EXAM 1: Statistics 100

READ THE DIRECTIONS BELOW TWICE!

Cover Sheet Questions

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 (Tues/Thurs at 12:30 pm) **ii)** KF (Flanagan Online) **iii)** ONL (Yu Online)

*This test is ALL multiple choice. Circle all answers on this exam and fill in the corresponding bubble on your green scantron. All questions have exactly one answer. If you circle/bubble in more than one answer, you will automatically be marked wrong. Make sure to circle the answers on this test and fill out your scantron. If you don't do both, you will get a 0.

SCANTRON Form Directions

- Print and bubble in your LAST NAME with **no spaces** starting in the left most column. Print your FIRST INITIAL in the right-most column.
- Print and bubble in your Student ID number (UIN) in the Student Number box.
- Print and bubble in the date in the Date box.
- Print and bubble in your NET ID with **no spaces** in the NETWORK ID box. Print and bubble in the Section Box. See section codes on the projector.
- *Write Stat 100* on the COURSE line.
- *Write your instructor's name* on the INSTRUCTOR line.
- *Write your section on the SECTION line*.
- Sign your name, and right underneath the student signature line PRINT your name

READ THIS: Failure to fill out your scantron correctly will result in a loss of 2 points on your exam!

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.

Make sure you have all 7 pages including the normal table (65 questions).

There is NO CLASS on Thursday!

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.

The following situation pertains to questions 1-5.
A study published in the journal *Mayo Clinic* found that children who have more than one surgery with general anesthesia before their second birthday have a higher risk of developing ADHD than those who never had general anesthesia. The researchers examined the medical records of 341 children diagnosed with ADHD to find out who had undergone a surgical procedure with anesthesia before they were 2. They found that 18 percent of children who had 2 or more surgeries with general anesthesia when they were babies eventually developed ADHD compared to only 7 percent of children who had no surgeries with general anesthesia as babies.

1. This study is an example of a….
a) Observational Study
b) Randomized Controlled Experiment without a placebo
c) Randomized Double-Blind Controlled Experiment
d) Non-Randomized Controlled Experiment with a placebo

2. Does the study show that anesthesia exposure before age 2 *causes* ADHD?
a) Yes, since those exposed before age 2 developed ADHD at more than twice the rate of the never-exposed children (18% vs. 7%).
b) No, this study only shows that there is an *association* between anesthesia exposure before age 2 and ADHD. It's not possible to conclude whether or not the anesthesia is responsible for the ADHD.
c) Yes, this study is strong evidence that general anesthesia can have lasting harmful effects on brain development.

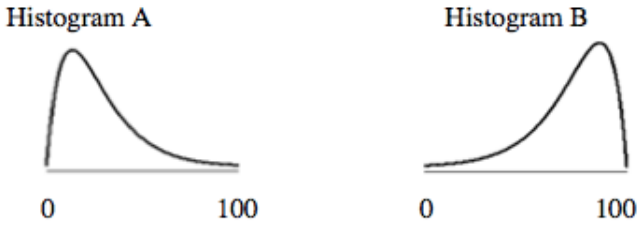
Below are either confounders (differences between those who had general anesthesia as babies and those who didn't that mix up the study), causal links that show *how* general anesthesia could *cause* ADHD, or neither.

3. Serious Medical Conditions – The babies who had general anesthesia had serious medical conditions that could put them at higher risk for ADHD.
Circle one: **a)** Confounder **b)** Causal Link **c)** Neither

4. Food Additives – Certain food preservatives and color additives may cause ADHD.
Circle one: **a)** Confounder **b)** Causal Link **c)** Neither

5. Anesthesia-Induced Neurological Damage- Exposure to anesthesia may damage brain development, leading to ADHD
Circle one: **a)** Confounder **b)** Causal Link **c)** Neither

The following situation pertains to questions 6-8.
Below are rough sketches of 2 histograms. One depicts scores on an Easy exam were most students did well. One depicts scores on a hard exam where most students did poorly. The horizontal axis ranges from 0% to 100%.



6. Which histogram depicts the easy exam?
a) Histogram A **b)** Histogram B **c)** Both **d)** Neither

7. In Histogram A, is the average greater than, less than, or equal to the median? **a)** greater **b)** less **c)** equal

The following situation pertains to questions 9-12.
The Washington Post recently reported on a study that links restricting screen time for kids to higher mental performance. The study assessed the behavior of 4,500 children, ages 8 to 11, by looking at their sleep schedules, how much time they spent on screens, their amount of exercise, and analyzed how those factors affected the children's mental abilities. They found that kids who spent less than 2 hours on screens had superior mental performance than those who spent more than 2 hours on screens.

9. How would you best describe this study?
a) Randomized Experiment **b)** Non-Randomized Double-Blind Experiment **c)** Observational Study

10. Did this study have a placebo? **a)** Yes **b)** No **c)** unable to determine

11. Which of the following conclusions are best**?**

a) The study shows that screen time is directly related to lower mental performance.

b) The study is valid because the Washington Post is a "fair and balanced" news source.

c) The results of this study must be wrong because they only looked at kids who were 8-11.

d) The study does show an association but does not establish a definite causal link

12. Say you think that "Amount of Exercise" could be a confounder because children who exercise are more likely to spend less time on screens and exercise stimulates brain development. What's the best way to handle exercise being a confounder in this particular study?

a) There should not be any confounders in this type of study.
b) At the beginning of the study, divide the subjects into subgroups based on how much they exercise, in other words, block based on exercise. Then randomly assign half the people who exercise to the treatment group and the other half to the control group. Do the same with those who don't exercise.
c) At the end of the study, stratify based on exercise. Compare those who exercise the same amounts in the treatment and control groups, so you are comparing groups that are as alike as possible.
d) At the end of the study, stratify based on screen time. Compare those who spend less than 2 hours on screens to those who spend more than 2 hours on screens.

The following situation pertains to questions 13-16.
At a particular high school, students can choose to take either Honors Courses or Regular Courses. Honors courses are much more difficult and it's much harder to get A's in them. The chart below compares the average GPA for boys and girls for honors classes, regular classes and overall total.

	Boys		**Girls**	
	# of Courses	Average GPA	# of Courses	Average GPA
Honors Classes	50	1.0	450	3.0
Regular Classes	450	3.5	50	4.0
Overall Total	500	3.25	500	3.1

13. Who has the higher GPA for Honors courses? **a)** Boys **b)** Girls **c)** Cannot be determined from the info given

14. Who has the higher GPA for Regular courses? **a)** Boys **b)** Girls **c)** Cannot be determined from the info given

15. According to the chart, who has the higher overall GPA? **a)** Boys **b)** Girls **c)** Cannot be determined from the info given.

16. The school decides to randomize assignment to honors and regular classes for the senior year, so that boys and girls will have proportionately the same number of honors classes. Assuming the students continue to perform as they did junior year, who will have the higher overall GPA average? **a)** Boys **b)** Girls **c)** Same

The following situation pertains to questions 17-21.
A study was done to see whether regular exercise can help lower cholesterol. The subjects were 1000 adults with high cholesterol. Half the subjects were ***randomly*** assigned to treatment and half were ***randomly*** to control. In the treatment group, the subjects were offered the usual health care plus given full access to a gym and a personal trainer and encouraged to exercise on a treadmill for 30 minutes 4 times a week. The control group was offered just the usual health care (which had no gym access). All the subjects were followed for 1 years and their cholesterol levels were compared.

17. Is this an observational study or a designed experiment? **a)** Designed Experiment **b)** Observational Study

18. What type of controls were used? **a)** Randomized **b)** Non-Randomized **c)** There were no controls.

19. Was there a placebo? **a)** Yes **b)** No

20. Will confounders be present in this type of study? **a)** Yes **b)** No

21. Say at the end of the study, even though everyone in the treatment group was encouraged to exercise regularly, only about half of the people actually did. The other half dropped out of the exercise program. Should the researchers compare the cholesterol levels of **everyone** in the treatment group to the controls?

a) No, they should just compare the cholesterol level of those who actually exercised to the cholesterol level of the control group, since exercise cannot help those who don't do it.

b) No, if people drop out of an experiment, that completely invalidates the experiment and there are no good comparisons to make.

c) Yes, they should compare everyone assigned to treatment to everyone assigned to control, otherwise the treatment group might consist of a different type of population than the control which could mix up the results.

The following list of numbers pertains to questions 22-26: 0, 0, 2, -2, 5

22. The average of the list is: **a)** 5 **b)** 0 **c)** 1 **d)** 1.8 **e)** 3.5

23. The median of the list is: **a)** 5 **b)** 0 **c)** 1 **d)** 1.8 **e)** 3.5

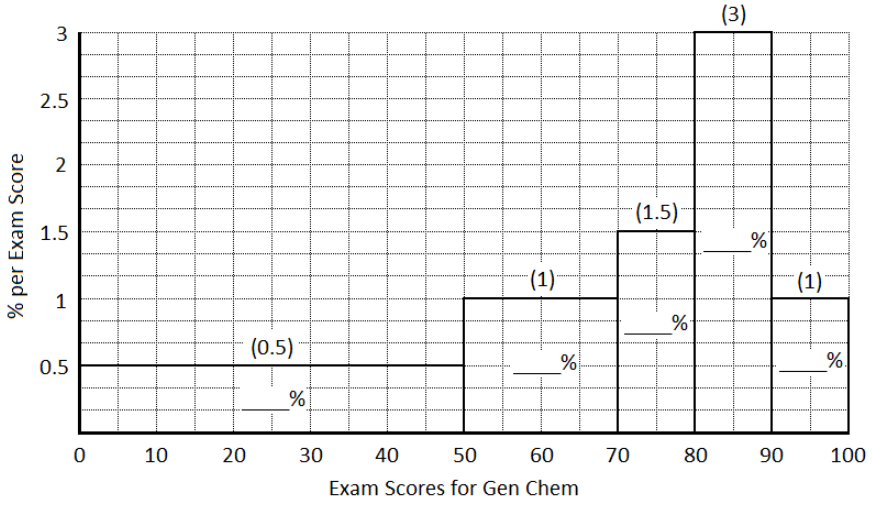
24. The deviations from the average are:

a) 1, 1, -1, -3, 4 **b)** -5, -5, -3, -7, 0 **c)** 0, 0, -2, 2, -5 **d)** 0, 0, 2, -2, 5 **e)** -1, -1, 1, -3, 4

25. The deviations should sum to: **a)** 5 **b)** 0 **c)** 1 **d)** 1.8 **e)** 3.5

26. The Standard Deviation (SD) of this list of numbers is: **a)** 2.57 **b)** 5.6 **c)** 2.37 **d)** 0 **e)** 1.8
Show work below (you can start with the deviations above):

The following situation pertains to questions 27-34.
The figure below is a histogram for the first exam scores of 520 freshmen and sophomores in general chemistry. The height of each block is given in parentheses**.** Before starting this question, fill in ALL 5 blanks in each block of the histogram above with the correct areas. **(Assume an equal distribution throughout the interval)**



27. What percent of the students received an exam score between 0 and 50? **a)** 10% **b)** 15% **c)** 20% **d)** 25% **e)** 30%

28. What percent of the students received an exam score between 80 and 90? **a)** 10% **b)** 15% **c)** 20% **d)** 25% **e)** 30%

29. The median exam score is **closest** to: **a)** 50 **b)** 70 **c)** 73 **d)** 80 **e)** 90

30. Is the median >, <, or = to the average? **a)** greater than (>) **b)** less than (<) **c)** equal to (=)

31. The percent of students who received exactly 75 on their first exam is closest to
a) 0.5% **b)** 1% **c)** 1.5% **d)** 10% **e)** 15%

Suppose all the students in the 0-30 range were given extra credit that raised each of their scores 20 points? How would that affect the average, median and standard deviation (SD)?

32. The average would…. **a)** increase **b)** decrease **c)** stay the same **d)** not enough info

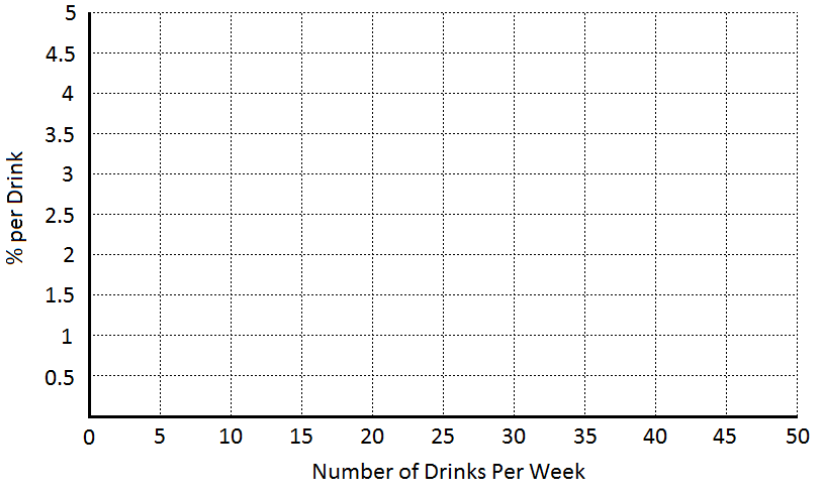
33. The median would…. **a)** increase **b)** decrease **c)** stay the same **d)** not enough info

34. The SD would…. **a)** increase **b)** decrease **c)** stay the same **d)** not enough info

The following situation pertains to questions 35-44.
A distribution table for the number of drinks a past semester of Stat 100 students said they typically consumed per week is shown below. The first row says that 45% of students said they had between 0 and 10 drinks per week. The table has 5 missing blanks. Fill them in with the correct widths, heights, and areas. Then draw the histogram. Write the area of each interval inside the block.

Fill in the 5 blanks in the table below and **then draw the histogram on the graph below.**

Interval	Width of Interval	Height (% per Drink)	Area (%)
0 to 10	10	**Blank 1**	45
10 to 15	5	4	**Blank 2**
15 to 20	5	3	15
20 to 30	10	**Blank 3**	**Blank 4**
30 to 50	20	**Blank 5**	10



35. What goes in **Blank 1**? **a)** 0 **b)** 0.22 **c)** 4.5 **d)** 20 **e)** 10
35. What goes in **Blank 2**? **a)** 0 **b)** 0.8 **c)** 1.25 **d)** 10 **e)** 20
36. What goes in **Blank 3**? **a)** 0 **b)** 1 **c)** 4.5 **d)** 20 **e)** 10
37. What goes in **Blank 4**? **a)** 0 **b)** 5 **c)** 10 **d)** 20 **e)** 50
38. What goes in **Blank 5**? **a)** 0.22 **b)** 0.5 **c)** 1 **d)** 2 **e)** 4.5

39. The area column should sum to **a)** 0 **b)** 50 **c)** 70 **d)** 100 **e)** unable to determine

40. If someone is in the 90th percentile, how many drinks per week do they drink? **a)** 10 **b)** 15 **c)** 20 **d)** 30 **e)** 40

41. Would it be appropriate to use a normal approximation for this data?
a) No, the histogram is far from normal, so using a normal approximation would not be appropriate.
b) Yes, because converting to z-scores will change the shape and make the histogram normal.
c) Yes, because the normal approximation is suitable for all data sets.
d) Yes, because we can determine the average and SD from the data.

The Survey only allowed students to give answers up to 50 drinks. I gave everyone who answered 50 the opportunity to change their answers. A few of them changed their answer from 50 to 60 drinks. How would that affect the average, median and standard deviation (SD)?

42. The average would…. **a)** increase **b)** decrease **c)** stay the same **d)** not enough info

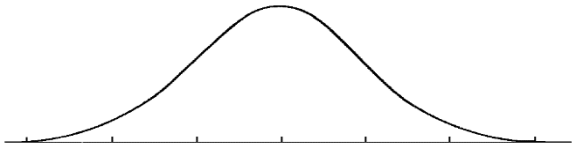
43. The median would…. **a)** increase **b)** decrease **c)** stay the same **d)** not enough info

44. The SD would…. **a)** increase **b)** decrease **c)** stay the same **d)** not enough info

The following situation pertains to questions 45-54.
One of the questions on Survey 1 this semester was: "How old is your mother?" Over 1,000 students responded. Their mothers' ages followed the normal curve with: **average= 49 years and SD = 5 years.** *When using the normal curve, round the middle area given in the normal table to the nearest whole number.*
Part 1: Let's figure out what percent of the mothers are **over** 55 years old? First convert to a z-score, then find the percentage.

45. What is **55** as a **Z** score? **Show work below and circle answer.** **a)** -1 **b)** 1 **c)** 1.2 **d)** 1.25 **e)** 1.5

Now use the normal table to determine the % of the mothers who are over 55 years old. Mark the z-score **accurately** on the curve and **shade the area of the curve** that represents the area we want**.**
46. What percent of mothers are over 55 years old? **a)** 55% **b)** 77% **c)** 23% **d)** 11.5% **e)** 16%

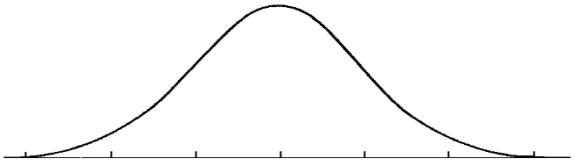


Part 2: What **percent** of the students have mothers between 40 and 49? **(Remember average = 49 and SD = 5). First convert to z-scores, then find the percentage.**

47. What is **40** as a **Z** score? **Show work below and circle answer.** **a)** 0 **b)** -1.5 **c)** -1.8 **d)** 1.8 **e)** 1.5

48. What is **49** as a **Z** score? **Show work below and circle answer.** **a)** 0 **b)** 1 **c)** -1 **d)** 2 **e)** -1.1

Now use the normal table to determine the % of the mothers who are between 40 and 49 years old. ***Mark the z scores <u>accurately</u> on the curve below and <u>shade</u> the appropriate area.***
49. What percent of mothers are between 40 and 49 years old? **a)** 50% **b)** 68% **c)** 93% **d)** 3.5% **e)** 46.5%



Part 3: Because the data follows the normal curve, 68% of the mothers' ages are within 1 SD of the average and 95% are within 2 SD's of the average given above. **(Remember average = 49 and SD = 5)**

50. So… 68% of the students have mothers between _____years and _____ years. **What goes in the two blanks?**
a) 49 and 50 **b)** 40 and 49 **c)** 44 and 54 **d)** 39 and 59 **e)** 68 and 95

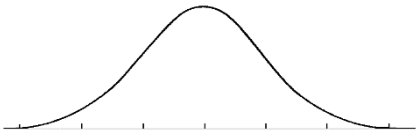
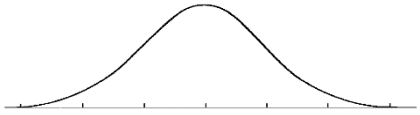
51. And 95% of the students have mothers between _____years and _____ years. **What goes in the two blanks?**
a) 49 and 50 **b)** 40 and 49 **c)** 44 and 54 **d)** 39 and 59 **e)** 68 and 95

52. If a mother is 2 SDs below average in age, what is her z-score?
a) 1 **b)** 2 **c)** -2 **d)** -1 **e)** not enough information to tell

53. If a mother is exactly at the 50th percentile, her Z score is…. **a)** 0 **b)** 1 **c)** -1 **d)** 1.5 **e)** 50

54. If a mother is exactly at the 50th percentile, she is _____ years old. What goes in the blank?
a) 40 **b)** 49 **c)** 50 **d)** 55 **e)** not enough information to tell

The following situation pertains to questions 55-65.
A group of freshman college students has an ***average ACT score = 26 and SD = 4***. The histogram of their ACT scores is close to the normal curve. In the table below, you're given either a student's ACT score, Z score, or percentile and you have to fill in the missing blanks. **For all these problems, please round the areas given in the normal table and all ACT scores to the nearest whole number.**

ACT	**Z score**	**Percentile**
Tony got an ACT score of 33.	Z= _____ **Show work:** **55. What's Tony's z-score?** **a)** 1.75 **b)** 1.12 **c)** -1.75 **d)** -0.67	Tony is in the _____ percentile.  **56. What's Tony's percentile?** **a)** 92nd **b)** 86th **c)** 96th **d)** 4th
ACT score = _____. **Show work:** **57. What's Natalie's ACT score?** **a)** 24 **b)** 28 **c)** 22 **d)** 26	Natalie has Z= - 0.5 **(Note negative sign.)**	Natalie is in the _____ percentile.  **58. What's Natalie's percentile?** **a)** 31st **b)** 38th **c)** 54th **d)** 69th
ACT score = _____. **Show work:** **59. What's AJ's ACT score?** **a)** 27 **b)** 30 **c)** 25 **d)** 24	Z= _____ **60. What's AJ's z-score?** **a)** 0.55 **b)** -0.25 **c)** 0.25 **d)** -0.55	AJ is in the 40th percentile What **middle area** should you look up on the normal table to find the correct Z score? _____%  **61. What middle area corresponds to AJ's percentile** **a)** 60th **b)** 10th **c)** 40th **d)** 20th
ACT score = _____. **Show work:** **62. What's Chelsea's ACT score?** **a)** 23 **b)** 29 **c)** 25 **d)** 27	Z= _____ **63. What's Chelsea's z-score?** **a)** 0.25 **b)** 0.85 **c)** 0.15 **d)** -0.25	Chelsea is in the 60th percentile. **No work is necessary.**

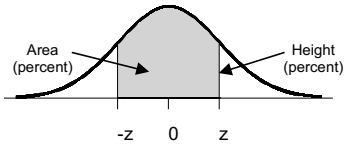
64. In the percentile column, you should always be shading which area?

a) the area to the left **b)** the area to the right **c)** the middle area **d)** it depends on the scenario

65. How difficult was this exam on a scale of 1 to 5? (1 being super easy, 5 being super hard)

a) 1 **b)** 2 **c)** 3 **d)** 4 **e)** 5

STANDARD NORMAL TABLE



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