

1. A bowl of Halloween candy contains 45 snack-sized candy bars. There are 16 Coffee Crisps, 20 Mars bars, and 9 Snickers.
- (a) You draw three candy bars (one at a time, without peeking) from the bowl. Find the probability that all three are Mars bars. [2 marks]
- (b) Repeat part (a), but find instead the probability that none are Snickers. [2 marks]

2. Assume that one person is selected randomly from the 2223 people aboard the Titanic. Let us use the following notation to represent different events of choosing a person from each category:
S = survived, D = died, M = man, W = woman, B = boy, G = girl

Titanic Mortality

	Men (M)	Women(W)	Boys (B)	Girls (G)	Total
Survived (S)	332	318	29	27	706
Died (D)	1360	104	35	18	1517
Total	1692	422	64	45	2223

Apply probability rules to determine the following:

- (a) $P(B)$ [1 mark]
- (b) $P(B, \text{ given } S)$ [2 marks]
- (c) $P(B \text{ and } S)$ [2 marks]
- (d) $P(B \text{ and } G)$ [1 mark]
- (e) Are the events B and S independent? Explain your answer. [2 marks]
3. Stuart is working too many hours and is available to attend only one class each morning. There are six possible courses he could take on Monday-Wednesday-Friday mornings and three courses he could take on Tuesday-Thursday mornings, as well as 2 that are offered on-line. If he takes exactly three courses (but not more than one on-line), how many different schedules could Stuart put together? [3 marks]
4. For one cancer-screening test, subjects with cancer will test positive 94% of the time, while subjects without cancer will test positive 3% of the time. Suppose for a particular community, 2% of the population has cancer.
- a) What percent of the population does not have cancer? [1 mark]
- b) If one person in this community tests positive, what is the probability that they actually have cancer? [3 marks]
5. Of the world population, approximately 10% are left-handed. In a random sample of 42 people, what is the probability of each of the following? Do not use any approximation technique.
- (a) Exactly 6 are left-handed. [2 marks]
- (b) At least 2 are left-handed. [3 marks]
6. Groups of five babies are randomly selected. In each group, let x = number of babies with green eyes. Let $P(x)$ = probability that x babies among the five have green eyes.

x	$P(x)$
0	0.528
1	0.360
2	0.098
3	0.013
4	0.001
5	0.000

- (a) Compute the probability that x is more than 2. [2 marks]
- (b) Compute the expected value of the x distribution. [2 marks]
- (c) Compute the standard deviation of the x distribution. [3 marks]

7. Membership in Mensa requires an IQ score above 131.5. Nine candidates take IQ tests, and their summary results indicated that their mean IQ score is 133. IQ scores are normally distributed with a mean of 100 and a standard deviation of 15.
- (a) If one person is randomly selected from the general population, find the probability of getting someone with an IQ score of at least 133. [2 marks]
- (b) If 9 people are randomly selected, find the probability that their mean IQ score is at least 133. [2 marks]
8. Six percent of typical people have blood that is group O and type Rh -. These people are considered to be universal donors, because they can give blood to anyone. One hospital is conducting a blood drive and 200 volunteers show up to donate blood. Use the Normal distribution with continuity correction to estimate the probability that at least 10 of the volunteers are universal donors. [5 marks]
9. Randomly selected students participated in an experiment to test their ability to determine when one minute (or 60 seconds) had passed. Forty students yielded a sample mean of $\bar{x} = 58.3$ seconds with a sample standard deviation of $s = 9.5$ seconds. Find a 95% confidence interval for the population mean of all students. [5 marks]
10. One poll of 1501 randomly selected U.S. adults showed that 70% of the respondents believe in global warming. Find a 90% confidence interval for the proportion of all U.S. adults who believe in global warming. [5 marks]
11. Suppose that we want to estimate the mean IQ score for the population of statistics students. The population standard deviation is assumed to be $\sigma = 15$. How many students should be included in the sample to be 95% confident that the sample mean \bar{x} is within 3 points of the population mean μ for all statistics students? [5 marks]
12. Ruth is concerned about the spending habits of teens. She read a report that the national weekly spending average for teens in the age group 12 to 15 years is \$42. She took a random sample of 60 teens who live in a rural area and found that they spent an average of \$39 per week with sample standard deviation \$7.50. Test the claim that rural teens from this area spend less than the national average. Use a 1% significance level.
- (a) State the null and alternate hypotheses. [2 marks]
- (b) What is the value of the sample test statistic? [2 marks]
- (c) Find (or estimate) the P -value. [2 marks]
- (d) Based on your answers for parts (a) through (c), will you reject or fail to reject the null hypothesis? [1 mark]
13. A particular type of avalanche studied in Canada had an average thickness of $\mu = 67$ cm. This type of avalanche was studied in a region of the southwest United States. A random sample of 16 such avalanche thicknesses had a mean of 70 cm and a known standard deviation of $\sigma = 11.3$. Assume this thickness has an approximately normal distribution. Use a 5% level of significance to test the claim that this mean avalanche thickness in this US region is more than that in Canada.
- (a) State the null and alternate hypotheses. [2 marks]
- (b) What is the value of the sample test statistic? [2 marks]
- (c) Find (or estimate) the P -value. [2 marks]
- (d) Based on your answers for parts (a) through (c), will you reject or fail to reject the null hypothesis? [1 mark]
14. A random sample of 8 years of Denver, Colorado weather records gave a sample average number of sunny days per year of 263 sunny days with known standard deviation $\sigma_1 = 24$ days. An independent random sample of 6 years of weather records from Phoenix, Arizona had an average of 296 sunny days per year with known standard deviation $\sigma_2 = 18.3$ days. Test to see if the population mean numbers of sunny days are different for the two cities. Use a 1% significance level.
- (a) State the null and alternate hypotheses. [2 marks]
- (b) What is the value of the sample test statistic? [2 marks]
- (c) Find (or estimate) the P -value. [3 marks]
- (d) Based on your answers for parts (a) through (c), will you reject or fail to reject the null hypothesis? [1 mark]

15. A total of 50 women and 60 men responded to a poll. 18 of the women said that female bosses are harshly critical, while 12 of the men said that female bosses are harshly critical.
- (a) Construct a 90% confidence interval for the difference between the proportions of women and men who said that female bosses are harshly critical. Does there appear to be a difference? [5 marks]
- (b) If you had used 95% confidence instead, would you have reached the same conclusion? Why or why not? [2 marks]
16. When considering effects from eliminating the penny as a unit of currency in the United States, 100 checks were randomly selected in order to record the cents portions of those checks. The table below lists those cents portions categorized according to the indicated values. Use $\alpha = 0.05$ to test the claim that the four categories are equally likely. In other words, test whether the given distribution fits one in which each category contains 25% of the checks.

Cents portion of check	Less than 25¢	Between 25¢ & 49¢	Between 50¢ & 74¢	Between 75¢ and 99¢
Number of checks	61	17	10	12

- (a) State the null and alternate hypotheses. [1 mark]
- (b) What is the value of the sample test statistic? [2 marks]
- (c) Find (or estimate) the P -value. [4 marks]
- (d) Based on your answers for parts (a) through (c), will you reject or fail to reject the null hypothesis? [1 mark]
17. Common colds are typically caused by a rhinovirus. In a test of the effectiveness of Echinacea, some test subjects were treated with Echinacea extracted with 20% ethanol, some were treated with Echinacea extracted with 60% ethanol, and others were given a placebo. All of the test subjects were then exposed to rhinovirus. The results are shown in the table below. Test using $\alpha = 0.05$ to determine if getting an infection is independent of the treatment group.

		Placebo	20% extract	60% extract	Row Totals
Infected?	Yes	88	48	42	178
	No	15	4	10	29
Column Totals		103	52	52	207

- (a) State the null and alternate hypotheses. [1 mark]
- (b) What is the value of the sample test statistic? [2 marks]
- (c) Find (or estimate) the P -value. [4 marks]
- (d) Based on your answers for parts (a) through (c), will you reject or fail to reject the null hypothesis? [1 mark]

ANSWERS:

- 1) a) 0.0803 b) 0.503
- 2) a) 0.0288 b) 0.0411 c) 0.01305 d) 0 e) No, since $P(B) \neq P(B|S)$
- 3) 36
- 4) a) 98% b) 0.390
- 5) a) 0.118 b) 0.9322
- 6) a) 0.014 b) 0.599 c) 0.725
- 7) a) 0.0139 b) 0
- 8) 0.7704
- 9) (55.25, 61.35)
- 10) (0.681, 0.719)
- 11) 97
- 12) a) $H_0: \mu = 42, H_1: \mu < 42$ b) $t = -3.098$ c) $0.0005 < p < 0.005$ d) Reject H_0 .
- 13) a) $H_0: \mu = 67, H_1: \mu > 67$ b) $z = 1.06$ c) $p = 0.1446$ d) Fail to Reject H_0 .
- 14) a) $H_0: \mu_1 = \mu_2, H_1: \mu_1 \neq \mu_2$ b) $z = -2.92$ c) $p = 0.0036$ d) Reject H_0 .
- 15) a) (0.02, 0.30) Yes. b) No, since the new interval would now contain 0.
- 16) a) H_0 : Distributions are the same, H_1 : Distributions are different b) $X^2 = 70.16$
c) $p < 0.005$ d) Reject H_0 .
- 17) a) H_0 : Getting an infection is independent of treatment group
 H_1 : Getting an infection is dependent of treatment group
b) $X^2 = 2.925$ c) $0.1 < p < 0.9$ d) Fail to Reject H_0 .