EXAM 3: Statistics 100

Cover Sheet Questions *(1 pt.)*

1) What's your name?   _____   _____

(Last name)   (First name)

2) What's your net ID (email)?   _____

3) Which Section are you in?

      Circle one: **i)** L1 (MWF at 12pm)   **ii)** L2 (Tues/Thurs 11am)   **iii)** ONLINE

Write answers in appropriate blanks. All multiple-choice questions have exactly one answer. If you circle more than one answer you will automatically be marked wrong.

SHOW WORK when requested, otherwise no credit. Do NOT use scrap paper.

Make sure you have all 7 pages including the normal table (12 questions).

DO NOT WRITE BELOW THIS LINE

_____

The numbers written in each blank below indicate how many points you missed on each page.
The numbers printed to the right of each blank indicate how many points each page is worth.

Page 1 _____17

Page 2 _____ 29

Page 3 _____16

Page 4 _____17

Page 5 _____8

Page 6 _____12

Cover Page_____ 1
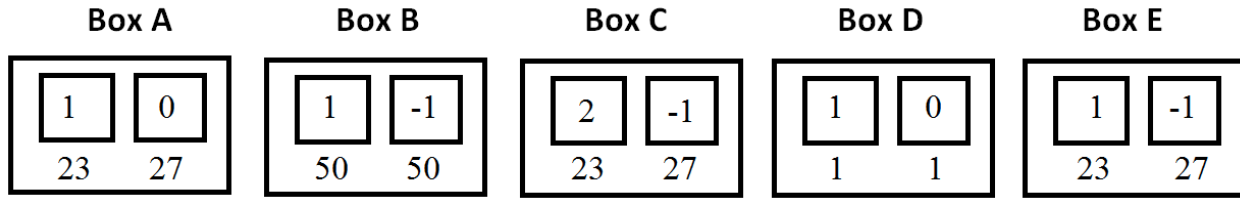
1 pt. *for answering cover page questions 1-3 correctly!*

> **WARNING**- The exams look alike but you are sitting next to people who actually have a different version than you. Copying from anyone is equivalent to giving a signed confession.
>
> All cheating including being caught with a non-permissible calculator or formula sheet will result in a 0 and an academic integrity violation on your University record.

Total Score _____

There is NO CLASS on Thursday or Friday!

Scores will be posted on Compass by Friday morning and exams will be returned in class next week. Online students may pick up their exam in 23 Illini Hall during office hours next week.

Question 4 *(18 points total)*
400 draws are made at random with replacement from the box containing 5 tickets: -1, 1, 2, 3, 5

a) *(2 pts.)* The smallest the sum of the 400 draws could possibly be is _____ and the largest is _____.
(Fill in the 2 blanks above with the correct numbers.)

b) *(2 pts.)* What is the EV (expected value) of the sum of the 400 draws? **Show work and circle answer. No work, no credit.**

c) *(2 pts.)* What is the SE (Standard Error) of the sum of the 400 draws? (SD of box = 2) **Show work and circle answer. No work, no credit.**

d) *(2 pts.)* What is the EV of the average of the 400 draws? _____

e) *(2 pts.)* What is the SE of the average of the 400 draws? (SD of box = 2) **Show work and circle answer. No work, no credit.**

f) Now suppose you draw at random with replacement from the same box above, but this time you're only interested in the percent of positive tickets you get. What is the EV and the SE of the percent of positive tickets in 400 draws? *Make sure to draw a new box below! Drawing the box is worth **4 points**.*
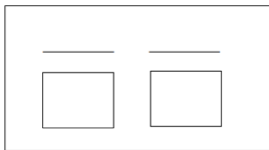
i) *(2 pts.)* EV of the percent of positive tickets in 400 draws =_____%

ii) *(2 pts.)* SE of the percent of positive tickets in 400 draws =_____%
No work, no credit.

Question 5 *(11 points total)*
A gambler plays roulette 400 times betting $1 on the 6 numbers: 1, 2, 3, 4, 5, and 6 each time. If the ball lands on 1, 2, 3, 4, 5, or 6 the gambler wins $5, if the ball lands on any of the other 32 numbers the gambler loses $1. The roulette wheel has 38 slots numbered 1-36, 0 and 00.

a) *(2pts.)* Which is the appropriate box model? **Choose one:**
        i) The box has 38 tickets: 6 marked "1" and 32 marked "-1"
        ii) The box has 38 tickets: one each of 1, 2, 3, ..., 36, 0, and 00.
        iii) The box has 38 tickets: 6 marked "5" and 32 marked "-1"
        iv) The box has 38 tickets: 6 marked "5" and 32 marked "0"

b) *(1pt.)* How many draws from the box? _____

c) *(2pts.)* What is the average of the box? _____ **Write your answer as a fraction.**

d) *(2pts.)* What is the SD of the box? Round your answer to 2 decimal places and circle it. **No work, no credit.**

e) Use the normal approximation and the fact that the EV is about -$21 and the SE is about $44 to figure the chance that the gambler will win more than $1 in 400 plays?
        i. *(2pts.)* First calculate the Z score. **No work, no credit. Z=_____**

        ii. *(2pts.)* Now mark the Z score accurately and shade the correct area. Round the middle area given in the table to the nearest whole number.
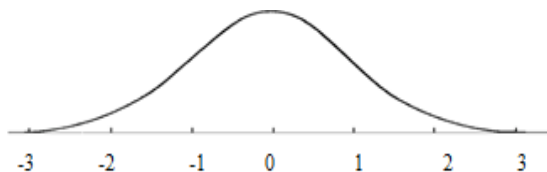
Chance = _____%

Question 6 *(12 points total)*
Look at the 3 boxes and 6 probability histograms below. Each box has 2 probability histograms associated with it. One is the probability histogram for the sum of 2 draws made at random with replacement and the other is the probability histogram for the sum of 20 draws made at random with replacement from the box.
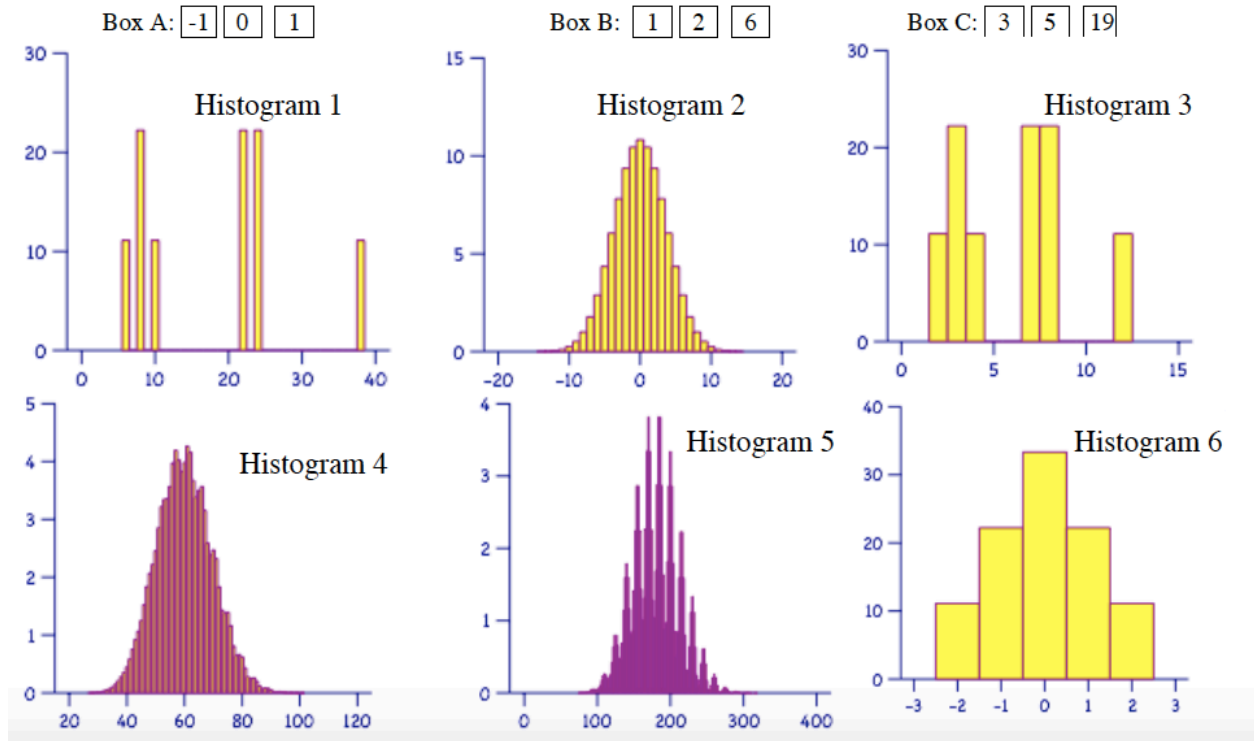
Fill in the first blank with either 2 or 20 and the second blank with A, B, or C.
 a) Histogram 1 represents _____ draws from Box _____.
 b) Histogram 2 represents _____ draws from Box _____.
 c) Histogram 3 represents _____ draws from Box _____.
 d) Histogram 4 represents _____ draws from Box _____.
 e) Histogram 5 represents _____ draws from Box _____.
 f) Histogram 6 represents _____ draws from Box _____.

Question 7 *(4 points total)*
A website called "The Journal" posts a Quick Vote question on its home page each day and anyone who visits the site can cast a vote. Recently, the Quick Vote question was: "So have you ever tried online dating (Match.com, Tinder, etc.)?" I asked the same question in class as an iClicker question. Here are the results of both polls:

	Yes	No	Sample Size
The Journal Quick Vote	48%	52%	12, 328
Class iClicker Poll	38%	62%	673

a) *(2 pts.)* As you can see, the results of the 2 polls are very different. Which survey gives a better estimate of how all US adults would answer this question? **Circle one:**
   i) The Journal Quick Vote because the sample size is 18 times larger than our class vote.
   ii) The Class iClicker Poll because everyone who attended class voted, not just those with strong opinions on the issue.
   iii) It's difficult to judge because neither survey is a random sample drawn from all US adults.

b) *(2 pts.)* Which survey can we calculate the SE of the sample percent? **Circle one:**
     i) Only Journal Quick Vote
     ii) Only the iClicker poll
     iii) Both surveys
     iv) Neither survey

Question 8 *(17 points total)*
A poll conducted in October by Gallup asked a random sample of 1,019 US registered voters the following question: "In general, do you feel that laws covering the sale of firearms (guns) should be made stricter?" 61% of the people in the sample answered "YES".

a) *(2 pts.)* What most closely resembles the relevant box model? **Circle one:**

      i) It has 1019 tickets, 61% are marked "1" and 39% are marked "0"

      ii) It has millions of tickets, exactly 61% are marked "1" and exactly 39% are marked "0"

      iii) It has millions of tickets marked "1" and "0." The exact percentage of each is unknown but are estimated from the sample to be 61% and 39% respectively.

      iv) It has 1019 tickets marked "1" and "0." The exact percentage of each is unknown but are estimated from the sample to be 61% and 39% respectively.

b) *(2 pts.)* The _____ draws are made _____ replacement. *Fill in the first blank with the number of draws and the second blank with either "with" or "without."*

c) *(3 pts.)* What is the SE for the percent of people who answered "YES?" *Fill in both blanks below!* **No work, no credit. Round answers to 2 decimal places.**

First, what's the SD of the sample percent? _____   SE%=_____

d) *(2 pts.)* Which of the following is a 95% CI for the percent of all US registered voters who would say they supported stricter gun control laws in the US? **Choose one:**

      i) 61% ± 2*SE%

      ii) 61% ± 1*SE%

      iii) 61% ± 2*SEavg

      iv) 95% ± 2*SE%

      v) 1019 ± 2*SE%

e) *(1 pt.)* What's the margin of error for an 80% confidence interval for the percent of all US registered voters who would say they supported stricter gun control laws in the US? **Choose one:**

      i) 80%

      ii) 2*SE%

      iii) 1.3*SE%

      iv) 1.3

      v) 1019*1.3

f) *(3 pts.)* To which of the following populations can we also apply the above 95% confidence interval from part d?

i. All male registered voters in the US.	**Circle one:**	Yes	No
ii. All gun owners who are registered voters in the US.	**Circle one:**	Yes	No
iii. All adults in the US whether they are registered to vote or not.	**Circle one:**	Yes	No

g) *(2 pts.)* A year ago, in April, Gallup asked the same question and the percentage of yes's was 67%. The sample size was the same. Would the SE% be the same? **Choose one:**

      i) Yes

      ii) No, the SE for the poll conducted in April with 67% yes's will be larger.

      iii) No, the SE for the poll conducted in April with 67% yes's will be smaller.

h) *(2pts.).* If the researcher increased the sample size to 9171 then the width of each confidence interval above would... **Circle one:**

      i) be multiplied by 3

      ii) be multiplied by 9

      iii) stay the same

      iv) be divided by 3

      v) be divided by 9

Question 9 *(4 points total)*
In January of 2013, Public Policy Polling asked a nationwide randomly selected sample of 830 registered voters whether they had a higher opinion of Congress or of several commonly disliked things including cockroaches and meth labs. Here's the results for 2 questions:

Question 1: "What do you have a higher opinion of: Congress or cockroaches?" **40%** answered Congress
 Question 2: "What do you have a higher opinion of: Congress or meth labs?" **60%** answered Congress

a) *(2pts.)* The SE of the sample percent is 1.7% for Question 1. Would the SE be higher, lower, or the same for Question 2?   **Circle one**: **i)** Higher   **ii)** Lower   **iii)** The Same

b) *(2pts.)* Suppose the poll was just taken among registered voters in Illinois instead of registered voters across the whole nation. How would Public Policy Polling have to adjust the sample size to keep the same level of accuracy in estimating how all Illinois voters would answer these questions as they had in estimating how all US voters would answer these questions?
Circle one:
        i) Significantly increase sample size
        ii) Significantly decrease sample size
        iii) Keep sample size about the same

Question 10 *(4 points total)*
Suppose a survey organization is planning to take a random poll at the U of I (about 34,000 undergrads) and a random poll at Notre Dame (about 8,500 undergrads) to estimate the percent of undergraduates at each university who would support getting rid of the +/- grading system.
a) *(1 pt.)* They took a random sample of 100 students at UIUC and a random sample of 400 students at Notre Dame. The accuracy in the poll at Notre Dame is _____ the accuracy than the poll at U of I.
Circle one:
        i) 4 times more than
        ii) 2 times more than
        iii) 4 times less than
        iv) 2 times less than
        v) the same as

b) *(3 pts.)* How many people would you have to poll at the University of Illinois to get a 95% Confidence Interval with the following Margins of Error:

        i. 2% Margin of Error (assume SD=0.5):
        Circle one: i) 100   **ii)** 484   **iii)** 625   **iv)** 900   **v)** 1111   **vi)** 2500

        ii. 4% Margin of Error (assume SD=0.5)
        Circle one: i) 100   **ii)** 484   **iii)** 625   **iv)** 900   **v)** 1111   **vi)** 2500

        iii. 4% Margin of Error (assume SD=0.44)
        Circle one: i) 100   **ii)** 484   **iii)** 625   **iv)** 900   **v)** 1111   **vi)** 2500

Question 11 *(10 points total)*
A random sample of 900 medical school graduates from the class of 2018 were selected from all medical schools across the United States and asked how much medical school debt they had. The sample average was about $196,000 with a SD of about $90,000.
a) *(2pts.)* What most closely resembles the relevant box model? Circle one:
       i) It has thousands of tickets. The average of the tickets = $196,000 and the SD = $90,000
       ii) It has thousands of tickets marked with "0"s and "1"s, but the exact percentage of each is unknown.
       iii) It has thousands of tickets. On each ticket is written a dollar amount. The exact average and SD are unknown but are estimated from the sample to be $196,000 and $90,000 respectively.
       iv) It has 900 tickets. The average of the tickets = $196,000 and the SD = $90,000

b) *(2pts.)* We'd estimate that the average amount of debt that all US medical school graduates from the class of 2018 would have is $_____. Fill in the blank with a number.

c) *(2pts.)* What is the SE of the sample average? **No work, no credit. Circle your answer.**

d) *(4 pts.)* Circle whether each of the statements below is true or false. Assume the 900 students all reported their true debt.
       i) $196,000 +/- $6,000 is a 95% confidence interval for the average amount of debt all Canadian medical school graduates from the class of 2018 have.
       a) True   **b) False**

       ii) About 95% of all US medical school graduates from the class of 2018 have debt between $196,000 +/- $6,000.
       a) True   **b) False**

       iii) $196,000 +/- $6,000 is a 95% confidence interval for the average amount of debt all US medical school graduates from the class of 2018 have.
       a) True   **b) False**

       iv) About 95% of the 900 students in our sample have debt between $196,000 +/- $6,000.
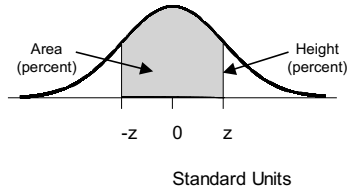   **a) True**   **b) False**

Question 12 *(2 points total)*
Find the average of a box that has 3 tickets marked "7", 5 tickets marked "-100", and 1 ticket marked "300."
Show work below. **No work, no credit. Write your answer as a fraction.**

Average=_____

STANDARD NORMAL TABLE

Standard Units

z	Area		z	Area		z	Area
0.00	0.00		1.50	86.64		3.00	99.730
0.05	3.99		1.55	87.89		3.05	99.771
0.10	7.97		1.60	89.04		3.10	99.806
0.15	11.92		1.65	90.11		3.15	99.837
0.20	15.85		1.70	91.09		3.20	99.863
0.25	19.74		1.75	91.99		3.25	99.885
0.30	23.58		1.80	92.81		3.30	99.903
0.35	27.37		1.85	93.57		3.35	99.919
0.40	31.08		1.90	94.26		3.40	99.933
0.45	34.73		1.95	94.88		3.45	99.944
0.50	38.29		2.00	95.45		3.50	99.953
0.55	41.77		2.05	95.96		3.55	99.961
0.60	45.15		2.10	96.43		3.60	99.968
0.65	48.43		2.15	96.84		3.65	99.974
0.70	51.61		2.20	97.22		3.70	99.978
0.75	54.67		2.25	97.56		3.75	99.982
0.80	57.63		2.30	97.86		3.80	99.986
0.85	60.47		2.35	98.12		3.85	99.988
0.90	63.19		2.40	98.36		3.90	99.990
0.95	65.79		2.45	98.57		3.95	99.992
1.00	68.27		2.50	98.76		4.00	99.9937
1.05	70.63		2.55	98.92		4.05	99.9949
1.10	72.87		2.60	99.07		4.10	99.9959
1.15	74.99		2.65	99.20		4.15	99.9967
1.20	76.99		2.70	99.31		4.20	99.9973
1.25	78.87		2.75	99.40		4.25	99.9979
1.30	80.64		2.80	99.49		4.30	99.9983
1.35	82.30		2.85	99.56		4.35	99.9986
1.40	83.85		2.90	99.63		4.40	99.9989
1.45	85.29		2.95	99.68		4.45	99.9991