

# Review Questions for the Final Exam

Fall 20017

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- For each of the following samples:
  - 12, 24, 30, 19, 20, 41, 22
  - 1.90, 3.00, 2.53, 3.71, 2.12, 1.76, 2.71, 1.39, 4.00, 3.33
  - Find the median.
  - Find the sample mean  $\bar{x}$ .
  - Find the sample standard deviation  $s$ .
- Maria is applying for a job. The application consists of two steps. In the first step she has to submit a written application, and then to be interviewed by a hiring committee. 65% of the written applications are approved, and 60% of the applicants pass the hiring committee interview. We also know that 80% of those whose written application has been approved, pass the interview by the hiring committee.
  - What is the probability that Maria's written application is approved **and** she passes the hiring committee interview?
  - What is the probability that Maria's written application is approved **or** she passes the hiring committee interview?
- When admitted to a college a student has to take a math test and an English test. The probability that a random student will pass the math test is .55, that they will pass the English test .60, and that they will pass both English and math .35. What's the probability that a random students will pass at least one of the tests?
- The American Community Survey is an ongoing survey that provides data every year to give communities the current information they need to plan investments and services. The 2010 American Community Survey estimates that 14.6% of Americans live below the poverty line, 20.7% speak a language other than English (foreign language) at home, and 4.2% fall into both categories.
  - Are the events "living below the poverty line" and "speaking a foreign language at home" mutually exclusive?
  - What percent of Americans live below the poverty line and only speak English at home?
  - What percent of Americans live below the poverty line or speak a foreign language at home?
  - What percent of Americans live above the poverty line and only speak English at home?
  - Are the events "living below the poverty line" and "speaking a foreign language at home" independent?
- About 50% of all federal inmates are serving time for drug dealing. A random sample of 16 federal inmates is selected.
  - What is the probability that 12 or more are serving time for drug dealing?
  - What is the probability that 7 or fewer are serving time for drug dealing?
  - Whet is the expected number of inmates serving time for drug dealing?
  - What is the standard deviation?
- About 10% of teenagers (ages 13 to 17) suffer from arachnophobia, that is they are extremely afraid of spiders. At a summer camp there are 10 teenagers sleeping in each tent. Consider the teenagers sleeping in particular tent.

- (a) What's the probability that exactly 2 suffer from arachnophobia?
  - (b) What's the probability that at most one of them suffers from arachnophobia?
  - (c) What's the probability that at least one of them suffers from arachnophobia?
7. The following table gives the number of suicides estimated in the U.S. for a recent year by age, race (black or white) and sex. For the following questions the sample space is the set of all individuals in US that committed suicide that year.

Race and Sex	1-14	15-24	25-64	over 64	TOTALS
white, male	210	3,360	13,610		22,050
white, female	80	580	3,380		4,930
black, male	10	460	1,060		1,670
black, female	0	40	270		330
all others					
TOTALS	310	4,650	18,780		29,760

- (a) Fill in the missing data.
  - (b) Find the probability that a randomly selected individual was a white male.
  - (c) Find the probability that a randomly selected individual was a black female.
  - (d) Find the probability that a randomly selected individual was black.
- For the remaining parts do not use "all others", that is consider the population to be individuals that committed suicide and were either black or white.
- (e) Find the probability that a randomly selected individual was male.
  - (f) Find the probability that a randomly selected individual was male or black.
  - (g) Find the probability that a randomly selected individual was female given that they were over the age of 64.
  - (h) Find the probability that a randomly selected individual was white given that they were male.
8. Let  $x$  be a random variable that represents the length of time a student studies before an exam. It was found that  $x$  has approximately normal distribution with mean  $\mu = 6.8$  hours and standard deviation  $\sigma = 2.1$  hours.
- (a) What is the probability that a randomly selected student studies for at least 4 hours?
  - (b) Suppose 40 students are selected at random. What is the probability that the mean time  $\bar{x}$  that these students studying for the exam is more than 7 hours?
9. In 2005, the distribution of the score in the math portion of the SAT test was approximately normal with a mean  $\mu=520$  and a standard deviation  $\sigma = 115$ .
- (a) What percentage of students scored more than 720 in the math portion of the SAT test in 2005?

- (b) Suppose that sample of 64 students that took the SAT in 2005 is randomly selected. What is the probability that the average score  $\bar{x}$  in the math portion of the SAT for these 64 students is between 491 and 549?
10. Jose conducts a random sample of 41 people regarding their television viewing habits. He found that the sample mean was  $\bar{x} = 4.615$  hours per week with a sample standard deviation of  $s = 2.277$  hours per week. Find a 90% confidence interval for the population mean.
11. Nicole decides to run for political office. In order for her name to appear on the ballot, she must collect 7,500 valid signatures from registered voters. After she collects 10,000 signatures, she decides to check what proportion of the ones she collected are valid. She takes a random sample of 150 of the signatures she collected and brings them to the Board of Elections to verify them. It turns out that of the sample of 150, only 87 are valid.
- (a) Construct a 95% confidence interval for the proportion of valid signatures she has collected.
- (b) If Nicole wants to be sure her name appears on the ballot, should she continue to collect signatures?
12. It is commonly reported that the mean normal body temperature is  $\mu = 98.6^\circ\text{F}$ . A sample of 36 healthy people was taken and their body temperatures were recorded. The sample mean was found to be  $\bar{x} = 98.3^\circ$  and the sample standard deviation was found to be  $s = 0.62^\circ$ . Does it appear that the mean is less than  $98.6^\circ$ ? Use a level of significance of  $\alpha = 0.05$ . Be sure to state the null and alternate hypotheses.
13. Ever since Andrew took MTH 23, he has been obsessed with looking up statistics. One day, he comes across a study that claims that the amount of money a household spends on bottled water every year can be represented by a normally distributed variable  $x$  with population mean  $\mu = 195$  dollars and population standard deviation  $\sigma = 25$  dollars. He can't believe it. He checks his records and sees that last year he spent way more than that on bottled water. He decides to conduct a random sample of 13 people in his building and finds out that the average amount spent by the sample group was  $\bar{x} = 210$  dollars. Aha!
- Test the claim that the mean amount spent on bottled water is more than 195 dollars with a level of significance of  $\alpha = 0.01$ . Identify the null and alternate hypotheses.
14. Let  $x$  be random variable that represents blood glucose level after a 12-hour fast. Let  $y$  be a random variable representing blood glucose level 1 hour after drinking sugar water (after 12-hour fast). Units are in milligrams per 10 milliliters. A random sample of eight adults gave the following information:

$x$	6.2	8.4	7.0	7.5	8.1	6.9	10.0	9.7
$y$	9.8	10.7	10.3	11.9	14.2	7.0	14.6	12.2

- (a) Draw a scatter diagram of the data.
- (b) Based on the diagram would you estimate the correlation coefficient to be negative, close to zero, or positive?
- (c) Explain your answer to part (b).
15. Consider the data in Question (14) again. Given that  $\sum x = 63.8$ ;  $\sum x^2 = 521.56$ ;  $\sum y = 90$ ;  $\sum y^2 = 1070.87$ ;  $\sum xy = 739.65$
- (a) Find the correlation coefficient  $r$ .
- (b) Find the equation of the least square line and plot it on the same graph as the scatter diagram.
- (c) If  $x = 9.0$ , use the least squares line to predict  $y$ .