

Statistics Test 7 Review

Chapters 11, 12, 14 and 15

What you should know (use your textbook to look these up):

- What a simulation is
- How to generate (or simulate) random numbers
- How to use a random number table
- Difference among a population, a sample frame and a sample.
- Difference between parameter and statistic
- What bias is, and types of bias: nonresponse bias, voluntary response bias, response bias
- Types of samples: SRS, stratified sample, cluster sample, systematic sample, convenience sample, multistage sample
- What a census is
- The Law of Large Numbers
- Sample space
- The sum of probabilities of elementary outcomes is 1
- The complement rule
- Disjoint (or mutually exclusive) events
- Addition rule
- Independence of events
- Multiplication rule
- Conditional probability

Practice Problems:

1. There are eight different car keys in a drawer, including yours. Suppose you grab one key at a time until you get your car key. Estimate the probability that you get your car key on the second try. Describe the method that you will use to simulate this exercise. Use the attached random number table to do your estimation.

2. A statistics teacher wants to know how her students feel about an introductory course. She decides to administer a survey to a random sample of students taking the course. She has several sampling plans to choose from. Name the sampling strategy in each, and comment on the strategy (whether it's a good strategy or not, and why)
 - a) There are four classes of students taking the course: freshmen, sophomores, juniors and seniors. Randomly select 15 students from each class rank.
 - b) Each student has a 9-digit student number. Put the numbers in order, and with a random number generator, randomly select 60 numbers.
 - c) Randomly select a class (freshmen, sophomores, juniors and seniors) and survey every student in that class.
 - d) Using the class roster, select every fifth student from the list, starting from a randomly chosen person.
 - e) Offer extra credit to students to volunteer for the survey.
 - f) At the beginning of class one day, survey everyone present.

3. Suppose a state has 10 universities, 25 four-year colleges, and 50 community colleges, each of which offers multiple sections of an introductory statistics class each year. Researchers want to conduct a survey of 100 students taking introductory statistics in the state. Explain a method for collecting each of the following types of samples:
 - a) A **stratified sample**.
 - b) A **cluster sample**.
 - c) A **simple random sample**.

4. What are some advantages/disadvantages of each of the prior question's data collection methods?

5. Which type of bias (if any) do you think would be introduced in each of the following situations?
 - a) A list of registered automobile owners is used to select a random sample for a survey about whether people think homeowners should pay a surtax to support public parks.

 - b) A survey is mailed to a random sample of residents in a city asking if they think the current mayor is doing an acceptable job.

 - c) In a college town, college students are hired to conduct door-to-door interviews, based on a multistage cluster sample, to determine if city residents think there should be a law forbidding loud music at parties.

 - d) A magazine sends a survey to a random sample of its subscribers asking them if they would like the frequency of publication reduced from biweekly to monthly, or would prefer that it remain the same.

6. Gastwirth (1988, p. 507) describes a court case in which Bristol Myers was ordered by the Federal Trade Commission to stop advertising that "twice as many dentists use Ipana as any other dentifrice" and that more dentists recommended it than any other dentifrice. Bristol Myers based its claim on a survey of 10,000 randomly selected dentists from a list of 66,000 subscribers to two dental magazines. They received 1983 responses, with 621 saying they used Ipana and only 258 reporting that they used

the second most popular brand. As for the recommendations, 461 respondents recommended Ipana, compared with 195 for the second most popular choice.

a) Specify the **sampling frame** for this survey, and explain whether or not you think “using the wrong sampling frame” was a problem here, based on what Bristol Myers was trying to conclude.

b) What could Bristol Myers have done to improve the validity of the results after it had mailed the 10,000 surveys and received only 1983 of them back? (Assume it kept track of who had responded and who had not.)

7. An Internet poll sponsored by a site called About.com asked Internet users to pick one of two choices in response to the question, “Should jurors opposed to gun control laws refuse to convict defendants even if they have clearly broken the laws?” The two choices and the number and percent choosing them were

- Yes, that’s an effective way to defeat unjust laws (16,864, 23%)
- No, that undermines the legal system (55,519, 77%)

Discuss this poll, including whether or not you think the results are **representative** of all adults and whether you think the wording is appropriate.

8. You have rolled two fair six-sided dice.

- a) List the sample space for the **sum** of two rolled fair dice.
- b) What is the probability that the sum is greater than 8?
- c) What is the probability that the sum is greater than or equal to 8?
- d) What is the probability that the sum is odd?
- e) What is the probability that the sum is odd and even?
Odd and even are called _____ events.
- f) What is the probability that the sum is greater than 12?
- g) What is the probability that the sum is greater than 9 GIVEN that the sum is even?
- h) What is the probability that the sum is odd GIVEN that the sum is greater than 6?
- i) If A is an even roll and B is a roll greater than 9, are events A and B dependent or independent? Why? Are they disjoint or not? Why?

9. Home security experts estimate that an untrained housedog has a 70% chance of detecting an intruder. They also believe that the dog has a 50% of scaring the intruder away IF he/she has been detected (undetected intruders don’t get scared away). Assume “Fido” is an untrained housedog; what is the probability that Fido will successfully scare away an intruder?

10. Two questions were asked of 50 randomly selected football fans at the UT-A&M game. (1) What team were they cheering for? And (2) were they wearing shoes? Let A be the event of being an A&M fan. Let S be the event of wearing shoes.

- Find $P(A)$.
- Find $P(S)$.
- Find $P(A \text{ and } S)$.
- Find $P(A \text{ or } S)$.
- Find $P(A | S)$.
- Find $P(S | A)$.

	UT fans	A&M fans
Wearing shoes	4	30
Not wearing shoes	16	0

11. A card is selected from a well-shuffled deck of 52 cards. Let H be the event that the card is a heart, and let F be the event that the card is a face card (King, Queen, Jack).

- Determine $P(H)$.
- Determine $P(F)$.
- Determine $P(H | F)$.
- Determine $P(F | H)$.
- Are H and F independent events? Explain intuitively (or using parts (b) and (d)) your answer regarding independence.

12. At a fictional high school Statistics High, after-school activities can be classified into three types: athletes, fine arts, and other. The table gives the number of students participating in each of these types of activities by grade. For the purpose of this example, we will assume that any given student is in exactly one of these after-school activities.

	9 th	10 th	11 th	12 th	Total
Athletes	150	160	140	150	600
Fine Arts	100	90	120	125	435
Other	125	140	150	150	565
Total	375	390	410	425	1600

- What is the probability that a student selected is a 9th grader?
- What is the probability that a student selected is an athlete?
- What is the probability that a student selected is a junior or senior?
- Are being an athlete and being in the 11th grade dependent or independent events?
- What is the probability that a student selected is a 9th grader, given the student selected is an athlete?
- What is the probability that a student selected is an athlete, given the student selected is a 9th grader?
- What is the probability that a student selected is a junior or senior, given the student is in fine arts?
- What is the probability that a student selected is in fine arts, given the student is a junior or senior?

13. An insurance company has the following information about drivers aged 16 to 18 years: 20% are involved in accidents each year; 10% in this age group are A students; among those involved in accidents, 5% are A students.
- What is the probability that a driver from this age group is involved in an accident?
 - What is the probability that a driver that is not involved in an accident is not an A student?
 - What is the probability that an A student driver is involved in an accident?
14. I've got a little leather pouch with some coins in it. I've got 3 quarters, 8 nickels, 4 dimes and a penny. I start drawing coins randomly from the pouch.
- What is the probability that the first two coins are quarters?
 - What is the probability that the first four coins are quarters?
 - What is the probability that the value of the first two coins picked is more than 30 cents?
 - What is the probability that in the first 5 coins picked, one of them is a penny?
 - What is the probability that in the first 5 coins picked, at least one of them is a nickel?

69571	44927	06220	71020	78336	38877	00512	99602
44617	41152	51398	10533	86731	97824	37955	48185
99999	88276	18346	58650	56476	86504	42111	33055
57553	52822	73125	08463	85731	71003	38491	83871
23261	56141	19828	85055	75202	35032	63432	23671
18235	61204	20160	14732	53790	71839	46288	65321
44730	36327	36584	87768	81319	82043	63202	87389
84000	45607	41131	53658	34674	04314	75604	62243
67164	20190	04210	31468	39707	20324	10213	68265
43346	54771	61884	21828	73997	00342	87399	64070
32085	41043	67095	00345	90652	58516	90238	70236
86442	28429	97092	09278	64899	28093	01044	88919
92141	68958	35269	45256	27134	85131	69970	60972
59575	64434	17530	20336	33251	80109	70113	72821
98612	86304	84321	41296	62043	36671	52437	58522
51943	81752	07875	79525	81825	88449	79106	41168
69403	66930	90604	41676	70485	94858	75185	83296
43815	41340	35931	77408	44745	74287	95330	20441
08964	05563	58535	26733	12657	39700	25477	51730
80507	94365	85305	71200	01490	73697	84489	41164
14876	82436	46119	46691	95955	59889	41813	12080
30921	16762	12114	19812	42948	44588	71891	64129
55284	72329	43629	20608	29073	28534	70755	74158
16426	19098	43442	62310	27640	30192	97182	76891
64893	94094	46415	18223	07581	11360	54634	15035
03886	06189	06314	10891	01285	50318	05836	97248
80328	10512	11746	00333	64083	99318	95838	52121
00937	67446	38101	96227	59182	21174	47943	13984
20033	63132	33922	86796	47463	30397	84300	21911
31802	15446	09609	58808	18845	87998	34674	88711
10238	53709	83741	70979	20691	26281	27770	29032
95268	31476	62524	67929	00626	43327	92862	72938
17042	56359	01132	87950	94396	74996	77917	96424
49408	46927	52476	99544	54157	04786	84517	65870
12024	87918	40636	07284	49953	87265	99804	13822
46081	98670	00166	85395	97728	27594	74548	52102