

1. In a certain lottery, six different numbers between 1 and 21 inclusive are drawn.
- a) To win, you must select the winning six number combination (in any order).
What is the probability of winning? [3]
- b) If instead you must select the correct 6 numbers in the same order in which they were drawn, what is the probability of winning? [3]

2. The table below describes the smoking habits of a group of asthma sufferers.

	Nonsmoker	Light Smoker	Heavy Smoker	Total
Men	380	83	87	550
Women	322	73	67	462
Total	702	156	154	1012

If one of the 1012 subjects is randomly selected, find the probability that the person chosen is

- (a) a smoker [3]
 (b) a nonsmoker and a man [4]
 (c) a woman given that the person is a light smoker. [4]
 (d) a man or a heavy smoker [4]
 (e) Are the events woman and light smoker mutually exclusive? Explain. [3]
3. A movie snack trio includes six different choices of drink, two choices of popcorn (battered or not) and five different choices of candy. If you want to try a different trio every time you go to the movies, how many movies would you have to see before having to repeat the trio? [4]
4. Two manufacturers supply food to a large cafeteria. Manufacturer A supplies 40% of the soup served in the cafeteria, while Manufacturer B supplies 60% of the soup that is served. 3% of the soup cans provided by Manufacturer A are found to be dented, while 1% of the cans provided by Manufacturer B are found to be dented. Given that a can of soup is dented, find the probability that it came from manufacturer B. [5]
5. In the past year, Valentino's Pizza Restaurant grossed more than \$1500 a day for about 75% of its business days. During the next 8 business days, what is the probability (rounded to two decimal places) that Valentino's will gross more than \$1500 a day for
- (a) all 8 days? [4]
 (b) less than 7 days? [4]
6. An insurance company says that 15% of all fires are caused by arson. A random sample of fifty fire insurance claims is under study. Let r be the number of claims in this sample from fires that were started by arson.
- (a) What is the expected number of arson fires among five fires? [2]
 (b) What is the standard deviation of r ? [2]
 (c) Use the Normal Distribution with continuity correction to obtain an approximation of the probability that more than 12 of the fires were caused by arson. [5]
7. The life of a Freeze Breeze electric fan is normally distributed with mean 4 years and standard deviation 1.2 years. The manufacturer will replace any fan that wears out during the guarantee period.
- (a) What proportion of the fans will have to be replaced if the fans are guaranteed for three years? [4]
 (b) How long should the fans be guaranteed if the manufacturer does not want to replace more than 5% of them? (Give the answer to the nearest month.) [4]
8. A study is being planned to estimate the mean number of semester hours taken by students at a college. The population standard deviation is assumed to be $\sigma = 4.2$ hours. How many students should be included in the sample to be 95% confident that the sample mean \bar{x} is within one semester hour of the population mean μ for all students at this college? [5]

9. A random sample of 62 credit card holders showed that 54 regularly paid their credit card bills on time. Let p represent the proportion of all people who regularly paid their credit card bills on time. Find a 90% confidence interval for p . [5]
10. A new bus route has been established between downtown Montreal and Saint-Anne-de-Bellevue. Dan has taken the bus to work for many years. For the old bus route, he knows from long experience that the mean waiting time between buses at his stop was $\mu = 15.1$ minutes. However, a random sample of 5 waiting times between buses using the new route had mean $\bar{x} = 12.7$ minutes with sample standard deviation $s = 8.2$ minutes. Does this indicate that the population mean waiting time for the new route is less than what it used to be? Use a 5% significance level. Assume that waiting time between buses is normally distributed.
- State the null and the alternate hypotheses. [2]
 - What is the value of the sample test statistic? [3]
 - Find (or estimate) the P-value. [3]
 - State your conclusions in the context of the application. [2]
11. Carla is comparing automobile insurance premiums in Quebec with those in Ontario. A random sample of 31 insurance companies in Quebec yielded a sample mean premium \$740 per year with known population standard deviation \$115. An independent random sample of 34 insurance companies in Ontario gave a sample mean premium \$815 with known population standard deviation \$150 for similar coverage. Test to see if the data supports the hypothesis that insurance premiums are different in Ontario then they are in Quebec. Use a 5% significance level.
- State the null and the alternate hypotheses. [2]
 - What is the value of the sample test statistic? [3]
 - Find (or estimate) the P-value. [3]
 - State your conclusions in the context of the application. [2]
12. A pharmaceutical research team is testing the effectiveness of a new drug. A random sample of subjects were selected with a similar medical condition. The drug was then administered under two conditions: one large dose once a day, smaller doses three times a day. A doctor assessed the effectiveness of the drug and classified it as high, medium, or low. The number of subjects falling into each category is given in the table below. Use a 5% significance level to test the claim that the effectiveness of the medication is independent of the dosage delivery.

Effectiveness	Dosage Delivery	
	Once a day	Three times a day
High	16	19
Medium	17	14
Low	7	6

- State the null and the alternate hypotheses. [2]
- What is the value of the sample test statistic? [5]
- Find (or estimate) the P-value. [3]
- State your conclusions in the context of the application. [2]

Answers

1. a) $1 / 21C6 = 1/54264 = 0.0000184$ b) $1 / 21P6 = 1/39070080 = 0.0000000256$
2. a) $310 / 1012 = 0.306$ b) $380 / 1012 = 0.375$ c) $73 / 156 = 0.468$
d) $617 / 1012 = 0.610$ e) No, it is possible to be both simultaneously.
3. 60
4. $1 / 3$
5. a) 0.0899 b) 0.6574
6. a) 0.75 b) 2.525 c) 0.0239
7. a) 0.2033 b) 24 months
8. 68
9. 0.80 to 0.94
10. a) $H_0: \mu = 15.1, H_1: \mu < 15.1$
b) $t = -0.65$
c) p-value > 0.25
d) Fail to Reject H_0 . There is not sufficient evidence to suggest a change in the waiting time.
11. a) $H_0: \mu_1 = \mu_2, H_1: \mu_1 \neq \mu_2$
b) $z = -2.27$
c) p-value 0.0232
d) Reject H_0 . There is sufficient evidence to suggest a difference in premiums.
12. a) H_0 : Effectiveness and Delivery of drug are independent
 H_1 : Effectiveness and Delivery of drug are dependent
b) $X^2 = 0.6118$
c) $0.100 < \text{p-value} < 0.900$
d) Fail to Reject H_0 .
There is not sufficient evidence to suggest that effectiveness is dependent on delivery.