Math 147 - Elementary Statistics

Spring 2020 Exam 02 Version A

NAME: _____ Section: _____

This Exam is worth a total of 150 points.

Instructions

- Turn off all electronic devices including, but not limited to, cell phones, tablet, laptops, ...
- The only exception to the above rule is that you may use a basic calculator.
- This exam has a **label with your name**. If this is not your exam then **you must find your seat or 20 point will be taken off your grade.** See your TA if you cannot find your seat!
- You are **not allowed** to use a pencil to write the exam. You will **lose 10 points** if you use a pencil!
- In order to get full credit, you must show all your work, clearly and in order. Points will be taken off if we cannot see how you arrived at your answer (even if your final answer is correct).
- We use the following abbreviations: SD for standard deviation, SE for standard error.
- Multiple choice questions may have zero, one, or more than one correct statement! You can write **T** for **True** and **F** for **False** but be sure to write clearly!
- This test has **9** problems on pages 2–6 and is worth 150 points. It is your responsibility to make sure that you have all of the pages! **Do not remove the staple! You will lose 3 points if you do!**
- Do NOT return your index card with your exam.
- Good Luck!

DO NOT TURN THIS PAGE UNTIL TOLD TO DO SO.

Problem	1	2	3	4	5	6	7	8	9	Total
Points Earned										
Out of	18	15	15	23	20	16	20	8	15	150

1. - 18 points Answer each statement with **True** or **False**.

(I) The binomial formula:

- **a.** can be used when drawing tickets from a box without replacement. _____
- **b.** gives the chance that an event occurs exactly k times out of n trials. _____
- **c.** can be used when the probability of success changes from trial to trial. _____

(II) If A and B are independent events, then:

- **a.** $P(A) = P(A|B)$. _____
- **b.** $P(A \textbf{ and } B) = P(A) \cdot P(B)$. _____
- **c.** A and B are mutually exclusive. _____

(III) The chance that an event A happens:

- **a.** must be between 0% and 100%. _____
- **b.** equals the number of times that A is expected to happen if the chance process is repeated many times. _____
- **c.** is equal to $1 - P(\text{not } A)$, where $P(\text{not } A)$ represents the chance that A does **not** happen. _____

2. - 15 points 500 tickets are drawn with replacement from one of the boxes below.

Box **A** = | **-2** | **2** | **2** | **-2** | Box **B** = | **2** | **-2** |

You will win two dollars if a 2 is drawn, and you will lose a dollar if a -2 is drawn.
You prefer box A _____ box B _____ neither box (it doesn't matter) _____

Choose one of the above and **explain why!**

3. - 15 points A fair die is rolled 15 times. A player will win $\$10$ whenever a 1 is rolled and will win $\$20$ whenever a 6 is rolled. Otherwise, they will lose $\$7$.

a. Create a box model for the above random variable.

b. How much does this player expect to win in total?

4. - 23 points The winnings for a single game offered by the Golden Fortune casino have an expected value of -5 cent with an SD of one dollar (i.e., expect to lose 5 cent if you play this game). Joanne plays this game $10,000$ times.

a. Compute Joanne's total net gain. It will be negative since she loses 5 cents on average per game.

b. What is the SE of Joanne's total winnings?

c. Use approximation with a normal curve to compute the probability that Joanne will lose at most 300.00 dollars. You may use the empirical rule.

5. - 20 points

A box contains two red marbles and four blue marbles. Six draws are made at random with replacement from the box. Find the probability for each of the following:

a. A red marble is never drawn.

b. A red marble is drawn less than two times.

c. A blue marble is drawn exactly four times.

d. A blue marble is never drawn.

e. A blue marble is drawn at least once.

6. - 16 points Answer the following as precisely as possible.
a. In the following A and B are two events.
(i). State both the general multiplication rule and the general addition rule.
(ii). What is the multiplication rule in the special case that A and B are independent?
(iii). What is the addition rule in the special case that A and B are mutually exclusive?

b. What is the binomial formula and what does it compute?

7. - 20 points A die is rolled and you will win 4 dollars if the number you bet on comes up, you will lose 1 dollar if another number comes up. You play this game 36 times.

a. Compute the expected value of your total winnings.

b. Compute the standard error of your total winnings.

c. Interpretation: You expect a net gain after 36 games of _____ dollars, give or take _____ dollars or so.

8. - 8 points Fill in the blanks.

a. When A and B are **dependent** events, the probability that both A and B occur is

_____

b. If a fair coin is tossed 1000 times, the _____ says that the number of heads will likely be close to 500, although it is unlikely that the number of heads will be exactly 500.

c. The binomial coefficient $\binom{n}{k}$ is _____ the binomial coefficient $\binom{n}{n-k}$. (Choose one of **less than, equal to**, or **greater than**.)

d. When drawing at random from a box of numbered tickets, the SE of the sum is the product of

_____ and _____

9. - 15 points One ticket is drawn from Box **A** and one ticket is drawn from Box **B**:

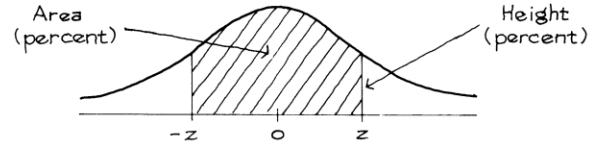
Box **A** = | **1** | **2** | **3** | **6** | **8** | Box **B** = | **1** | **3** | **6** | **7** | **8** | **9** |

Find the probability that

a. One or both of the numbers drawn are $even$.

b. The sum of the numbers drawn is 9. Hint: Write (on scratch) all possible combinations that give a sum = 9.

c. One of the numbers drawn is more than twice as big as the other number. Hint: Write (on scratch) down all possible combinations that give one draw more than twice as big as the other draw.



A NORMAL TABLE

z	*Height*	*Area*	*z*	*Height*	*Area*	*z*	*Height*	*Area*
0.00	39.89	0	1.50	12.95	86.64	3.00	0.443	99.730
0.05	39.84	3.99	1.55	12.00	87.89	3.05	0.381	99.771
0.10	39.69	7.97	1.60	11.09	89.04	3.10	0.327	99.806
0.15	39.45	11.92	1.65	10.23	90.11	3.15	0.279	99.837
0.20	39.10	15.85	1.70	9.40	91.09	3.20	0.238	99.863
0.25	38.67	19.74	1.75	8.63	91.99	3.25	0.203	99.885
0.30	38.14	23.58	1.80	7.90	92.81	3.30	0.172	99.903
0.35	37.52	27.37	1.85	7.21	93.57	3.35	0.146	99.919
0.40	36.83	31.08	1.90	6.56	94.26	3.40	0.123	99.933
0.45	36.05	34.73	1.95	5.96	94.88	3.45	0.104	99.944
0.50	35.21	38.29	2.00	5.40	95.45	3.50	0.087	99.953
0.55	34.29	41.77	2.05	4.88	95.96	3.55	0.073	99.961
0.60	33.32	45.15	2.10	4.40	96.43	3.60	0.061	99.968
0.65	32.30	48.43	2.15	3.96	96.84	3.65	0.051	99.974
0.70	31.23	51.61	2.20	3.55	97.22	3.70	0.042	99.978
0.75	30.11	54.67	2.25	3.17	97.56	3.75	0.035	99.982
0.80	28.97	57.63	2.30	2.83	97.86	3.80	0.029	99.986
0.85	27.80	60.47	2.35	2.52	98.12	3.85	0.024	99.988
0.90	26.61	63.19	2.40	2.24	98.36	3.90	0.020	99.990
0.95	25.41	65.79	2.45	1.98	98.57	3.95	0.016	99.992
1.00	24.20	68.27	2.50	1.75	98.76	4.00	0.013	99.9937
1.05	22.99	70.63	2.55	1.54	98.92	4.05	0.011	99.9949
1.10	21.79	72.87	2.60	1.36	99.07	4.10	0.009	99.9959
1.15	20.59	74.99	2.65	1.19	99.20	4.15	0.007	99.9967
1.20	19.42	76.99	2.70	1.04	99.31	4.20	0.006	99.9973
1.25	18.26	78.87	2.75	0.91	99.40	4.25	0.005	99.9979
1.30	17.14	80.64	2.80	0.79	99.49	4.30	0.004	99.9983
1.35	16.04	82.30	2.85	9.69	99.56	4.35	0.003	99.9986
1.40	14.97	83.85	2.90	0.60	99.63	4.40	0.002	99.9989
1.45	13.94	85.29	2.95	0.51	99.68	4.45	0.002	99.9991