

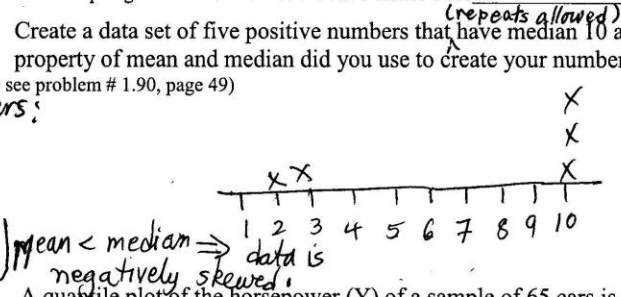
Math 661-102, Spring 2012
Mid-Term Exam

Name: _____
 Student ID: _____

March, 21. Please show the complete solution (with all steps) to wherever possible to receive perfect score!
 I pledge I have not violated the NJIT Honor Code _____

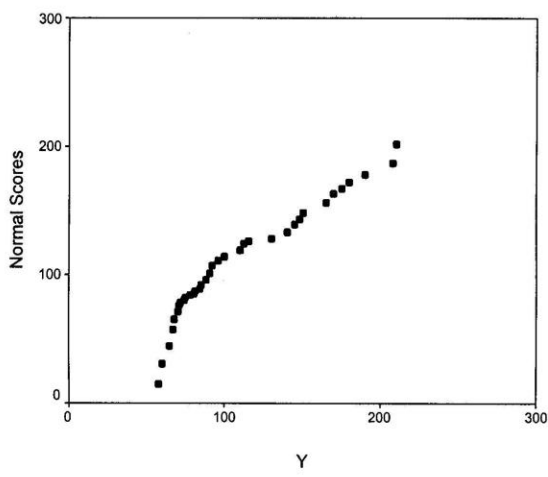
1. Create a data set of five positive numbers that have median 10 and mean 7. What property of mean and median did you use to create your numbers? (7 points)

Possible answers:
 1, 1, 10, 10, 13
 1, 1, 10, 11, 12
 1, 2, 10, 11, 11
 1, 2, 10, 10, 12
 1, 3, 10, 10, 11
 1, 4, 10, 10, 10
 2, 2, 10, 10, 11
 2, 3, 10, 10, 10



Since
 mean = 7
 total = 35 and
 median = 10 =>
 have 3 tens

2. A quartile plot of the horsepower (Y) of a sample of 65 cars is shown below:



Which of the following descriptions best describes the shape of the distribution of horsepower?

- A) Normal
 B) Normal with some outliers
 C) Skewed because not a straight line but a C-shaped curve. (6 points)

3. The scores on a university examination are Normally distributed with a mean of 62 and a standard deviation of 11. If the bottom 5% of students will fail the course, what is the lowest mark that a student can have and still be awarded a passing grade? (nearest integer)

$$z = \frac{x - \mu}{\sigma}$$

$$-1.645 = \frac{x - 62}{11}$$

$$x = 43.905 \text{ or } x = 44$$

(12 points)

4. The correlation coefficient between two variables x and y is $r = 0.121$. What conclusion can we draw?

- A) Because the correlation is so low, the relationship between x and y is not very strong, thus there is no use in studying this relationship. *wrong*
- B)** Because the correlation is so low, we only know that the linear relationship between x and y is not very strong, but there may be a different relationship between the two variables. We need to first look at a scatterplot.
- C) The correlation between x and y is low, but that does not matter. We can still use least-squares regression to calculate an equation of the form $\hat{y} = ax + b$. *makes no sense*
- D) None of the above. *wrong because B works.* (7 points)

5. A recent survey of 100 United Kingdom music fans aged 14 to 64, revealed that roughly 30% of the teenage music fans are listening to streamed music on their computer everyday. You decide to interview a random sample of 10 US teenage music fans and assume that they behave similarly to UK teenagers.

- a. What is the distribution of the number of teenagers in the sample who listen to streamed music daily? Justify why the distribution can be applied here. (8 points)

Binomial ($n=10$ & $p=.3$)

- (1) Each teenager either listens to stream music ($p=.3$) or not ($1-p=.7$). This defines the trial.
- (2) Random sample makes their answers independent of one another. (3) Teenagers in US/UK behave "similarly" *thus $p=.3$ for all 10 trials.*

- b. What is the probability that at least 2 of the 10 listen to steamed music daily? (Please see 5.73, page 337) (10 points)

X : # of teenagers in US out of 10 who listen to streamed music.

$$\begin{aligned}
 P(X \geq 2) &= 1 - P(X < 2) \\
 &= 1 - P(X=0 \text{ or } X=1) \\
 &= 1 - \{P(X=0) + P(X=1)\} \\
 &= 1 - \{(0.7)^{10} + 10(0.3)(0.7)^9\} \\
 &= 1 - \{(0.7)^9(0.7 + 3)\} \\
 &= 1 - (0.7)^9(3.7) \\
 &= 1 - .1493 = 0.8507
 \end{aligned}$$

6. The weight of the eggs produced by a certain breed of hen is normally distributed with mean 65 gram (g) and standard deviation 4 g. If cartons of such eggs can be considered to be simple random sample of size 12 from the population of all eggs, what is the probability

$\mu_T = 65 + 65 + \dots + 65 = (12)(65)$ (Please see 5.77, page 338) (15 points)
 $\sigma_T^2 = 4^2 + \dots + 4^2 = (12)(16) = 780$ T : total weight of 12 eggs
 $\sigma_T = 13.85640646$
 $Z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{\bar{X} - 65}{4/\sqrt{12}}$
 $\sigma_{\bar{X}} = 1.154700538$
 $P(760 < T < 800) \stackrel{OR}{=} P\left(\frac{760}{12} < \bar{X} < \frac{800}{12}\right)$
 $= P(63.\bar{3} < \bar{X} < 66.\bar{6})$
 $= P(-1.44 < Z < 1.44)$

7. The distribution of blood types in Ireland is given by

Blood type	A	B	AB	O
Ireland probability	.33	.15	.02	.50

and that of US distribution is given by

Blood type	A	B	AB	O
US probability	.40	.11	.07	.42

. Choose a person from the United States and a person from Ireland at random, independently of each other. (i) What is the probability that both have type 'A' blood? $(.33)(.4) = .132$

(ii) What is the probability that both have same blood types? (15 points)

(Please see 4.26, page 246)

$P(\text{same blood type}) = P(\text{both A}) + P(\text{both B}) + P(\text{both AB}) + P(\text{both O})$
 $= .132 + .0165 + .0014 + .2100$
 $= .3599$

8. A researcher at a large company has collected data on the beginning salary and current salary of 48 randomly selected employees. The least-squares regression equation for predicting their current salary from their beginning salary is $\hat{y} = -2532.7 + 2.12x$.

The current salaries had a mean of \$32,108 with a standard deviation of \$15,300. The beginning salaries had a mean of \$16,340 with a standard deviation of \$5,970. What is the correlation between current and beginning salary? (3 decimal place accuracy)

(10 points)

$$b_1 = 2.12 = \frac{S_y}{S_x} r$$

$$2.12 = \frac{15300}{5970} r \Rightarrow r = .827216$$

(10 points)

9. Should you have a cup of coffee to make you more alert when studying for a big test? A study on the effect of caffeine involved asking volunteers to take a memory test 20 minutes after drinking cola. Some volunteers were randomly assigned to drink caffeine-free cola, some to drink regular cola (with caffeine), and others a mixture of the two (getting a half dose of caffeine). For each volunteer, a test score (the number of items recalled correctly) was recorded. The volunteers were not told which type of cola they had been given, but the researchers for the study prepared the cups of cola right on the spot (out of sight of the volunteers).

Suppose 49 volunteers participated in this study. Each of the volunteers is assigned a label: 01 through 49. Fifteen students are supposed to be assigned to the caffeine-free group, 16 to the regular group, and the remaining 18 students to the mixture group. Use the list of random digits below to randomly select the labels of the 15 volunteers that will be assigned to the caffeine-free group. Start at the beginning of the list.

73924 28411 10384 83920 02055 67433 84374 92373 55232 11886 85325

(10 points)

Answer

42, 44, 10, 38, 48, 39, 20, 02, 05, 33, 37, 49, 23, 21, 18

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮