

Math 153 - Test 2
March 5, 2015

Name key _____
Score _____

Show all work to receive full credit. Supply explanations where necessary.

1. (15 points) Professor Granger has taught a statistics course every semester for many years. The following list gives the numbers of students enrolled each semester, in the order in which they occurred.

29 27 27 21 34 24 24
32 27 25 10 25 28 26
29 37 32 23 20 29 21

Determine the five-number summary, the IQR, and the cutoffs for outliers. Then sketch the modified boxplot on graph paper.

From TI-84...

MIN = 10
Q₁ = 23.5
MEDIAN = 27
Q₃ = 29
MAX = 37

IQR = 29 - 23.5 = 5.5

1.5 × IQR = 8.25

CUTOFFS:
23.5 - 8.25 = 15.25
29 + 8.25 = 37.25

SEE BOXPLOT
ON
GRAPH PAPER.

* 10 IS THE ONLY OUTLIER

2. (6 points) Heights of adult U.S. women are normally distributed with mean 65.5 in and standard deviation 2.5 in. Men's heights are similarly distributed with mean 69.0 in and standard deviation 2.9 in. A certain man is 78 in tall and a woman is 73.75 in tall. Compute their z-scores and determine which person is relatively taller.

MAN: $Z = \frac{78 - 69}{2.9} \approx 3.10$

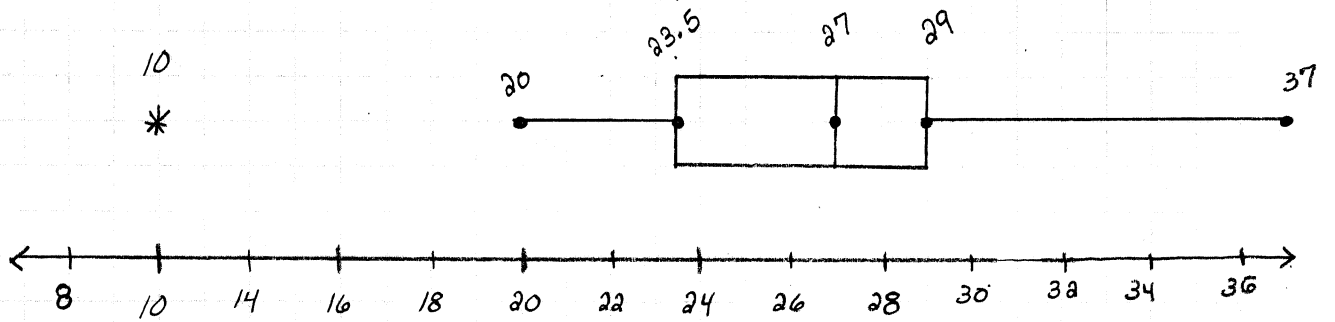
WOMAN: $Z = \frac{73.75 - 65.5}{2.5} = 3.30$

RELATIVELY SPEAKING,
THE WOMAN IS
TALLER.

Problem #1

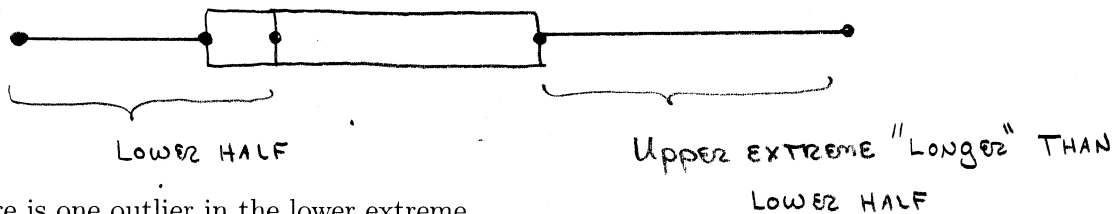
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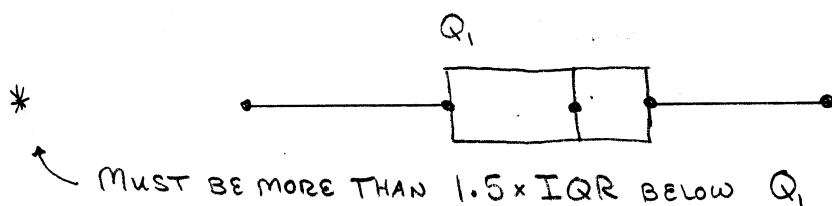


3. (9 points) For each part of this problem, sketch a boxplot that would correspond to a data set with the given characteristics.

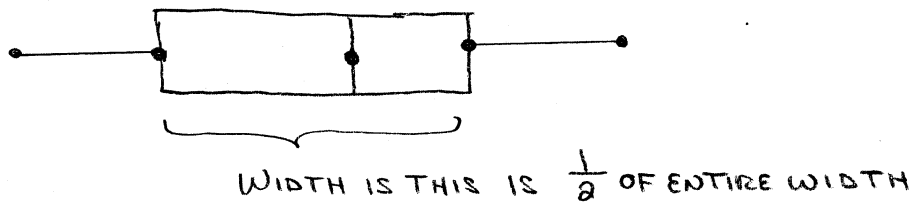
(a) There is more spread in the upper extreme than in the lower half.



(b) There is one outlier in the lower extreme.



(c) The IQR is one-half of the range.



4. (3 points) Stan took a standardized test and obtained an unusually high score. Nonetheless, quite a few people scored higher than Stan. Give an example of a z-score that could represent Stan's score. Explain.

TO BE UNUSUAL, STAN'S SCORE MUST BE GREATER THAN 2.

SINCE QUITE A FEW PEOPLE SCORED HIGHER, HIS SCORE

CANNOT BE MUCH GREATER THAN 2. SUCH A SCORE COULD BE ABOUT 2.25

5. (4 points) In his 1964 fight against Sonny Liston, the odds against Cassius Clay (Muhammad Ali) were 8 to 1. What were the odds in favor of Ali? What was his probability of winning?

ODDS IN FAVOR = $\frac{1}{8}$

PROB OF WINNING = $\frac{1}{9}$

6. (9 points) The prices of 40 homes listed for sale in the Saratoga Falls subdivision are given on the attached sheet.

(a) Find the percentile for \$221,000.

$$\frac{15}{40} = 0.375 = 37.5\%$$

Roughly 38th percentile.

(b) Determine the price at the 80th percentile.

$$\frac{L}{40} = 0.80 \Rightarrow L = 32$$

$$\frac{32^{\text{nd}} + 33^{\text{rd}}}{2} = \frac{272 + 272}{2} = 272$$

(c) Determine the price at the 42nd percentile.

\$272,000

$$\frac{L}{40} = 0.42 \Rightarrow L = 16.8 \Rightarrow L = 17$$

17th is 221

\$221,000

7. (6 points) Mary is getting very frustrated with her cell phone service. In her last 52 calls, 38 of them were dropped.

(a) What number should Mary assign to the probability that a call is dropped?

$$\frac{38}{52}$$

(b) Is Mary's probability an example of a theoretical, experimental, geometric, or subjective probability? (Choose one.)

EXPERIMENTAL

(c) After spending several days arguing with customer service representatives, Mary told Stan that there was less than a 1% chance that her cell phone company would help fix her problem. What type of probability is this?

SUBJECTIVE

8. (2 points) What does it mean for two events to be mutually exclusive?

THEIR INTERSECTION IS EMPTY.

A & B ARE MUTUALLY EXCLUSIVE MEANS $A \cap B = \emptyset$.

9. (10 points) Suppose a letter is selected at random from the word *ASSESSEE*.

(a) What is the sample space for this experiment?

$\{A, S, E\}$

(b) Is your sample space uniform? Explain.

NO, THE OUTCOMES ARE NOT EQUALLY LIKELY.

(c) Determine the probability of each outcome in your sample space.

$$P(\{A\}) = \frac{1}{8}$$

$$P(\{E\}) = \frac{3}{8}$$

$$P(\{S\}) = \frac{4}{8}$$

(d) Are your probabilities above experimental, theoretical, or subjective?

THEORETICAL

(e) What are the odds in favor of selecting a vowel?

$$\frac{\text{FAVORABLE}}{\text{UNFAVORABLE}} = \frac{4}{4} = 1$$

10. (6 points) A fair, six-sided die is rolled three times. What is the probability that at least one 3 is rolled?

$\frac{5}{6}$ Not 3 $\frac{5}{6}$ Not 3 $\frac{5}{6}$ Not 3 \rightarrow PROB OF NO 3'S = $\frac{125}{216}$
 $\frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6}$
 PROB OF AT LEAST ONE 3
 $= 1 - \frac{125}{216} = \frac{91}{216}$

11. (5 points) There are 75 students in a room. 35 are taking a math class, 50 are taking an English class, and 25 are taking both. If a student in the room is selected at random, what is the probability that the student is taking a math class OR an English class?

M = EVENT OF STUDENT TAKING MATH

E = EVENT OF STUDENT TAKING ENGLISH

$$P(M) = \frac{35}{75} \quad P(M \cap E) = \frac{25}{75} \Rightarrow P(M \cup E) = \frac{35}{75} + \frac{50}{75} - \frac{25}{75}$$

$$P(E) = \frac{50}{75}$$

$$= \boxed{\frac{60}{75}}$$

12. (3 points) Jake and Sarah are planning to have 3 children. They determined that the probability of having three boys is $1/8$. What does that make the probability of having at least one girl?

↓
Complement

$$1 - \frac{1}{8} = \boxed{\frac{7}{8}}$$

13. (10 points) Suppose A and B are events such that $P(A) = 0.52$, $P(\bar{B}) = 0.36$, and $P(A \cup B) = 0.68$.

- (a) Compute $P(B)$.

$$1 - 0.36 = \boxed{0.64}$$

- (b) Compute $P(A \cap B)$. = $P(A) + P(B) - P(A \cup B)$

$$= 0.52 + 0.64 - 0.68 = \boxed{0.48}$$

- (c) Are A and B mutually exclusive? Explain.

No, THEIR INTERSECTION IS NOT
EMPTY --- IT IS PROB 0.48

- (d) What are the odds against A ?

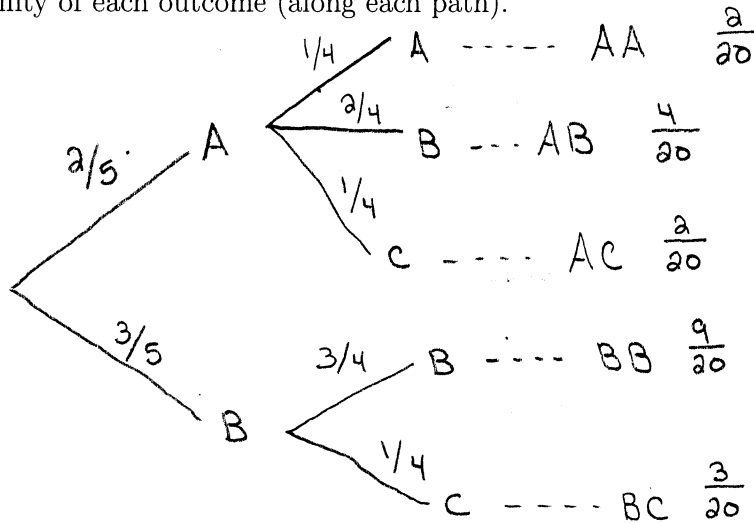
$$\frac{P(\bar{A})}{P(A)} = \frac{1 - 0.52}{0.52} = \frac{0.48}{0.52} = \frac{48}{52} = \boxed{\frac{12}{13}}$$

14. (12 points) A letter is selected at random from the first box and placed into the second box. Then a letter is selected from the second box.

A A B B B

B B C

- (a) Sketch the probability tree associated with this two-stage experiment and find the probability of each outcome (along each path).



- (b) Are the probabilities above theoretical or experimental? Explain your reasoning.

THEORETICAL. THEY WERE COMPUTED BY ASSUMING EACH OF THE LETTERS IN EACH BOX ARE EQUALLY LIKELY.

- (c) What is the probability of selecting the letter B from the second box?

$$AB \text{ \& } BB \quad \frac{4}{20} + \frac{9}{20} = \boxed{\frac{13}{20}}$$

- (d) What are the odds against selecting a B from the second box?

$$\frac{7/20}{13/20} = \boxed{\frac{7}{13}}$$

Housing Prices in Saratoga Falls

(In thousands of dollars)

143	145	186	192	192	192	194	195	199	201
202	202	205	209	219	221	221	221	230	232
233	235	238	240	245	246	249	257	268	270
271	272	272	275	280	287	324	345	346	387