Question 1 *(8 points total)*
In tossing a fair coin, follow the steps to find the standard error (SE) that makes the chances equally likely in both scenarios.

a) 50% +/- 6% heads in 65 tosses is about as likely as getting 50% +/- ? heads in 585 tosses.

i) *(1 point)* Compare the number of tosses in both cases. The number of tosses (n) is increasing by a factor of_______

ii) *(2 points)* This means that we are going to: Multiply or Divide by ______ **(Fill in the blank with a #)**
(Circle one)

iii) *(1 point)* Your new SE is ________ **(Fill in the blank with a number)**

b) 15 +/- 3 heads in 30 tosses is about as likely as getting 375+/- ? heads in 750 tosses.

i) *(1 point)* Compare the number of tosses in both cases. The number of tosses (n) is increasing by a factor of_______

ii) *(2 points)* This means that we are going to: Multiply or Divide by ______ **(Fill in the blank with a #)**
(Circle one)

iii) *(1 point)* Your new SE is ________ **(Fill in the blank with a number)**

Question 2
Fill in the first blank with the number of draws and the second blank with the word "with" or "without", then circle the appropriate box model. Remember, a roulette wheel has 38 slots numbered 0,00, 1, 2, 3, ….. 36.

a) A gambler plays roulette 100 times betting a $1 on the numbers "7" and "11" each time. If the ball lands on "7" or "11" he wins $17, if it lands on any other number he loses $1.

This corresponds to taking the sum of ________draws ____________replacement from which of the following box models? *(1 point)* *(1 point)*
Circle one *(2 points)*:
- *i)* The box has 100 tickets, 2 marked "17" and 98 marked "-1"
- *ii)* The box has 38 tickets: one each of 1, 2, 3, ..., 36, 0, and 00.
- *iii)* The box has 38 tickets, one marked "7", one marked "11" and the rest marked "0".
- *iv)* The box has 100 tickets, 2 marked "1" and the rest marked "0"
- *v)* The box has 38 tickets, 2 marked "17" and 36 marked "-1"

b) A multiple-choice test has 25 questions. Each question has 5 possible answers, only 1 of which is correct. Each correct answer is worth 4 points and 1 point is deducted for each incorrect answer. Suppose you guess at random on all 25 questions and your score is computed.

This corresponds to taking the sum of ________draws____________ replacement from which of the following box models? *(1 point)* *(1 point)*
Circle one *(2 points)*:
- *i)* The box has 25 tickets, five tickets are marked "1" and twenty are marked "0".
- *ii)* The box has 5 tickets, one marked "1" and four marked "0"
- *iii)* The box has 5 tickets, one marked "4", and four marked "-1/4".
- *iv)* The box has 5 tickets, one marked "4", and four marked "-1".
- *v)* The box has 25 tickets, one marked "4", and the rest marked "-1".

Question 2 continued
Fill in the first blank with the number of draws and the second blank with the word "with" or "without", then circle the appropriate box model.

c) You roll a die 30 times and count the number of "2"s.

This corresponds to taking the sum of ________draws ___________replacement from which of the following box models? *(1 point)* *(1 point)*

Circle one *(2 points):*

i) The box has 6 tickets, 1 marked "1" and 5 marked "0".
ii) The box has 6 tickets, 1 marked "2" and 5 marked "0".
iii) The box has 6 tickets: one each of 1,2,3,4,5,6
iv) The box has 30 tickets: 5 each of 1,2,3,4,5,6
v) The box has 30 tickets: 1 marked "1" and the rest marked "0"

Question 3 pertains to the following situation:
100 draws are made at random with replacement from a box that has 4 tickets: $\boxed{2}\boxed{4}\boxed{4}\boxed{10}$

a) *(2 points)* What is the smallest possible the sum of the draws can be? ________

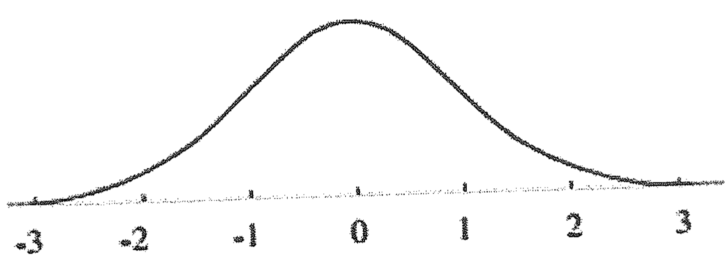
b) *(2 points)* What is the largest the sum can be?_____

c) *(2 points)* What is the EV for the sum of the draws? ___________

d) *(2 points)* What is the SE for the sum of the draws? (The SD of the box is 3) ___________

e) *(3 points)* Use the normal curve to estimate the *chance* that the sum of the draws is greater than 551?
Show ALL work—calculate the z-score, shade the correct area on the curve, and write it in the box

Chance= _______%



f) *(1 point)* What is the expected value of the percent of "2"s in 100 draws?____________

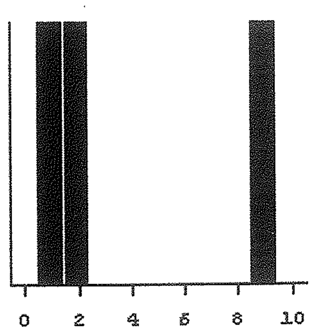
g) *(7 points)* What is the SE for the percent of "2"s in 100 draws? **Show work. Circle answer.** Give your answer to 2 decimal places. *(Note: draw a new box- 4 points for marking the numbers in the tickets and above the tickets)*

Question 4 pertains to the 2 boxes and 5 histograms below: *(12 points total- 2 points for each circled answer)*

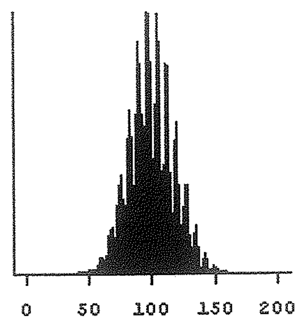
Box 1
1 2 3

Box 2
1 2 9

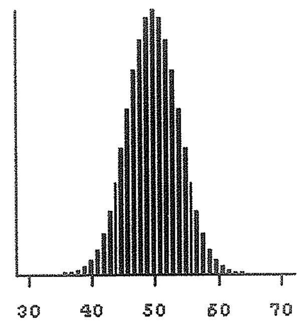
Histogram A

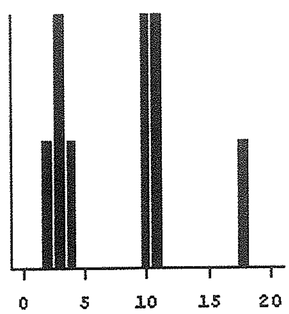


Histogram B

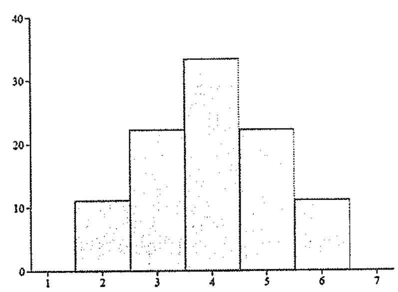


Histogram C





Histogram D



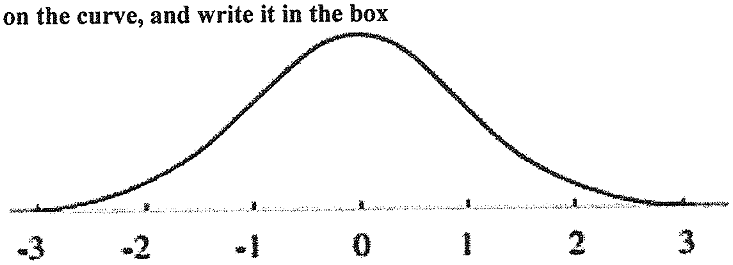
Histogram E

Circle HISTOGRAM A, B,C, D, or E below to make the statements true. (Each histogram is circled once.)
For (a) also circle the number of the correct BOX.

a) Histogram A B C D E is the histogram for the **contents** of Box 1 2
(Circle 1 or 2 above)

b) Histogram A B C D E is the probability histogram for the **sum** of 25 draws from Box 1.
c) Histogram A B C D E is the probability histogram for the **sum** of 25 draws from Box 2.
d) Histogram A B C D E is the probability histogram for the **sum** of 2 draws from Box 1.
e) Histogram A B C D E is the probability histogram for the **sum** of 2 draws from Box 2.

Question 5 *(3 points total)*
Suppose 50% of the households in the city of Chicago have school age children. You would expect 50% of the 400 households in the sample to have school age children with a SE for the sample percent of 2.5%. Use this information and the normal curve to figure the chance that the percent of the sample households in Chicago have school age children will be greater than 49%. **Show ALL work— calculate the z-score, shade the correct area on the curve, and write it in the box**



Chance= ________%

Question 6
The CNN website conducts a public opinion poll daily called Quick Vote. Any Internet user can go to www.cnn.com and cast their vote. On November 11th, the Quick Vote question was: "Do you believe there is a U.S. government cover-up surrounding 9/11?" 8,900 people responded; 8,000 answered "YES" and 900 answered "NO".

a) *(2 points)* The main problem with this sample is
i) Selection Bias since the people selected themselves ii) Bias in the wording iii) Sample Size

b) *(2 points)* What is the SE for the percentage of "YES"s?
i) $\sqrt{8900} * \sqrt{(.89)(.11)}$ ii) $\frac{\sqrt{(.89)(.11)}}{\sqrt{8900}} * 100\,\%$ iii) SE is not valid here since the people weren't randomly chosen

Question 7 *(2 points)*
A poll is taken in a city of population 100,000. A simple random sample of 1,000 is chosen and polled. Another poll is to be taken in the same way from a city with a population 100 times bigger (10 million people). In order to obtain the same accuracy as in the first city, the sample size in the second city should be:

a) 100,000 b) 10,000 c) 1,000 d) 100 e) need more info to answer

Question 8 *(8 points total)*
A Fox News Poll asked a random sample of 900 adults nationwide the following question: "Do you personally believe in the existence of the Devil?" 71% of the people in the sample answered "YES".

a) *(2 points)* The SE of the % of people in the sample who said "YES" is about 1.5%. An approximate 89% confidence interval for the percentage of all American adults who believe in the Devil is:

(________ , ________)

b) *(2 points)* If the researcher increased the sample size to 8100 people, the SE for the percent would...

i) be multiplied by 3 ii) be multiplied by 9 iii) be divided by 3 iv) be divided by 9 v) be multiplied by 81

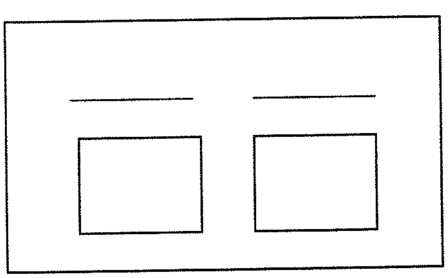
c) *(2 points)* If the researcher increased the sample size to 8100 people, the length of the 89% confidence interval would...

i) be multiplied by 3 ii) be multiplied by 9 iii) be divided by 3 iv) be divided by 9 v) be multiplied by 81

d) *(2 points)* In the same poll of 900 people, 92% answered "Yes" to the question: "Do you personally believe in the existence of God?" Would the SE of the % of people in the sample who said "YES" to this question still be 1.5% as in part (a)?

i) Yes, it would be exactly the same ii) No, it would be bigger iii) No, it would be smaller

Question 9
Suppose you are playing a game similar to roulette, except now the wheel has 50 slots instead of 38, each slot numbered 1-50. If you bet $1 on the number "3" and it comes up 3, you win $42; otherwise, you lose $1. What is the box model for your total winnings playing this gambling game 75 times, betting $1 each time? *(4 points for the box model)*



a) *(2 points)* **The average of this box is ________**

b) *(2 points)* **The SD of this box is ________**

Question 10
A recent survey asked a random sample of 1600 college students nationwide the following question: "How many hours have you spent watching Netflix in the past month?" The sample average was 20 hours and the SD was 16.

a) (2 points) What most closely resembles the relevant box model? Circle one.
i) It has 1600 tickets marked with "0"s and "1"s. The exact average and SD are unknown, but estimated from the sample.
ii) It has millions of tickets marked with "0"s and "1"s, but the exact percentage of each is unknown.
iii) It has millions of tickets. On each ticket is written a number indicating the hours spent watching Netflix. The exact average and SD are unknown but are estimated from the sample.
iv) It has 1600 tickets. The average of the tickets is 20 and the SD is 16

b) (2 points) 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) (2 points) What is the SE of the sample average?
i) 640 *ii)* 40 *iii)* 0.4 *iv)* Impossible to calculate since the data does not follow the normal curve.

d) (2 points) Suppose 100 researchers each took a random sample of 1600 college students and each computed 95% confidence intervals, about how many of the confidence intervals would cover the average number of hours all college students spent watching Netflix in the past month?
i) All of them *ii)* 95 *iii)* 50 *iv)* 5 *v)* none of them since the data doesn't follow the normal curve

e) (2 points) The researchers computed 3 confidence intervals: a 68% CI, an 80% CI & a 95% CI from the same sample of 1600.
The longest one is the _________CI and the shortest one is the ________CI. **(Fill in the blank with 68%, 80% or 95%)**

f) (2 points) If the study asked the 1600 students whether or not they watched the season premiere of Game of Thrones this past Sunday, the relevant box model would contain tickets with
i) Only "1"s and "0"s *ii)* Numbers ranging from about 0 to 100 *iii)* not enough info

g) (2 points) If another study asked the question: "Think about all the times you've done something that you later regretted. What percent of those times was alcohol involved?" the relevant box model would be
i) Only "1"s and "0"s *ii)* Numbers ranging from 0 to 100 *iii)* not enough info

Question 11
Say that my fiancé, Steve, wanted to run for mayor of Champaign. For a pre-election poll in a close race, we may want a 95% confidence interval with a small margin of error.

a) *(2 points)* Estimate how many people you'd need to poll to get a 95% confidence interval with only a 1% margin of error. **(Assume the SD of the population is around 0.39. Show work and circle answer)**

b) *(2 points)* Estimate how many people you'd need to poll to get a 95% confidence interval with only a 4% margin of error. **(Assume the SD of the population is around 0.5. Show work and circle answer)**

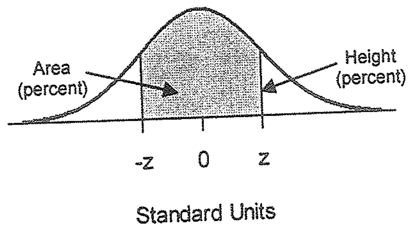
Question 12 pertains to a 0-1 box.
a) *(2 points)* The SD of a 0-1 box **CAN** be negative. **(circle answer)** *i)* True *ii)* False

b) *(1 point)* The smallest that the SD of a 0-1 box can be is ___________ **(fill in the blank with a number)**

c) *(1 point)* The largest that the SD of a 0-1 box can be is ___________ **(fill in the blank with a number)**

d) *(2 points)* The SD of a 0-1 box is largest when we have _____ % zeros & _______ % ones. **(fill in the blanks w/ #s)**

STANDARD NORMAL TABLE



z	*Height*	*Area*	*z*	*Height*	*Area*	*z*	*Height*	*Area*
0.00	39.89	0.00	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	39.70	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	0.69	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