

**Review Problems for Test #1**

Each question will be weighted equally on the test. The test is open-book and open-notes. Bring a calculator. In order to get full credit, you must show the calculations used to arrive at your answers. Draw any diagrams clearly. Show at least two significant digits in final answers.

- (1) In Shirley Jackson's short story "The Lottery," all the people living in a small village gather each June 27 and conduct the following lottery. First, the head of each family draws from a box a slip of paper, one of which is marked. Then, all members of the selected person's family conduct their own drawing, and the chosen person is ritually stoned to death by the villagers. Explain why this procedure is not simple random sampling. What sort of bias is involved?
- (2) Suppose a set of measurements has a mode of 12, a median of 10, a mean of 9.8, a range of 14, and a standard deviation of 3. If each of the original measurements is multiplied by 10, what are the new values for the mode, median, mean, range, and standard deviation?
- (3) In 1989, major league baseball player Dave Justice had 12 hits in 51 at-bats for a batting average of .235, while in 1990, he had 124 hits in 439 at-bats for an average of .282. Meanwhile, in 1989, Andy Van Slyke had 113 hits in 476 at-bats for an average of .237, while in 1990, he had 140 hits in 493 at-bats for an average of .284. Who had a better batting average for the two-year period?
- (4) Suppose that a patient with some disease visits two different doctors. The first doctor is 80% successful in finding the disease when it is present, and the second doctor is 90% successful. What is the probability that at least one of the two doctors will find the disease?
- (5) In 1941, Joe DiMaggio hit safely in 56 straight baseball games. Make the following three assumptions: 1) the probability of a hit in each at-bat was his lifetime batting average of .325; 2) the outcomes of all at-bats are independent; 3) he had four at-bats per game. How likely was he to have this batting streak in those particular 56 games?
- (6) Two dice are thrown and we are interested in the following events:
  - E: first die is 5
  - F: total is 7
  - G: total is 10

By calculating the probabilities using Venn diagrams, show that:

- a.  $\Pr(F|E) = \Pr(F)$
- b.  $\Pr(G|E) \neq \Pr(G)$
- c. Is the following a correct verbal conclusion? (If not, correct it.) If I'm going to bet on whether or not the dice show 10, it will help (change the chances) to peek at the first die to see whether it is a 5. But if I'm going to bet on whether the dice show 7, a peek won't help.
- (7) A nursery buys 30% of its seeds from supplier A and 70% from supplier B. Seeds from supplier A have an 80% germination rate and seeds from supplier B have a 90% germination rate. A seed is planted and germinates; what is the probability it came from supplier B?

- (8) Susan has an 80% chance of making a sale every time she calls on her best customer. She will make 12 calls on this customer over the next year. Assume the calls are statistically independent. What is the probability that she will make at least 6 sales?
- (9) An electrical subcontractor has to finish the electrical wiring in a renovated office building within 28 days or pay a penalty. The time required to finish the wiring is normally distributed with a mean of 20 days and a standard deviation of 5 days. What is the probability that the penalty will be charged?
- (10) To see how happiness is related to age, a 1971 poll had Americans rank themselves from unhappy ( $H = 0$ ) to very happy ( $H = 2$ ). Age  $X$  (in years) was also recorded for each individual, to produce the following joint distribution:

$x$	$h$		
	0	1	2
25	.01	.11	.16
40	.01	.17	.16
60	.03	.20	.15

- Calculate  $E(H|X)$  for each age  $X$ . Does happiness increase or decrease with age?
- Calculate the correlation  $\rho$ .