   (b) Calculate the test statistic and decide whether to reject or fail to reject H_0.

9. Suppose a sample of size 100 is drawn (with replacement) from a large box with average 29.3 and SD 7.1. The box follows the normal curve well. The average of the sample is then computed. (4 pts)

   True or False (no work required):

   (a) **T** **F** The sample average will be exactly 29.3.

   (b) **T** **F** The sample average will be about 29.3, give or take about 0.71.

   (c) **T** **F** The sample average will be about 29.3, give or take 7.1.

   (d) **T** **F** About 68% of the tickets in the box have numbers in the range 29.3 ± 0.71.

10. The table below gives frequencies of two variables, flower color (white, pink), and petal length (long, short) in 300 specimens of a specific plant. Use the χ^2 statistic to test whether these traits are independent. (8 points)

	Long	Short	Totals
White	20	97	117
Pink	56	127	183
Totals	76	224	300

Normal Table

z	Area	z	Area
0.00	0	1.50	86.64
0.05	3.99	1.55	87.89
0.10	7.97	1.60	89.04
0.15	11.92	1.65	90.11
0.20	15.85	1.70	91.09
0.25	19.74	1.75	91.99
0.30	23.58	1.80	92.81
0.35	27.37	1.85	93.57
0.40	31.08	1.90	94.26
0.45	34.73	1.95	94.88
0.50	38.29	2.00	95.45
0.55	41.77	2.05	95.96
0.60	45.15	2.10	96.43
0.65	48.43	2.15	96.84
0.70	51.61	2.20	97.22
0.75	54.67	2.25	97.56
0.80	57.63	2.30	97.86
0.85	60.47	2.35	98.12
0.90	63.19	2.40	98.36
0.95	65.79	2.45	98.57
1.00	68.27	2.50	98.76
1.05	70.63	2.55	98.92
1.10	72.87	2.60	99.07
1.15	74.99	2.65	99.20
1.20	76.99	2.70	99.31
1.25	78.87	2.75	99.40
1.30	80.64	2.80	99.49
1.35	82.30	2.85	99.56
1.40	83.85	2.90	99.63
1.45	85.29	2.95	99.68

χ^2 Table

Degrees of freedom	10%	5%	2.5%	1%	0.1%
1	2.706	3.841	5.024	6.635	10.828
2	4.605	5.991	7.378	9.210	13.816
3	6.251	7.815	9.348	11.345	16.266
4	7.779	9.488	11.143	13.277	18.467
5	9.236	11.070	12.833	15.086	20.515
6	10.645	12.592	14.449	16.812	22.458
7	12.017	14.067	16.013	18.475	24.322
8	13.362	15.507	17.535	20.090	26.125
9	14.684	16.919	19.023	21.666	27.877
10	15.987	18.307	20.483	23.209	29.588

Useful formulas

EV for average of draws = average of box

EV for percent 1's in sample = percent 1's in box

SE for sum = $\sqrt{\text{number of draws}} \times$ (SD of box)

$$\text{SE for average} = \frac{\text{SE for sum}}{\text{number of draws}}$$

SE for count = SE for sum, from a 0-1 box

$$\text{SE for percent} = \frac{\text{SE for count}}{\text{number of draws}} \times 100\%$$