MIDTERM **Math 243** SUMMER 2009

NAME: Key

1. [3] TRUE/FALSE: Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F.

   T (F) If x is an observation from a distribution that has mean μ and standard deviation $\frac{\sigma}{\sqrt{5}}$, the standardized value of x is $z = \frac{x-\mu}{\sigma}$

   practice midterm

   T (F) Populations with a Normal distribution are best described by the five-number-summary.

   practice midterm

   (T) F The mean is more sensitive to outliers than the median.

Show your work for the following problems. The correct answer with no supporting work will receive NO credit (this includes multiple choice questions).

2. The National Halothane Study was a major investigation of the safety of anesthetics used in surgery. Records of over 850,000 operations performed in 34 major hospitals showed the following death rates for four common anesthetics.

Anesthetic	A	B	C	D
Death rate	1.7%	1.7%	3.4%	1.9%

   (a) [2] Is the above study an observational study or an experiment? Why?

   An observational study because those collecting the data did not get to impose treatment.

   Answer (+1) justify (+1)

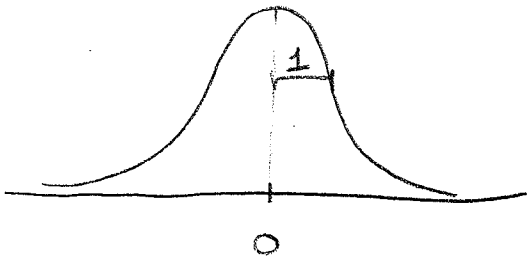
   (b) [3] A friend of yours is going into surgery and needs anesthetic. After discovering the above data, she decides she wants to avoid the anesthetic C. Explain to your friend why her conclusions are wrong.

   lurking (+2) example (+1)

   There may be lurking variables in the data given that this was neither an experiment or used randomness. Some lurking variables could be the doctors preference or health concerns in patients

3. [2] Draw the standard Normal curve:

Shape +1
labels +1



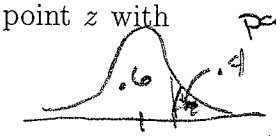
(a) [1] What is the area bounded between the standard Normal curve and the horizontal axis? 1 +1

(b) [2] What is the area bounded between the standard Normal curve and the horizontal axis that is to the left of the z-score 1.55?

Table A .9394

normalcdf(-1000, 1.55) .9394

Quiz 2 #2b #3.13 (c) [3] Treat the standard Normal curve as a density curve. Find the point z with 40% of the observations falling above it.



partial +1

Table A
entry closest to .6
.25 but I'd take .26

invNorm(.6, 0, 1) .253

used .6 +1

looking for z-score +1

Quiz 3 #2 #9.45de 4. People who eat lots of fruits and vegetables have lower rates of colon cancer than those who eat little of these foods. Fruits and vegetables are rich in "antioxidants" such as vitamins A, C, and E. Will taking antioxidants help prevent colon cancer? A medical experiment studied this question with 864 people who were at risk of colon cancer. The subjects were divided into four groups: daily beta-cartene, daily vitamins C and E, all three vitamins every day, or daily placebo. After four years, the researchers were surprised to find no significant difference in colon cancer among the groups.

(a) [4] What does "no significant difference" mean in describing the outcome of the study?

partial
conclude +1
small effect +1 (of rates)
chance +1
sense +1

The variation of colon cancer rates observed in each group was small enough to have been the result of chance alone.

rates +1
chance .5
about .5

(b) [2] Suggest some lurking variables that could explain why people who eat lots of fruits and vegetables have lower rates of colon cancer.

Perhaps people who eat a lot of fruits & vegetables have healthier diets or lifestyles. Perhaps it is another part of the fruit that is causing the effects or perhaps it is a compound effect of fiber & antioxidants.

5. Suppose the scores on a final exam are Normally distributed with a mean of 72 and standard deviation of 9.8.

Practice test

- [2] What is the probability of choosing a student with a score less than 70?

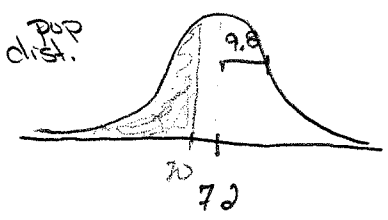


Table A: $\frac{70-72}{9.8} = -.204 \Rightarrow .4207$

normalcdf $(-10000, \frac{70-72}{9.8})$ $= .4191$

normalcdf $(-10000, 70, 72, 9.8) = .4191$

- [2] If I randomly ask 20,000 students what their test score was, *about* how many should I expect to have a scores less than 70?

Table A $20000 \cdot .4207 = 8414$

Calc $20,000 \cdot .4191 = 8382$

- [4] What is the probability that a student received a B on the exam? (Assume scores between 80 and 90 receive a B.)

z-score for 80: $\frac{80-72}{9.8} = .8163$ z-score for 90: $\frac{90-72}{9.8} = 1.83$

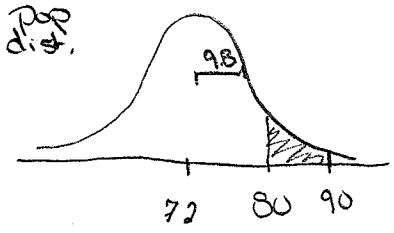


Table A: $.9671 - .7939 = .1732$

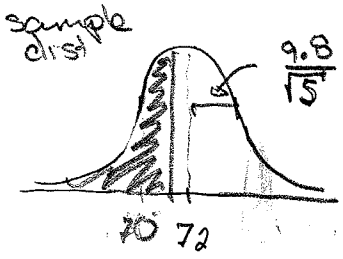
normalcdf $(\frac{80-72}{9.8}, \frac{90-72}{9.8})$ $= .174$

normalcdf $(80, 90, 72, 9.8) = .174$

- [5] Collect a simple random sample of five students. What is the probability that the average test score of the five students is below 70?

Hint: Draw the density curve you will be working with.

We are using a sample dist? partial +1



Know standard dev +1
mean +1
sample size +1
overall sign +.5

z-score for 70: $\frac{70-72}{\left(\frac{9.8}{\sqrt{5}}\right)} = -.456$

Table A: .3228

$\frac{9.8}{\sqrt{5}} = 4.383$

normalcdf $(-10,000, \frac{70-72}{\left(\frac{9.8}{\sqrt{5}}\right)})$ $= .3241$

normalcdf $(-10,000, 70, 72, \frac{9.8}{\sqrt{5}}) = .3241$

6. Biologists studying the healing of skin wounds measured the rate a razor cut in the skin of an anesthetized newt. Assume that we know that the standard deviation of healing rates is 8 micrometers (millionths of a meter) per hour. Here are the data from 18 newts, measured in micrometers per hour.

x 14.3
Sum book

29 27 34 40 22 14 35 26 28
35 12 30 23 18 11 22 28 38

11 12 14 18 22 22 23 23 26 27 28 29 30 33 34 35 35 40

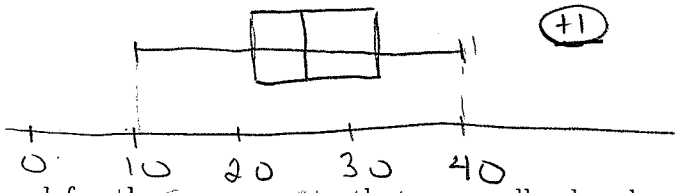
(a) [2] Find the mean and median.

Median 26.5

mean 25.7

(b) [5] Draw a box plot of the data.

+1 Min 11
+1 Q1 22
M 26.5
+1 Q3 33
+1 Max 40



(c) [3] Find the 95% confidence interval for the average rate that new cells closed razor cuts in newts.

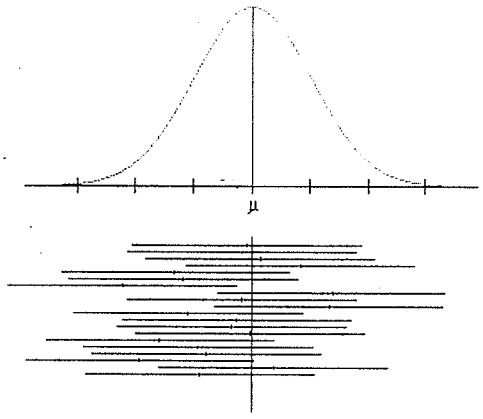
$\bar{x} \pm 2\frac{8}{\sqrt{18}}$ +1.5 +1.5 Sum +1

$25.7 \pm 3.8 = 25.7 \pm 2 \cdot 1.89$

(21.9, 29.5)

(d) [5] Use the figure below to explain the concept of the 95% confidence interval that you found in part (c).

"As we take many SRS & calculate each confidence interval, the μ (ie the mean of the population) would be caught in approximately 95% of them."



"If we took SRS samples many times, about 95% of the intervals calculated should catch μ."

"If several SRS were taken and the confidence interval calculated for each, μ would be caught in ~~[illegible]~~ about 95% of the intervals!"

"If we were to calculate many SRS, of all the intervals calculated, μ would be caught approximately 95% of the time!"