

Information

The following applies to Questions 1 to 3.

A box contains four numbered balls (1, 1, 2, and 3). We will randomly select two balls from the box (**without replacement**).

(Hint: since the selections are without replacement, this means, for example, that if the ball labelled "2" is selected on the first selection, it **cannot** be selected again on the second selection.)

Question 1 (1 point)

The outcome of interest is the number on each of the two balls we select. How many outcomes are contained in the sample space?

Question 2 (2 points)

Let X be the sum of the two numbers on the selected balls. Find the probability distribution of X .

In the following four blanks, enter your answers **as fractions** in the following order: $P(X = 2)$, $P(X = 3)$, $P(X = 4)$, and $P(X = 5)$.

Question 2 options:

Blank # 1

Blank # 2

Blank # 3

Blank # 4

Question 3 (2 points)

What is the probability that $X = 3$ if we know that the first selection is not a "3"?

Enter your answer as a fraction.

Information

The following applies to Questions 4 to 6.

A survey of the members of a magazine club revealed the following results:

- 42% read *Reader's Digest*
- 31% read *Maclean's*
- 50% read *Maclean's* or *Canadian Geographic*
- 10% read *Reader's Digest* and *Canadian Geographic*
- 9% read *Maclean's* and *Canadian Geographic*
- 6% read *Reader's Digest* and *Maclean's*
- 4% read all three magazines

We will randomly select one member of the magazine club.

Question 4 (1 point)

What is the probability that the selected person reads *Canadian Geographic*?

Enter your answer as a decimal.

Question 5 (1 point)

What is the probability that the selected person reads *Maclean's* if we know they don't read *Reader's Digest*?

Enter your answer as a decimal.

Question 6 (1 point)

What is the probability that the selected person reads *Maclean's* if we know they read *Reader's Digest* and *Canadian Geographic*?

Enter your answer as a decimal.

Information

The following information about a deck of cards applies to Questions 7 and 8.

A standard deck of cards consists of 52 cards. There are 13 cards (2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King, Ace) in each of four suits (Clubs, Diamonds, Hearts, and Spades).

Question 7 (1 point)

You randomly select 3 cards without replacement. Let S_1 be the event that the first card is a spade, let S_2 be the event that the second card is a spade, and let S_3 be the event that the third card is a spade. What is $P(S_3 | S_1^c \cap S_2^c)$?

Enter your answer as a fraction.

Question 8 (1 point)

You randomly select **one** card from a deck of cards. Let A be the event that the selected card is an Ace and let H be the event that the selected card is a heart. Are the events A and H independent? Explain why or why not.

Information

The following applies to Questions 9 and 10.

Let the probability distribution of X be given as follows:

x_i	1	2	3
p_i	0.2	0.3	0.5

Question 9 (1 point)

What is the expected value of X?

Enter your answer as a decimal.

Question 10 (1 point)

What is the variance of X?

Keep all decimal places in intermediate calculations and enter your answer as a decimal.

Question 11 (2 points)

Scores on the Math portion of a college entrance exam are normally distributed with mean 530 and standard deviation 70. Scores on the Verbal portion of the same exam are normally distributed with mean 475 and standard deviation 75. What is the probability that a randomly selected Math score is greater than a randomly selected Verbal score?

Question 12 (2 points)

Quiz scores in a Statistics class follow a normal distribution mean 70 and standard deviation 10.

In a random sample of 10 students from the class, what is the probability that at least 1 student has a quiz score above 85?

(Hint: first find the probability that **one** randomly selected student has a quiz score above 85. Then use this answer to answer the above question.)

Give your answer to 4 decimal places.

Question 13 (2 points)

Trees are distributed in a large forest according to a Poisson distribution with a rate of 0.2 per square meter. If we randomly select a circular area of the forest with a radius of 3 meters, what is the probability this area will contain 5 trees? (Area of a circle = πr^2)

Give your answer to 4 decimal places.

Question 14 (1.5 points)

We would like to conduct a hypothesis test at the 10% level of significance to determine if the true proportion of Canadians who are left-handed differs from 0.10. A random sample of 200 Canadians is selected. What is the rejection rule in terms of \hat{p} ?

(You do not need to show your work. Just give the final answer. You can write \hat{p} as "p-hat" to avoid using the Graphical Equation Editor.)

Question 15 (2 points)

We would like to compare the current unemployment rates in Canada and the U.S. In a random sample of 400 Canadians, 28 of them are found to be unemployed. In a random sample of 300 Americans, 15 are unemployed. Calculate a 94% confidence interval for the true difference in proportions of Canadian and American adults that are unemployed ($p_C - p_A$).

Keep 6 decimal places in intermediate calculations and report your final answer to 3 decimal places.

Lower limit:

Upper limit:

Information

The following applies to Questions **16 - 19**.

We would like to compare the grade distributions for three different science courses at a large university. Random samples are selected from first-year biology, chemistry, and physics courses and their final grades are summarized in the table below, as well as some expected cell counts and some cell chi-square values:

Observed Expected Cell Chi-Square	Biology	Chemistry	Physics	Row Total
A+	17 20.9 0.72	25 20.3 1.09	18 18.8 0.04	60
A	32 24.0 2.66	22 23.3 0.08	15 21.6 2.04	69
B+	24 20.5 0.59	18 20.0 0.19	17 18.5 0.12	59
B	38 32.0 1.12	28 31.1 0.32	26 28.9 0.28	92
C+	18 19.8 0.17	20 19.3 0.03	19 17.9 0.07	57
C	31 33.4 0.17	34 32.5 0.07	31 30.1 0.03	96
D	16 18.8 0.41	17 18.3 0.09	21 16.9 0.97	54
F	7 13.6 3.18	14 13.2 0.05	18 ??? ???	39
Column Total	183	178	165	526

Question 16 (1 point)

What are the appropriate hypotheses to test?

Question 17 (1 point)

What is the decision rule for testing the hypotheses in Question 16 using the critical value method with a 1% level of significance?

(The answer is partially pre-filled. Add to the answer.)

Reject H_0 if $\chi^2 \geq$

Question 18 (1 point)

What is the appropriate test statistic?

(To save you time, the sum of the 23 cell chi-square values that are given (**excluding the one missing value**) is 14.49.)

Give your answer to 2 decimal places.

Question 19 (1 point)

What is the conclusion of the hypothesis test at the 5% level of significance?

(The answer is partially pre-filled. Edit/add to the answer.)

We have sufficient/insufficient evidence to conclude that ...

Information

The following applies to Questions **20** and **21**.

Three contestants compete on each episode of the TV game show *Jeopardy!*. The number of female contestants for a random sample of 100 episodes are shown in the table below:

# of females	0	1	2	3
# of episodes	45	35	15	5

Question 20 (4 points)

Conduct a chi-square goodness of fit test at the 5% level of significance to determine whether the number of female contestants per episode follows a binomial distribution with parameter $p = 0.25$.

Show all of your work. The conclusion of the hypothesis test is partially pre-filled. Edit/add to the answer.

We have sufficient/insufficient evidence to conclude that ...

Question 21 (1 point)

What would be the estimated value of the parameter p if we didn't want to make an assumption about its value?

Give your answer to 2 decimal places.