**Lesson 15 Assessment**

You are three-quarters of the way through this course. This is an **Assessment of Learning**, which is used to evaluate your work based on established criteria and to assign a mark. Your teacher will provide you with feedback and a mark. This **Assessment of Learning** is worth **17%** of your final mark for the course.

**Instructions**

There are six tasks in this **Assessment of Learning**.

Task 1: It’s all in the cards.

**(5 marks total)**

1. A card is drawn from a standard deck of 52 playing cards. Leave answers as fractions in lowest terms and odds as a ratio in lowest terms. Find each of the following probabilities or odds:
   1. the probability that the card is a diamond **(1 mark)**
   2. the probability that the card is an odd-numbered card **(1 mark)**
   3. the probability that the card is a face card **(1 mark)**
   4. the probability that the card is not a face card **(1 mark)**
   5. the odds in favour of drawing a face card **(1 mark)**

Task 2: To be mutually exclusive or not to be mutually exclusive – that is the question

**(6 marks total)**

1. For each situation, state whether or not the events are mutually exclusive (and explain why) and determine the probability of the event occurring. Leave answers as fractions in lowest terms.
   1. rolling a power of 2 or a multiple of 3 with a single 12-sided die **(3 marks)**
   2. drawing an even-numbered card or a card with a red suit from a standard deck of cards **(3 marks)**

Task 3: What are the chances?

**(4 marks total)**

1. A cooler has 24 Greek yogurt containers and 6 vanilla yogurt containers. The person in charge of distributing the yogurt reaches into the cooler (without looking) and randomly picks them out of the cooler. What is the probability that your friend gets a Greek yogurt and that you get a vanilla yogurt? Leave answers as percentages rounded to one decimal place. **(4 marks)**

Task 4: Tetrahedral sums

**(7 marks total)**

1. Two 4-sided dice are tossed and the sum of the down sides noted. A 4-sided die doesn’t have an “up” face like a 6-sided die has, so the down side is used.
   1. Create a probability distribution **(3 marks)** and graph **(1 mark)** for this experiment.
   2. Determine the expected value of the sum. **(3 marks)**

Task 5: Probability distributions with dice

**(4 marks total)**

1. Two 4-sided dice are tossed 10 times. Leave probability answers as percents rounded to one decimal place.
   1. Is this a binomial or a hypergeometric distribution? Explain. **(1 mark)**
   2. What is the probability that a sum of 4 occurs, at most, twice? **(2 marks)**
   3. Calculate the expected number of times that a sum of 3 should occur. **(1 mark)**

Task 6: Probability distributions with socks

**(4 marks total)**

1. A drawer contains 5 pairs of green socks, 3 pairs of black socks, and 4 pairs of red socks. All of the pairs are together, meaning that there are not 24 randomly distributed socks, but 12 pairs. You reach into the drawer and pull out 3 pairs of socks without putting any back.
   1. Is this a binomial or a hypergeometric distribution? Explain. **(1 mark)**
   2. What is the probability that you get 2 pairs of green socks? Leave your answer as a fraction in lowest terms. **(2 marks)**
   3. What is the expected number of pairs of green socks? **(1 mark)**

**Lesson 20 Assessment**

You are near the end of this course. This is your final **Assessment of Learning**, which is used to evaluate your work based on established criteria and to assign a mark. Your teacher will provide you with feedback and a mark. This **Assessment of Learning** is worth **24%** of your final mark for the course.

**Instructions**

There are six tasks in this **Assessment of Learning**. Remember to express all final probability calculation answers as a percentage, rounded to 1 decimal place.

Task 1: Uniform gaming

**(4 marks total)**

1. In a board game, a timer is designed to run out somewhere between 60 s and 180 s. All times are equally distributed from 60 s to 180 s.
   1. What is the probability that the timer runs out in less than 100 s? **(2 marks)**
   2. What is the probability that the timer lasts more than 130 s? **(2 marks)**

Task 2: What’s the distribution?

**(7 marks total)**

1. The table below shows the heights, rounded to the nearest centimetre, of all of the students in Grade 12 at West End High School.
   1. Construct a frequency polygon of these data and classify the distribution as *uniform*, *unimodal*, or *bimodal*. **(5 marks)**
   2. Comment on the skewness of this distribution and explain your choice. **(2 marks)**

|  |  |
| --- | --- |
| **Height (cm)** | **Frequency** |
| 120–129 | 1 |
| 130–139 | 2 |
| 140–149 | 6 |
| 150–159 | 14 |
| 160–169 | 20 |
| 170–179 | 23 |
| 180–189 | 11 |
| 190–199 | 6 |

Task 3: Middle-class incomes

**(10 marks total)**

1. Family incomes have a mean of $60 000 with a standard deviation of $20 000. The data are normally distributed.
   1. What is the probability of a randomly chosen family having an income greater than $50 000? **(3 marks)**
   2. What is the probability that a family income is less than $36 000? **(3 marks)**
   3. A new tax law designed for the middle class is to help families with incomes from $45 000 to $80 000. What percentage of families will this new law help? **(4 marks)**

Task 4: Coffee shop scheduling

**(9 marks total)**

1. The Lakeside Coffee Shop morning customer load follows a normal distribution. The mean number of customers is 60 and the standard deviation is 15.
   1. Determine the probability that the number of customers tomorrow will be 50. **(3 marks)**
   2. If the store gets more than 70 customers, they need to have a fourth staff member working. What is the probability that they will need that fourth person tomorrow? **(3 marks)**
   3. If the number of customers falls below 42, then two staff members are sufficient. What are the chances only two workers are required tomorrow? **(3 marks)**

Task 5: Normal approximation for binomial births

**(9 marks total)**

1. In Chelmsford County, the probability that a randomly chosen birth results in a boy is 45% at the local hospital. Over the course of a month, there are 20 births.
   1. Is a normal approximation to the binomial random distribution appropriate here? Show your calculations and explain your choice. **(3 marks)**
   2. Use the normal approximation to find the following probability. What is the chance that more than 14 of the births are boys? **(3 marks)**
   3. Use the binomial probability formula to calculate the probability that more than 14 boys are born in these 20 births.**(3 marks)**

Task 6: Employment in health care and social assistance comparison

**(11 marks total)**

1. The following table shows the number of employees in Ontario and Quebec in the health care and social assistance fields from 2010 to 2014.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Employment in health care and social assistance (thousands)** | | | | | |
|  | **2010** | **2011** | **2012** | **2013** | **2014** |
| **Ontario** | 597.5 | 615.1 | 628.7 | 634.3 | 644.4 |
| **Quebec** | 392.3 | 400.9 | 410.2 | 417.2 | 422.6 |

* 1. Create time-series graphs to display both sets of data. **(4 marks)**
  2. Which province appears to have the largest growth in this employment field? Justify your choice. **(1 mark)**
  3. Calculate the percentage change for each province from year to year and graph these new data. **(5 marks)**
  4. Do the percentage change graphs tell the same story as the graph of the population figures? Explain. **(1 mark)**