Name: Key (102)

MATH 130 – ELEMENTS OF STATISTICS
EXAM I – VERSION 2

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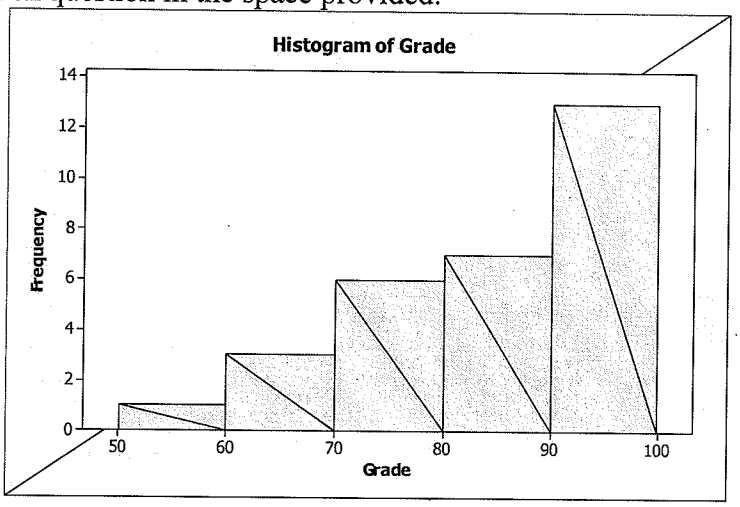
SHOW ALL WORK NEATLY and clearly indicate your answers. Show all your working for every problem. A correct answer with no work shown (except on problems which are trivial) will receive no credit. If you are not sure if you have written enough, please ask. There are 12 problems on 5 pages. The time allowed is 75 minutes and the exam is worth 100 points. *Write your name on every page in the space provided.* You may use a calculator for this test, but not a cell-phone or laptop. You may also use a 3x5 inch formula card.
Good luck!!

1. (4 points) A surveyor is conducting a poll. Indicate for each of the following variables whether the variable being described is *qualitative* or *quantitative*.
   a) The telephone number of the respondent. a) qualitative
   b) The gender of the respondent. b) qualitative
   c) The age of the respondent. c) quantitative
   d) The political affiliation of the respondent (democrat, republican or independent.) d) qualitative

2. (6 points) Determine the type of sampling (simple random, stratified, cluster, or systematic) in each of the following situations.
   a) Every fifth person entering a rock concert is checked for possession of a weapon. a) systematic
   b) A political party randomly selects 100 voter registration numbers and surveys the people having those numbers. b) simple random
   c) A researcher for an airline interviews all of the passengers on seven randomly selected flights. c) cluster

3. (6 points) Consider the given histogram of grades for a section of 30 chemistry students. Indicate the appropriate answer for each question in the space provided.



a) B How many students have a grade more than 80?
A) 26 B) 20 C) 13 D) 7

b) A What is the shape of the histogram?
A) skewed left B) skewed right
C) symmetric D) uniform

c) C What percentage of students have a grade in the 70's?

A) 13% B) 6% C) 20% D) 80%

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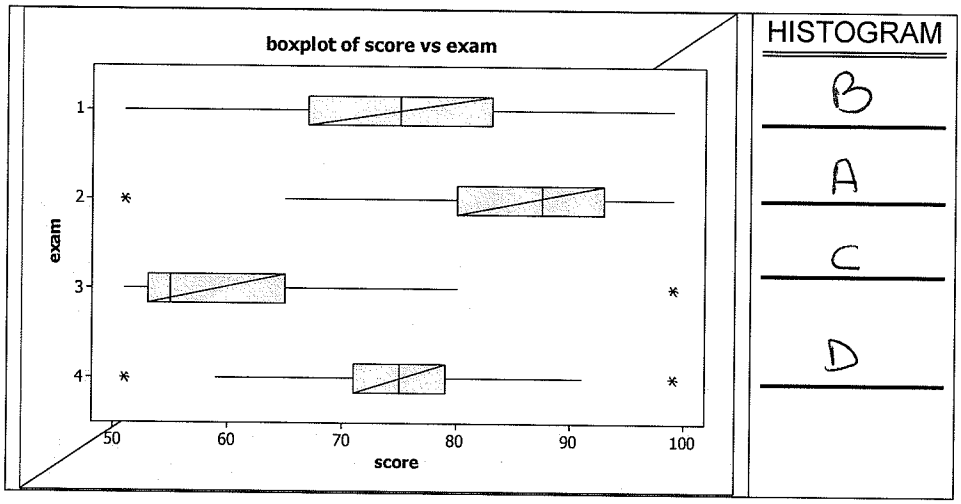
4. (8 points) Four exams were given in the general philosophy course resulting in the following graphical displays. Match the appropriate histogram to the corresponding box-plot.



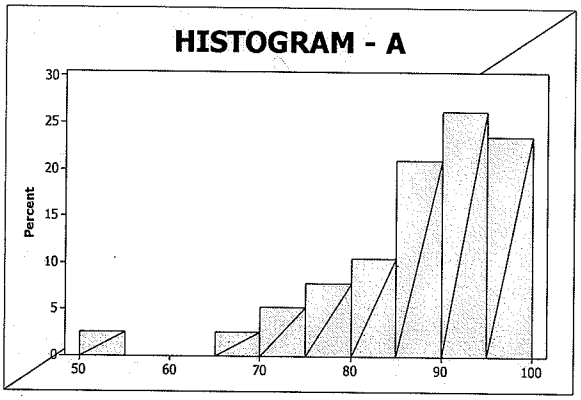
HISTOGRAM

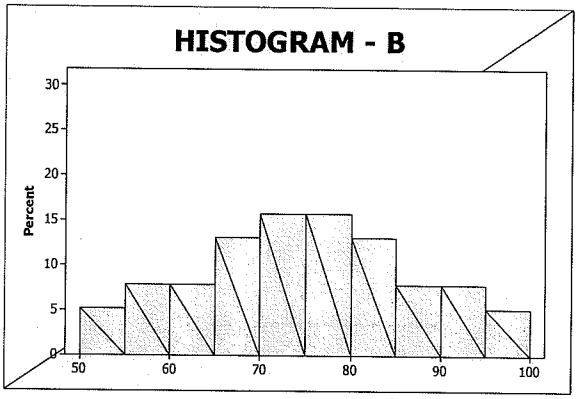
B

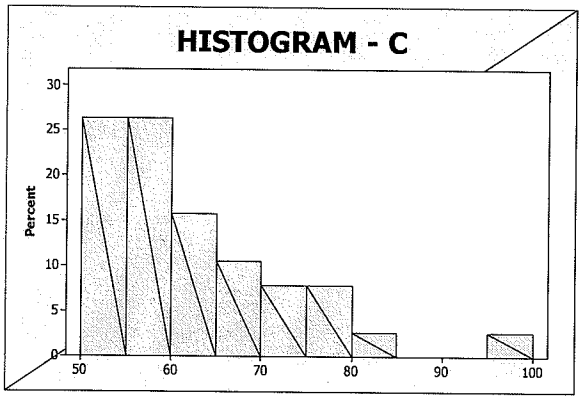
A

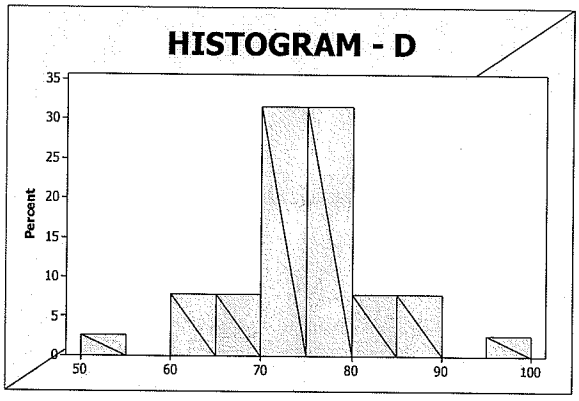
C

D









5. (8 points) Construct a stem-and-leaf plot for the following data:

1.7	2.6	2.5	0.3
4.1	1.8	1.7	0.2
2.3	4.2	4.0	2.1
0.1	1.3	3.2	3.5

0	1 2 3
1	3 7 7 8
2	1 3 5 6
3	2 5
4	0 1 2

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6. (12 points) Consider the following data.

2220	2656	2997	3448	2406	2841	3140	3535
2279	2804	3024	3513	2530	2903	3253	3581

In each of the following questions, start the first class at a lower class limit of 2000 and maintain a class width of 400.

a) Construct a frequency distribution.

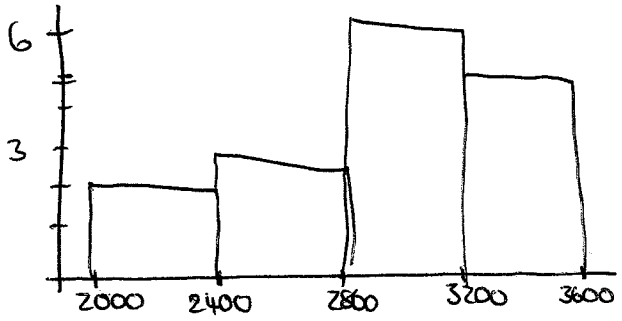
Class	Count	Frequency
2000-2399	II	2
2400-2799	III	3
2800-3199	HHI	6
3200-3599	HHI	5

3

b) Construct a relative frequency distribution.

Class	Rel. freq
2000-2399	$\frac{2}{16} = .125$
2400-2799	$\frac{3}{16} = .1875$
2800-3199	$\frac{6}{16} = .375$
3200-3599	$\frac{5}{16} = .3125$

c) Construct a frequency histogram.



7. (6 points) A packet contains 10 batteries, 3 of which are defective. If 2 are selected at random, what is the probability that both are defective?

$P(\text{both defective}) = P(\text{second def} \mid \text{first def})\, P(\text{first def})$

$= \frac{3}{10} \cdot \frac{2}{9} = \frac{1}{15}$

OR $P(\text{both defective}) = \frac{{}_3C_2}{{}_{10}C_2} = \frac{1}{15}$

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8. (15 points) Consider the following data: 2 0 2 3 7 1 8 1

3 a) Compute the sample mean.

$$\bar{x} = \frac{2+0+2+3+7+1+8+1}{8} = \frac{24}{8} = 3.$$

2 b) Compute the sample median.

0 1 1 2|2 3 7 8 2.

2 c) By considering your answers for parts a) and b), what is the shape of this distribution?

mean > median skewed right

2 d) Compute the range.

range = 8 − 0 = 8

4 e) Compute the sample standard deviation.

x_i	$x_i - 3$	$(x_i-3)^2$
2	−1	1
0	−3	9
2	−1	1
3	0	0
7	4	16
1	−2	4
8	5	25
1	−2	4
		60

$$S^2 = \frac{60}{7} \approx 8.57$$

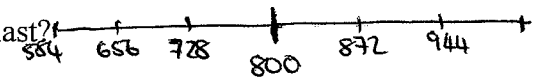
$$S = \sqrt{\frac{60}{7}} \approx 2.93$$

2 f) What is the third quartile (Q3) of this data?

$$\frac{3+7}{2} = 5.$$

9. (9 points) Suppose that a random sample of 400 lightbulbs has a mean life of 800 hours and a standard deviation of 72 hours. Suppose that the sample data has a bell-shaped distribution.

a) How long would you expect 68% of the lightbulbs to last?



728 to 872 hours

b) What percentage of lightbulbs will last less than 584 hours?

0.15%

c) What percentage of lightbulbs will last more than 656 hours?

95 + 2.5 = 97.5%

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10. (8 points) Julie has 5 green flags, 2 blue flags and 3 red flags. How many arrangements are there of the 10 flags?

$${}_{10}C_5 \cdot {}_5C_2 \cdot {}_3C_3 = \frac{10!}{5!2!3!} = 2520$$

11. (12 points) Suppose that P(E)=0.7, P(F)=0.42, and P(E and F)=0.22.

a) Are E and F disjoint events?

No

b) What is P(E or F)?

$$P(E) + P(F) - P(E \text{ and } F) = 0.9$$

c) What is P(F|E)?

$$\frac{P(E \text{ and } F)}{P(E)} = \frac{0.22}{0.7} = 0.31$$

d) Are E and F independent?

No

12. (8 points) Consider a sample data set containing 74 data items listed in ascending order.

a) In what position (i.e.: at what index) would you find the 12th percentile?

$$i = \frac{12}{100}(74+1) = 9$$

b) What percentile rank is the 53rd data item?

$$\text{percentile rank} = \frac{52}{74} \times 100 = 70.27$$

THE END