high 19.5/20

mean 14.5

median 14.2

MATH 371 Name : SOLUTIONS

Quiz 1 September 26, 2008

Instructions: Round all answers to two decimal places. There are 20 points on this quiz.

1. (4 pts.) Consider the following table which contains the number of hours spent exercising per week by eight students in Math 371.

Student	1	2	3	4	5	6	7	8
No. Hrs of Exercise per Week	7	3	6	0	0	7	2	1

   (a) Give the mean and median of the data.

   $\bar{x} = 3.25$ median $= 2.5$

   (b) Compare the mean and the median from part (a). Can you infer anything about the data from this comparison? Explain briefly.

   some largish data pts.

   (c) What formula would you use to calculate the standard deviation of the data?

   $$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

   (d) Use the formula from part (c) to give the standard deviation s of the data.

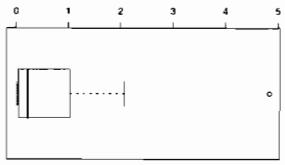
   $s \approx 3.012$

2. (1 pt.) The State of Alaska reports that arsenic is present in small quantities in all of its 100,000 drinking water sources. The mean amount of arsenic is $\mu = .016$ parts per billion (ppb), and the standard deviation is $\sigma = .009$ ppb. Do arsenic amounts have a normal distribution? Why or why not?

   $2\sigma = .018 \Rightarrow \mu - 2\sigma < 0 \quad \mu - 3\sigma < 0$

   But these cants must be positive.

3. (2 pts.) Consider the boxplot below:



   Estimate Q_1, Q_3, and the median. Is the mean larger than, smaller than, or roughly equal to the median? Explain briefly.

   $Q_1 \approx .1 \quad Q_3 \approx 1 \quad \text{median} \approx .25$

   $\bar{x} > \text{median}$ large outlier

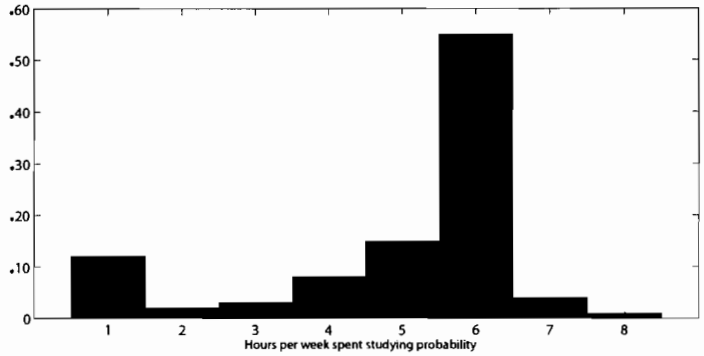
4. (1 pt.) Suppose the distribution of scores on the three-part SAT Reasoning Test is approximately normal with mean $\mu = 1500$ and standard deviation $\sigma = 300$. The range of scores is $[600, 2400]$.

   Approximately what percentage of students score above in the range $[1200, 2100]$ on the SAT?

   range is $[\mu - \sigma, \mu + 2\sigma]$ = 68% + $\frac{1}{2}$(95-68)% = .68 + .135

   $\approx$ .815 = 81.5%

5. (2 pts.) At a large state university, 100 students are enrolled in a course in probability. Below is a relative frequency histogram indicating the number of hours per week students study for this course.



   (a) What percentage of the students study three of fewer hours per week for probability?

   $\approx$ .01 + .02 + .12 = .14

   (b) Estimate the median number of hours per week spent studying probability.

   6 more than 50% of students study ≤ 6 hrs/week

   ⇒ median must be 6

6. (3 pts.) A new couple, known to have two children, has just moved into Fairbanks. Suppose that the mother is seen walking with one of her children. If this child is a girl, what is the probability that both children are girls? (Assume that having a boy or a girl are equally likely events and that the mother is equally likely to walk with either child.)

   $P(GG|G) = \frac{1}{2}$

   Using the sample space is hard. An intuitive explanation is you don't know the gender of 1 kid ⇒ 50-50 chance 2nd kid is girl.

   Alternative. $P(GG|G) = \frac{P(G|GG)P(GG)}{P(G|GG)P(GG) + P(G|BG)P(BG) + P(G|GB)P(GB) + P(G|BB)}$

   G: mother seen walking w/girl

   B: " " w/boy

   $= \frac{1(\frac{1}{4})}{1(\frac{1}{4})^2 + \frac{1}{2}(\frac{1}{4}) + \frac{1}{2}(\frac{1}{4}) + 0} = \frac{1}{2}$

   GG, etc = composition of family

7. (3 pts.) A study of a legal system in a small city suggests that the race or ethnicity of a defendent may effect the likelihood of being convicted by a jury. The proportions of the total number of jury decisions in the six race-conviction categories are given below.

	Convicted	Acquitted
Caucasian	.19	.24
African American	.27	.12
Hispanic	.12	.06

(a) What is the probability that the defendent is convicted and is either African American or Hispanic?

$.27 + .12 = .39$

(b) Consider the two events:

A: *the defendent is African American*
B: *the defendent is acquitted*

i. Are events A and B independent? Justify your answer.

$P(A \cap B) = .12$ $\Rightarrow$ DEPENDENT

$P(A)P(B) = (.39)(.42) = .1638 \neq P(A \cap B)$ EVENTS

ii. Explain informally the event $B \mid A$ and find $P(B \mid A)$.

The defendant is acquitted, given that (s)he is African Americ

$$P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{.12}{.12 + .27} = \frac{.12}{.39} \approx .31$$

8. (4 pts. total – 1pt. each)

(a) On a soccer team with eleven players, how many ways can a goalie, half-back, and a forward be selected? (Assume no one plays more than one position.)

$11(10)(9) = \boxed{990}$

(b) Six cards are selected at random from a 52 card deck of cards. What is the probability that two pairs are drawn?

$$\frac{\binom{13}{2}\binom{4}{2}^2\binom{11}{2}\binom{4}{1}^2}{\binom{52}{6}} \approx .1214$$

(c) A seven member Academic Decathalon team of three boys and four girls is to be chosen from a group of 10 boys and 12 girls. How many different teams can be formed?

$\binom{10}{3}\binom{12}{4} = 59,400$

(d) If men constitute 45% of the population and lie 15% of the time, while women lie 11% of the time, what is the probability that a person selected at random will answer a question truthfully?

T: tells truth

L: lies

M: male

F: female

$P(L) = P(L|F)P(F) + P(L|M)P(M)$

$= (.55)(.11) + (.45)(.15) \approx .128$

$\Rightarrow P(T) = 1 - .128 \approx \boxed{.872}$

Alternatively

$P(T) = P(T|F)P(F) + P(T|M)P(M)$

$= (.89)(.55) + (.85)(.45)$

$= \boxed{.872}$