

Statistics 2000, Section 001, Midterm 2 (185 Points)

Friday, November 5, 2010

Part I: Text Answers

Your Name: _____

Question 1: Two-Way Tables (35 Points)

Full-time and part-time college students. The U.S. Census Bureau provides estimates of numbers of people in the United States classified in various ways. Let's look at college students. The following table gives us data to examine the relation between age and full-time or part-time status. The numbers in the table are expressed as thousands of U.S. college students.

Age	Status	
	Full-time	Part-time
15–19	3388	389
20–24	5238	1164
25–34	1703	1699
35 and over	762	2045

Show your work!

1. (5 Points) What is the U.S. Census Bureau estimate of the *number* of full-time college students aged 15 to 19?

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2. **(10 Points)** Add the joint distribution of age and status to the table on the previous page. Show your calculations below.

3. **(10 Points)** What is the marginal distribution of age? Add these percentages to the table on the previous page. Show your calculations below. Also, display the results graphically via a bar chart.

4. **(10 Points)** What is the marginal distribution of status? Add these percentages to the table on the previous page. Show your calculations below. Also, display the results graphically via a bar chart.

Question 2: Probabilities, Means, and Variances of Random Variables (**50 Points**)

Based on past experience, an architect has determined the distribution for the number of times a drawing of a house must be examined by a client before it is accepted. Let the random variable X represent the number of times a drawing of a house must be examined by a client before it is accepted. The probability distribution of X is shown below:

Value of X	1	2	3	4	5
Probability	0.1	0.2	0.3	0.2	0.2

Show your work!

1. (**8 Points**) What is the average number (mean) μ_X of times a drawing of a house must be examined by a client before it is accepted?

Answer: _____ times

2. (**8 Points**) Calculate the standard deviation σ_X of the random variable X .

Answer: _____ times

3. (**8 Points**) What is the probability that a client examines a drawing of a house at least 3 times before it is accepted?

Answer: _____ %

4. (**8 Points**) Mr. Klein is one of the clients of this architect. Mr. Klein has already inspected his drawing twice. What is the probability that he will accept the drawing upon the next examination, i.e., after exactly the third time?

Answer: _____ %

5. **(8 Points)** Let the random variable Y represent the number of times a drawing of a garage must be examined by a client before it is accepted. The architect determined that the average number (mean) μ_Y of times a drawing of a garage must be examined by a client before it is accepted is 1.8 times. Assuming a customer plans to get a house and a garage from the architect, what is the expected (average) number of times a customer will look at all drawings (of the house and the garage) before they are accepted?

Answer: _____ times

6. **(10 Points)** Based on past data, the architect also determined that the standard deviation σ_Y of the random variable Y is 1.1 times. Moreover, some clients in general want to see many drawings of any building while other clients are satisfied after just a few drawings. So, no big surprise that the correlation between X and Y equals 0.90. What is the standard deviation for the number of times a customer will look at all drawings (of the house and the garage) before they are accepted?

Answer: _____ times

Question 3: Probability (40 Points)

For a road trip, a student places the following nine CDs into the glove compartment of his car:

- 5 *modern rock* CDs (Fallout Boy, Hawthorne Heights, The Used, Finger Eleven, Taking Back Sunday),
- 3 *pop* CDs (P!nk, Fergie, Gwen Stefani),
- 1 *American Idol* CD (Jordin Sparks).

On his trip, the student blindly grabs a CD from the glove compartment, listens to it, and places it on the back seat when finished. Then he blindly grabs a second CD from the glove compartment. You should NOT comment on the musical taste of this student, but **answer each of the following questions separately. Show your work!** As a part of your answer, translate the everyday language into probability statements, using the proper notation, e.g., $P(A)$, $P(A \text{ and } B)$, $P(A \text{ or } B)$, $P(A|B)$, etc., where A (and B) are the events of interest.

1. **(8 Points)** What is the chance that the FIRST CD will be a *pop* CD or the *American Idol* CD? The chance is _____%
2. **(8 Points)** What is the chance that the SECOND CD will be a *pop* CD or the *American Idol* CD? The chance is _____%
3. **(8 Points)** What is the chance that he will listen to Jordin Sparks as one of his two selections? The chance is _____%
4. **(8 Points)** What is the chance that he will listen to **none** of the *pop* CDs? The chance is _____%
5. **(8 Points)** What is the chance that he will listen to **at least one** of the *modern rock* CDs? The chance is _____%

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Part II: Multiple Choice Questions

Your Name: _____

Question 4: Multiple Choice Questions (60 Points)

Mark your answer for each multiple choice question in the table below. There is only one correct answer for each question. Each correct answer is worth 4 points.

Question	(a)	(b)	(c)	(d)	Question	(a)	(b)	(c)	(d)
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	11	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	12	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	13	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	14	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	15	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
10	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					

1. Many studies are trying to find a cure for chronic back pain. In one such study, a physician is comparing the medication currently being used (drug A) to a newly developed drug (drug B). Seventy-three volunteers, suffering from chronic back pain, are participating in this study. The physician's assistant has a list of all 73 subjects and randomly divides the subjects into two groups. Group 1 will receive drug A and Group 2 will receive drug B. The assistant is the only one who knows to which group the subjects have been assigned. The physician monitors the subjects over a 2-month period and the amount of improvement is recorded. What type of study is this?
 - (a) An observational study.
 - (b) An experiment, but not a double-blind experiment.
 - (c) A double-blind experiment.
 - (d) A matched pairs experiment.

2. A group of college students believes that herbal tea has remarkable restorative powers. To test its theory, the group makes weekly visits to a local nursing home, visiting with residents, talking with them, and serving them herbal tea. After several months, many of the residents are more cheerful and healthy. What is the explanatory variable in this experiment?
 - (a) The emotional state of the residents.
 - (b) Herbal tea.
 - (c) The fact that this is a local nursing home.
 - (d) The college students.

3. The head of the quality control department at a publishing company is studying the effect of type of glue and type of binding on the strength of the bookbinding. The company has three possible glues to choose from and the book can either be bound as a paperback or a hardback. How many treatments is the company considering?
 - (a) 2.
 - (b) 3.
 - (c) 5.
 - (d) 6.

4. A survey was conducted using a mailed questionnaire, which asked about personal habits of the subjects. The subjects were assured that all information would be kept confidential. In addition the respondents are told not to do anything that would reveal their identity in order to maintain anonymity of their responses. However, each questionnaire had a hidden code placed on it so that the researcher could follow-up to reduce the nonresponse rate of the survey and thus increase the reliability of the survey results. What best describes the ethics of this survey?
- (a) Such practices are acceptable in the interest of obtaining better information from the sample.
 - (b) The researcher has the highest of ethical standards and would do nothing to breach the confidentiality so this practice is acceptable.
 - (c) By returning the questionnaire in the mail the subjects have agreed to participate and this is like giving informed consent. There are no ethical concerns here.
 - (d) Nonresponse is a valid concern but having implied that the results are both confidential and anonymous, this is an unethical practice.
5. David A. Miller owns a small advertising business. He has nine employees. The names of the employees are given below:

- | | | |
|------------|------------|-----------|
| 1. Becker | 4. Ito | 7. Taylor |
| 2. Brown | 5. Kiefer | 8. Walt |
| 3. Chasten | 6. Spitzer | 9. Weiss |

Use the list of random digits below to select a simple random sample of three names from the list of employees. Start at the beginning of the list and use the numerical labels attached to the names.

11793 20495 05907 11384 44982 20751 27498 12009 45287 71753

The simple random sample consists of

- (a) 117.
- (b) Becker, then Becker again, then Taylor.
- (c) Becker, Taylor, Weiss.
- (d) Chasten, Kiefer, Taylor.

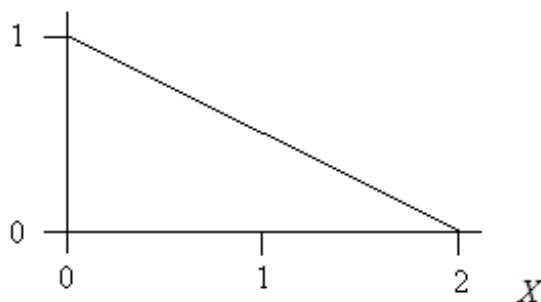
6. Females in a certain class rated their intelligence with a mean of about 6.5. The males in the same class rated their intelligence with a mean of about 7.25. The difference in the mean ratings (male – female) was
- (a) about -0.75 points.
 - (b) about 0.75 points.
 - (c) about 13.75 points.
 - (d) about 47.125 points.
7. Most people think babies are equally likely to come as either a boy or a girl. This is not true. Actually, about 51.3% of all babies are boys. If a family has two children (not twins), what is the chance both children are boys?
- (a) about 25% .
 - (b) about 26.3% .
 - (c) about 73.7% .
 - (d) about 102.6% .
8. A refrigerator contains 6 apples, 5 oranges, 10 bananas, 3 pears, 7 peaches, 11 plums, and 2 mangos. Imagine you stick your hand into the refrigerator and pull out a piece of fruit at random. What is the probability you pick a plum?
- (a) $1/7$.
 - (b) $11/42$.
 - (c) $1/4$.
 - (d) $\frac{11}{44} \cdot \frac{10}{43}$.
9. Students at University X must be in one of the class ranks Freshman, Sophomore, Junior, or Senior. At University X, 35% of the students are Freshmen and 30% are Sophomores. If a student is selected at random, the probability he or she is either a Junior or a Senior is
- (a) 10.5% .
 - (b) 35% .
 - (c) 65% .
 - (d) 70% .

10. A process is called random if
- (a) Individual outcomes are uncertain but happen in a predictable manner through time.
 - (b) One has no idea what will happen.
 - (c) Outcomes happen in a 50–50 split.
 - (d) We know exactly what will happen next.
11. A small store keeps track of $X =$ the number of customers who make a purchase during the first hour that the store is open each day. Based on the records, X has the following probability distribution:

Value of X	0	1	2	3	4
Probability	0.6	0.1	0.1	0.1	0.1

What is the mean number of customers who make a purchase during the first hour that the store is open?

- (a) 1.0.
 - (b) 2.5.
 - (c) 3.0.
 - (d) 4.0.
12. Suppose X is a continuous random variable taking values between 0 and 2 and having the probability density curve below:



What is $P(0 \leq X \leq 1)$?

- (a) 0.75.
- (b) 0.33.
- (c) 0.25.
- (d) 0.00.

13. At the end of a production run manufacturing rubber gaskets, items are sampled at random and inspected to determine if the item is Acceptable (A), or Defective (D). Suppose it is planned to select two items and determine if each is either A or D . What is the sample space S of the outcomes?
- (a) $S = \{A, D\}$.
 - (b) $S = \{AA, DD\}$.
 - (c) $S = \{AA, AD, DA, DD\}$.
 - (d) This depends upon the assignment of probability to the outcomes of the sampling.
14. Suppose we toss a penny and a nickel. Let A be the event that the penny is a head and B be the event that the nickel is a tail. The events A and B are
- (a) disjoint.
 - (b) complements.
 - (c) independent.
 - (d) (b) and (c).
15. Researchers are studying the absorption of two drugs into the bloodstream. Each drug is to be injected at three dosages. There are 24 people in the study, and they are randomly divided into six groups. Each of the six groups is randomly assigned to a different drug and dosage combination. After 30 minutes the concentration of drugs in a subject's blood is determined. Which of the following is correct?
- (a) The type of drug is a factor.
 - (b) The dosage of the drug is a factor.
 - (c) Both (a) and (b) are correct.
 - (d) Neither (a) nor (b) are correct.