Exam Review (2) AP Statistics

Experimental Design

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1. A nutritionist wants to study the effect of storage time (6, 12, and 18 months) on the amount of vitamin C present in freeze dried fruit when stored for these lengths of time. Vitamin C is measured in milligrams per 100 milligrams of fruit. Six fruit packs were randomly assigned to each of the three storage times. The treatment, experimental unit, and response are respectively:

(a) A specific storage time, amount of vitamin C, a fruit pack
(b) A fruit pack, amount of vitamin C, a specific storage time
(c) Random assignment, a fruit pack, amount of vitamin C
(d) A specific storage time, a fruit pack, amount of vitamin C
(e) A specific storage time, the nutritionist, amount of vitamin C

2. We wish to investigate if a new medicine is effective in reducing the length and severity of the flu. We take the next 20 patients that come to the walk-in clinic complaining of flu and, after a medical exam to verify that the patients do have the flu, we give them the new medicine and tell them about the new drug we are giving them. One week later, the patients are contacted and 15 patients state the new remedy was helpful in reducing the severity and length of the illness. Which of the following is ***not*** correct?

(a) This is a poor experiment because there is no control group. We do not know how many would feel better in a week without treatment.
(b) This is a poor experiment because it is not double-blinded. The patients may feel relief because they thought the drug should work.
(c) This is a poor experiment because a convenience sample was selected. Patients who come to the walk-in clinic may have more severe flu than people who do not.
(d) This is a poor experiment because we didn't give the remedy to people without the flu to assess its effect in a control group.
(e) This is a poor experiment because the sample size is likely to be too small to detect anything but a gross improvement in measuring the proportion of people reporting an improvement.

3. An experiment to measure the effect of giving growth hormones to girls affected by Turner's Syndrome was carried out recently in Vancouver. All 34 girls in the study were given the growth hormone and their heights were measured at the time the hormone was given and again one year later. No measurements were made on their final adult heights. Which of the following is ***not*** a problem with this experiment:

(a) There was no blinding
(b) There was no control group
(c) Nonresponse bias
(d) There was insufficient attention to the placebo effect
(e) Because final heights were not measured, it would be impossible to tell if the hormone affected final height or only accelerated growth and made no difference to final height.

4. A survey is to be undertaken of recent nursing graduates in order to compare the starting salaries of women and men. For each graduate, three variables are to be recorded (among others) sex, starting salary, and area of specialization.

(a) Sex and starting salary are explanatory variables; area of specialization is a response variable.

(b) Sex is an explanatory variable; starting salary and area of specialization are response variables.

(c) Sex is an explanatory variable; starting salary is a response variable; area of specialization is a possible confounding variable.

(d) Sex is a response variable; starting salary is an explanatory variable; area of specialization is a possible confounding variable.

(e) Sex and area of specialization are response variables; starting salary is an explanatory variable.

5. A researcher wishes to compare the effects of 2 fertilizers on the yield of a soybean crop. She has 20 plots of land available and she decides to use a paired experiment — using 10 pairs of plots. Thus, she will:

(a) Use a table of random numbers to divide the 20 plots into 10 pairs and then, for each pair, flip a coin to assign the fertilizers to the 2 plots.

(b) Subjectively divide the 20 plots into 10 pairs (making the plots within a block as similar as possible) and then, for each pair, flip a coin to assign the fertilizers to the 2 plots.

(c) Use a table of random numbers to divide the 20 plots into 10 pairs and then use the table of random numbers a second time to decide upon the fertilizer to be applied to each pair.

(d) Flip a coin to divide the 20 plots into 10 pairs and then, for each pair, use a table of random numbers to assign the fertilizers to the 2 plots.

(e) Use a table of random numbers to assign the 2 fertilizers to the 20 plots and then use the table of random numbers a second time to place the plots into 10 pairs.

6. We wish to draw a sample of size 5 without replacement from a population of 50 households. Suppose the households are numbered "01", "02", …, "50", and suppose that the relevant line of the random number table is:

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11362   35692   96237   90842   46843   62719   64049   17823
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Then the households selected are:

(a) Households `11 13 36 62 73`

(b) Households `11 36 23 08 42`

(c) Households `11 36 23 23 08`

(d) Households `11 36 23 56 92`

(e) Households `11 35 96 90 46`

7. A properly conducted random survey selected 1000 Canadians (from a total population of about 30 million) and 1000 Americans (from a total population of about 300 million). Which of the following is ***false***?

(a) Randomization ensures that both samples are representative of their respective populations.

(b) The precision is determined by the ratio of the sample size to the total population size.

(c) A smaller proportion of the American population has been chosen. Therefore, a particular person has a smaller chance of being selected in America than in Canada.

(d) A potential stratification variable for both countries could be location — eastern, middle, or western continental.

(e) Random digit dialing to select people for the survey could induce biases in the results if the characteristic of interest for the survey is related to income.

8. Consider an experiment to investigate the efficacy of different insecticides in controlling pests and their effects on subsequent yield. What is the best reason for randomly assigning treatment levels (spraying or not spraying) to the experimental units (farms)?

(a) Randomization makes the experiment easier to conduct since we can apply the insecticide in any pattern rather than in a systematic fashion.

(b) Randomization will tend to average out all other uncontrolled factors such as soil fertility so that they are not confounded with the treatment effects.

(c) Randomization makes the analysis easier since the data can be collected and entered into the computer in any order.

(d) Randomization is required by statistical consultants before they will help you analyze the experiment.

(e) Randomization implies that it is not necessary to be careful during the experiment, during data collection, and during data analysis.

Probability

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1. Suppose we have a *loaded* die which gives the outcomes 1 through 6 according to the following probability distribution.

X	1	2	3	4	5	6
$P(X)$	0.1	0.2	0.3	0.2	0.1	0.1

Note that for this die all outcomes are *not* equally likely as they would be if this were a fair die. If this die is rolled 6000 times, the number of times we get a 2 or a 3 should be about

A. 1000

B. 2000

C. 3000

2. A sample of 1000 women were polled and asked the question, "How often during the week do you serve a vegetarian (meatless) main dish to your family at dinnertime?" The partial results are listed below.

Outcome	Probability
Three or more times a week	0.06
Twice a week	0.10
Once a week	0.49
Never	?

What is the probability that a woman never serves her family a vegetarian main dish at dinnertime?

A. 0.65.

B. 0.

C. 0.35.

3. You read in a book about poker that the probability of getting a hand containing "four of a kind" is approximately 0.00024. This means that:

A. in every 100,000 hands of poker, you will receive a hand containing "four of a kind" exactly 24 times.

B. in a very large number of hands, the proportion of hands containing "four of a kind" will be approximately 0.00024.

C. in a very large number of hands, the percentage of hands containing "four of a kind" will be approximately 0.00024%.

4. A game consists of drawing three cards at random from a deck of playing cards. You win $3 for each red card that is drawn. It costs $2 to play. For one play of this game, the sample space S for the net amount you win (after deducting the cost of play) is

A. $S = \{\$0, \$1, \$2, \$3\}$

B. $S = \{\$0, \$3, \$6, \$9\}$

C. $S = \{-\$2, \$1, \$4, \$7\}$

5. A student takes a four-question quiz. Letting R = right answer and W = wrong answer, the sample space of possible outcomes may be written as follows:

RRRR	RRRW	RRWR	RWRR
WRRR	RRWW	RWRW	RWWR
WRWR	WWRR	WRRW	RWWW
WRWW	WWRW	WWWR	WWWW

Let A = the event that the student answers *at most one* question correctly. What outcomes in the sample space are elements of A?

A. RWWW, WRWW, WWRW, WWWR.

B. RWWW, WRWW, WWRW, WWWR, WWWW.

C. RWWW, WRWW, WWRW, WWWR, RRWW, RWRW, RWWR, WRWR, WWRR, WRRW, RRRW, RRWR, RWRR, WRRR. RRRR.

6. 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. 35%

B. 65%

C. 70%

7. 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

8. Here is a two-way table of 3549 undergraduate students enrolled in the fall semester at a certain university, classified by class rank (freshman, sophomore, junior, or senior) and gender (male or female). The entries are expressed in terms of thousands of students.

Class rank	Male	Female
Freshman	536	639
Sophomore	421	487
Junior	408	378
Senior	330	350

The percent of males at this university who are sophomores is approximately:

A. 46.4%.

B. 25.6%.

C. 24.8%.

9. A friend offers you the following "friendly" gambling game. He'll draw two cards *with* replacement from a standard deck of 52 cards, then draw two more cards *without* replacement from a second deck of 52 cards. You are invited to place a bet on one of the two sets of two cards yielding two red cards. What should you do?

A. Randomly select one of the two sets of cards, since you have the exact same probability of seeing two red cards in either case.

B. Bet on the first set of two cards, since you have a higher probability of seeing two red cards in this set than you do in the other set.

C. Bet on the second set of two cards, since you have a higher probability of seeing two red cards in this set than you do in the other set.

10. Here is a two-way table of 3549 undergraduate students enrolled in the fall semester at a certain university, classified by class rank (freshman, sophomore, junior, or senior) and gender (male or female). The entries are expressed in terms of thousands of students.

Class rank	Male	Female
Freshman	536	639
Sophomore	421	487
Junior	408	378
Senior	330	350

The probability that a certain randomly selected student is a male *or* a sophomore is:

A. 0.733.

B. 0.119.

C. 0.615.