

**STATISTICS 100 EXAM 1 KEY**

**FALL 2005**



**PRINT** NAME \_\_\_\_\_  
(Last name)

\_\_\_\_\_  
(First name)

**CIRCLE SECTION      M1 9am      C1 noon      S1 2:30 pm**

Write answers in appropriate blanks. When no blanks are provided **CIRCLE** your answers.  
**SHOW WORK** when requested, otherwise no credit.  
Do NOT use scrap paper.

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

**DO NOT WRITE BELOW THIS LINE**

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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 \_\_\_\_\_ 10

Page 2 \_\_\_\_\_ 22

Page 3 \_\_\_\_\_ 20

Page 4 \_\_\_\_\_ 12

Page 5 \_\_\_\_\_ 16

Page 6 \_\_\_\_\_ 20

**Total Score** \_\_\_\_\_

**There IS Class Tomorrow.**  
**Scores will be posted on Mallard by Monday night.**

**Question 1** (6 pts.)

A study published in a recent issue of the journal *Obesity Research* compared the fat distribution of smokers to non-smokers among 21,828 British men and women aged 45-79. The smokers had significantly higher waist to hip ratios and higher abdominal obesity than the non-smokers.

This study is an example of .... *Choose one:*

- a) **i) Observational Study**    ii) Randomized Controlled Experiment    iii) Non-Randomized Controlled Experiment

b) Based only on the results of this study, which of the following conclusions is most appropriate?

*Choose one:*

- i) Smoking causes abdominal obesity.
- ii) Smoking is associated with – but does not cause- abdominal obesity.
- iii) Smoking is associated with – and might cause - abdominal obesity.**
- iv) Abdominal Obesity causes smoking
- v) There is no relationship between smoking and obesity.

Which of the following could confound the results?

*Choose two:*

- i) Genetics- some people are genetically more prone to abdominal obesity.
- ii) Diet- People who smoke may also have problems controlling their diet, and may eat more fatty foods which could lead to more abdominal fat.**
- iii) Metabolism- Cigarette smoking may have an adverse effect on the uptake and storage of fatty acids, increasing abdominal fat mass.
- iv) Gender— The smoker group may have included more men and men tend to have higher waist to hip ratios and accumulate more abdominal fat than women.**

**Questions 2** (4 pts.)

Suppose I wanted to determine whether or not offering optional homework problems to supplement the required homework would help students learn. I randomly split the class into 2 groups—the treatment group was offered optional problems to supplement the required homework while the control group was just given the required problems.

At the end of the semester I compared the exam scores of the 2 groups and saw no significant difference.

**Both groups had an average of exam score of 80% and a SD of 20%.**

But only half the students in the treatment group actually did the supplemental problems. Those who chose to do the optional homework did much better than those who chose not to do it. The table below gives the data:

	<b>Treatment group</b>	<b>Control Group</b>
	<b>Exam Ave</b>	<b>Exam Ave</b>
Chose to do extra hw	90%	Not applicable
Chose not to do extra hw	70%	Not applicable
<b>Total</b>	<b>80%</b>	<b>80%</b>

a) Which 2 percentages are most appropriate to compare to determine whether or not the extra problems helped?

*Choose one:*

- i) 80% vs. 80%**
- ii) 90% vs. 80%
- iii) 80% vs. 70%
- iv) 90% vs. 70%

b) Which conclusion is most appropriate to draw from the data?

*Choose one:*

- i) Giving students the option of doing supplemental problems helps them learn.
- ii) Giving students the option of doing supplemental problems doesn't seem to make any difference in learning. Students who chose to do them are probably more serious students who would have done well without the supplemental problems.**
- iii) Giving students the option of doing supplemental problems impairs learning.
- iv) Those who choose to do the supplemental problems are clearly helped by them and those who choose not to do the supplemental problems are clearly hurt by them.

**Question 3** (6 pts.)

A recent study was done to test the effectiveness of acupuncture in the treatment of tension-type headaches. The subjects were 270 adult volunteers who reported having had tension headaches for at least eight days a month in the previous three months.

The subjects were randomly divided into 3 groups. One received 8 weeks of a traditional form of acupuncture, one received 8 weeks of a fake acupuncture (superficial needling at non-acupuncture points) and a third group were told they were on a waiting list and received no treatment for the 8 weeks.

The subjects didn't know if they were receiving the traditional or superficial acupuncture. All subjects kept headache diaries for 8 weeks. The evaluators recorded the difference in the number of headaches before and after treatment for each subject not knowing which subjects were in which group.

The average number of headaches after treatment decreased by 7 in both the real and fake acupuncture groups, but only decreased by 1.5 in the waitlist group.

- a) This study is an example of .... *Choose one:*
  - i) a randomized controlled experiment without any placebo.
  - ii) an observational study with controls.
  - iii) **a randomized controlled experiment with a placebo**
  - iv) a non-randomized controlled double-blind experiment.
  
- c) Which of the following statements is best? *Choose one:*
  - i) This study is very strong evidence that traditional acupuncture works better than a placebo in the treatment of tension-type headaches.
  - ii) This study only shows that there is an *association* between traditional acupuncture and reduced headaches. It does not prove or disprove that acupuncture actually caused fewer headaches since there are likely to be other differences between those who received the real acupuncture and those who received the fake acupuncture which could confound the results.
  - iii) **This study is strong evidence that acupuncture (both fake and real) has a strong placebo effect since the real acupuncture worked no better than the fake acupuncture but both worked better than nothing.**
  
- c) Which of the following are likely to confound the results of this study? *Choose one:*
  - i) Pain Tolerance- People who choose acupuncture are better able to tolerate pain and therefore may report fewer headaches.
  - ii) Alternative Medicine- People who choose acupuncture are more likely to be taking alternative therapies such as herbal cures and massage which could help alleviate headaches.
  - iii) Tension -- People who seek acupuncture are more likely to have tension headaches than those who don't.
  - iv) All of the above are likely confounders.
  - v) **None of the above are likely confounders.-**

**Question 4** pertains to a list of numbers that has an average of 100 and a SD of 30. (6 pts)

- a) If 5 is added to all the numbers on the list , the new average is 105 and the new SD is 30
- b) If all the numbers on the original list are multiplied by *negative 0.5*, the new average is -50 and the new SD is 15
- c) If all the numbers on the original list are decreased by 100, and then divided by 30, the new average is 0 and the new SD is 1

**Question 5** pertains to the following list of numbers: **9, 6, 6, 0, 0, 0, 0, 3, 3,3** (10 pts.)

- a) The average is 3
- b) The median is 3 (Order numbers from smallest to largest: **0 0 0 0 3 3 3 6 6 9**)
- c) The deviations from the average are: **-3 -3 -3 -3 0 0 0 3 3 6**
- d) The sum of the deviations from the average is always = **0**
- e) Compute the SD. (Show work. Circle answer.)

**Deviations Squared: 9 9 9 9 0 0 0 9 3 Ave: 90/10=9 SD= 3**

**Question 6** (8 pts)

A company has 455 job openings- 70 white collar jobs and 385 blue collar jobs. 600 men and 300 women apply for the new jobs. Here's the data:

	Men			Women		
	# Applied	# Hired	Hiring Rate	# Applied	# Hired	Hiring Rate
<b>White Collar</b>	200	30	15%	200	40	20%
<b>Blue Collar</b>	400	300	75%	100	85	85%
<b>Total</b>	600	330	55%	300	125	41.67%

a) Overall 55% of the men but only 42% of the women who applied were hired, raising the question of sexual discrimination. Assuming that the men and women were equally qualified, which job category was discriminating against women?

- i) White Collar Only    ii) Blue Collar Only    **iii) Neither**    iv) Both

b) Based only on the data above, if you're applying for a *white collar* job are your chances better if you're a male or female?

- i) Male    **ii) Female**    iii) Can't compare chances since the number who applied is different.

c) Based only on the data above, if you're applying for a *blue collar* job are your chances better if you're a male or female?

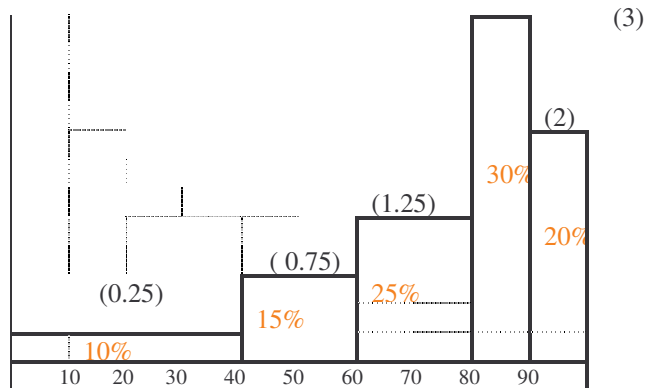
- i) Male    **ii) Female**    iii) Can't compare chances since the number who applied is different.

d) Based only on the data above, are your chances of getting hired better if you're a male or a female?

- i) Chances are better for Male  
**ii) Chances are better for Female**  
 iii) Chances are the same  
 iv) It depends on whether you're applying for a white or blue collar job.

**Question 7** pertains to the histogram below: (12 pts.)

The histogram below represents the scores on a final exam of a class of 500. The height of each block is given in parentheses.



a) Fill in the blanks with the percent of the students in these 2 intervals: 40-60 15% and 80-90 30%

b) The median is .... i) 50    ii) 60    iii) 70    **iv) 80**

c) Is the average greater than, less than or equal to the median? i) greater    **ii) less**    iii) equal

d) The percent of students who scored 85 is closest to. (Assume an equal distribution throughout the interval.)

- Circle one:**    0.5%    1%    1.5%    2%    2.5%    **3%**    4%    5%    6%

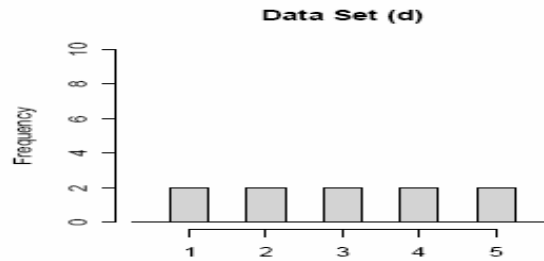
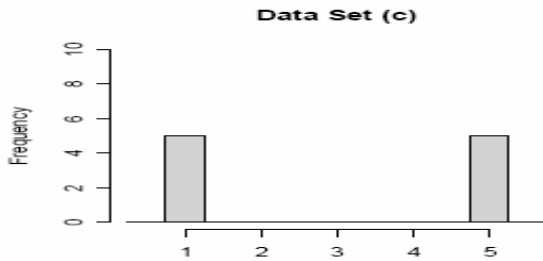
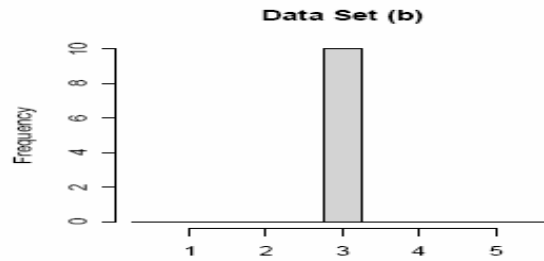
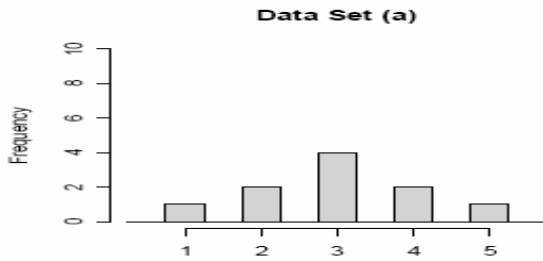
e) Could we use the normal approximation with this data to figure percentages within different intervals?

- i) Yes, if we knew the average and the SD we'd lose little accuracy in using the normal curve.  
 ii) Yes, normal approximations are always accurate in approximating percentages.  
 iii) Yes, because even though the histogram above is far from normal, it will become normal after the data is converted to Standard Units.  
**iv) No, this histogram is not close to normal, so the normal approximations would not be close to the real values.**

**Question 8 (6 pts.)**

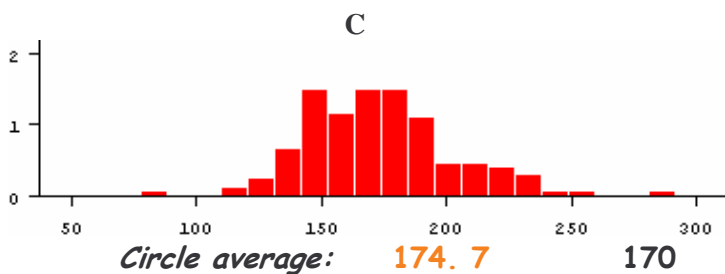
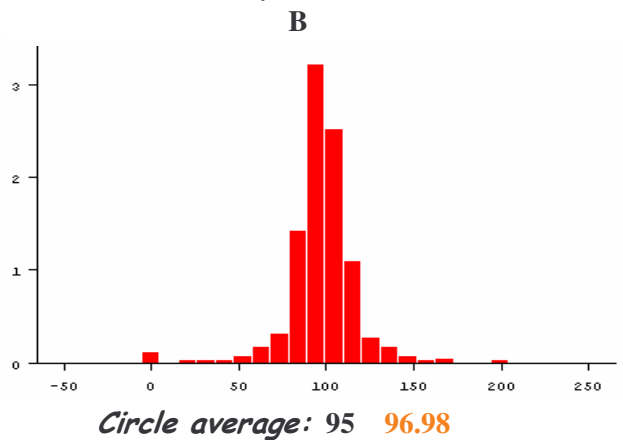
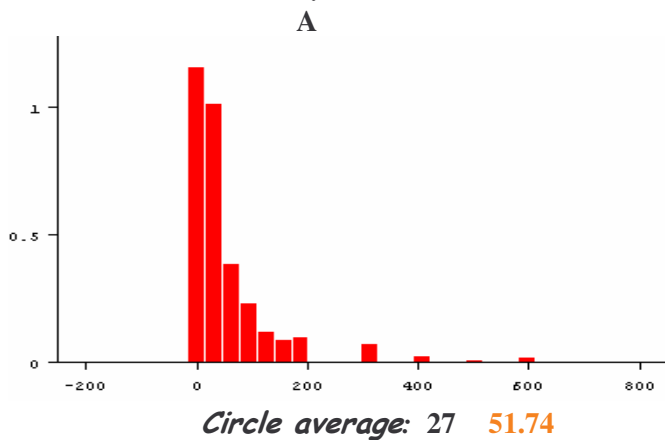
The 4 histograms below depict 4 data sets. Each data set has 10 numbers with an average of 3, but each has a different SD. All the histograms are drawn to the same scale. **Order the data sets from the smallest SD to the largest SD**

*Smallest SD*  b  →  a  →  d  →  c  *Largest SD*



**Question 9** Below are 3 histograms representing 3 variables from the survey responses of 600 students from a previous Stat 100 class: cash in pocket, fastest speed ever driven and weight of males in the class. (6 pts.)

a) *Histogram*  C  represents weight, *Histogram*  A  represents cash, and *Histogram*  B  represents speed.  
 (Fill in the blanks above with the correct letter.)



b) Below each graph are 2 numbers. (They're not in any particular order.) One is the average and the other is the median. For each histogram, circle the number which is the **average**. **Hint:** For B and C look at the **2 numbers**, not the histogram.

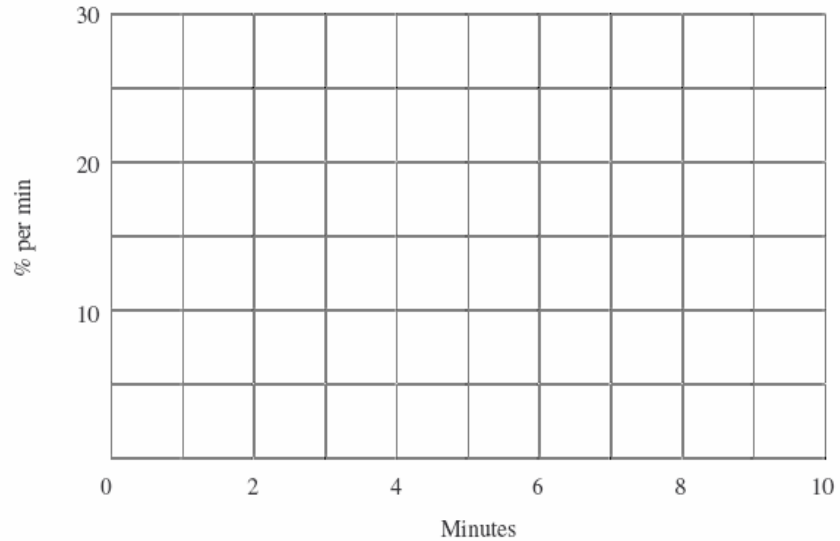
**Question 10** (12 pts.)

A group of college students were asked the question: "Suppose you had an 8am final and you woke up at 7:45am, how long would it take you to get out the door.?" Their responses (in minutes) are summarized in the table below.

a) *Fill in the height column on the table*

b) *Draw Histogram below*

Minutes	% of people	Height (% per min)
0-4	20	$20/4 = 5$
4-7	30	$30/3 = 10$
7-9	40	$40/2 = 20$
9-10	10	$10/1 = 10$



b) What is the *median* time? *Circle one:*    4    5    6    7    8    9

c) Which is larger: the median or the average, or are they the same?

- i) Median is larger
- ii) Average is larger
- iii) They're the same

d) If 10 minutes is added to everyone's time would the shape of the histogram change?

- i) Yes
- ii) No
- iii) Not enough information to determine

e) If 10% is added to everyone's time would the shape of the histogram change?

- i) Yes
- ii) No
- iii) Not enough information to determine

**Question 11** pertains to this semester's survey data (4 pts.)

For each question below check whether you think the histogram for the responses has a long left-hand tail, a long right-hand tail, or is fairly symmetrical.

*Next to each Survey Question Check the box that best describes its histogram.*

Survey Question	Long Left-Hand Tail	Long Right-Hand Tail	Fairly Symmetrical
a) How much cash do you have in your pocket?		✓	
b) How many times have you cheated in your life on an exam in school?		✓	
c) How many pairs of shoes do you own?		✓	
d) How much do you weigh? (Just the women's responses)			✓

**Question 12** IQ scores of US adults are normally distributed with an **average of 100 and an SD of 15**. (20 pts.)  
 (You may “round” z scores and percents to fit the closest line on the normal table and you may round percents on the table to the nearest whole number.)

a. Approximately 68% of U.S. adults have **IQ scores** between 85 and 115. (Give IQs, not z scores)

About 68% (68% corresponds to  $z=1$  on table) are within +/- 1 SD from the average so  $100-15=85$  and  $100 + 15 =115$

b. Convert an IQ of 130 to a z score. (In other words how many SDs above average an IQ of 130?) Circle answer.

$z = (130-100)/15 = 2$

c. What **percentage** of US adults have IQ’s between 73 and 127? (Show work, draw picture, circle answer)  
 (Don’t round your answer for this problem.)

- Convert endpoints of the interval to Std Units:  $z = (73-100)/15 = -1.8$  and  $z = (127-100)/15 = 1.8$
- Look up middle area for  $z = 1.8$   $A = 92.81\%$

d. People with IQs below 70 are classified as retarded and according to a recent Supreme Court ruling are exempt from the death penalty. What percent of the US population has IQs below 70? (Show work, draw picture, circle answer)

- Convert 70 to z  $(70-100)/15 = -2$
- Middle area is 95%
- Left-hand tail is  $(100-95)/2 = 2.5\%$

e. What **percentile** is someone with an IQ of 118? (i.e, what % of the population have lower IQs.) (Show work, draw a picture, circle answer.)

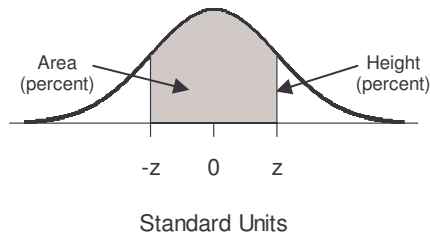
- Convert 118 to z  $(118-100)/15 = 1.2$
- Middle area is 77%
- Shaded area is middle area + left-hand tail =  $77\% + (100-77)/2 = 88.5^{\text{th}}$  percentile

f. If someone is exactly average in IQ, what percentile is he in? 50th percentile  
 (No work is necessary.)

g.. What IQ score corresponds to the 95<sup>th</sup> percentile? (Show work, draw a picture, circle answer.) **Round IQ score to the nearest whole number.**

- Look up z for *middle area* =90%  $z = 1.65$  (95th percentile means 95% of the population is lower and 5% is higher. To use the table you need to find the middle area. so divide the 95% into 2 pieces – a tail of 5% to match the upper tail and a middle of 90% )
- $z = 1.65$  means 1.65 SDs above average.  $100 + 1.65 * 15 = 124.75$  rounded to 125

### STANDARD NORMAL TABLE



<i>z</i>	<i>Height</i>	<i>Area</i>		<i>z</i>	<i>Height</i>	<i>Area</i>		<i>z</i>	<i>Height</i>	<i>Area</i>
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