Assignment two

Random Variables and Discrete and Continuous Distributions

Total points : 20

Question 1.*(7 points)*

Consider a small bike shop in Bank street Ottawa. Bicycles arrive at the shop in boxes. Before they can be sold, they must be unpacked, assembled, and tuned (lubricated, adjusted, etc.). Based on past experience, the shop manager makes the following assumptions about how long this may take:

- The times for each setup phase are independent.
- The means and standard deviations of the times (in minutes) are as shown:

Phase	**Mean**	**SD**
Unpacking	3.5	0.7
Assembly	21.8	2.4
Tuning	12.3	2.7

(a) What are the mean and standard deviation for the total bicycle setup time ? *(1 points)*

(b) A customer decides to buy a bike like one of the display models but wants a different color. The shop has one, still in the box. The manager says that they can have it ready in half an hour. Do you think the bike will be set up and ready to go as promised ? *(Hint: Base your decision on the expected value) (1 points)*

(c) Most days, the bike shop completes this process on three bikes. The manager schedules 90 minutes per day in total for store employees to complete this task. Are the workers going to be able to complete this task in 90 minutes (of their combined work times)? *(1 points)*

The bike shop will be offering two specially priced children's models at a sidewalk sale. The basic model will sell for $120 and the deluxe model for $150. Past experience indicates that sales of the basic model will have a mean of 5.4 bikes with a standard deviation of 1.2, and sales of the deluxe model will have a mean of 3.2 bikes with a standard deviation of 0.8 bikes. The cost of setting up for this sidewalk sale is $200.

(d) Define appropriate random variables and use them to express the bicycle shop's net income. *(1 points)*

(e) What is the mean of the net income ?*(1 points)*

(f) What is the standard deviation of the net income ? *(1 points)*

(g) Do you need to make any assumptions in calculating the mean? How about the standard deviation ?*(1 points)*

Question 2.*(4 points)*

According to Neurological research study published in Science news (161 no.24, 2002), in about 80% of people, language abilities reside in the brain's left side. Another 10% display right-brain language centres, and the remaining 10% have two sided language control. The later two groups are categorized as mainly left-handers.

(a) Assume that a first-year composition class in Telfer contains 25 randomly selected students. What is the probability that no more than 15 of these students have left-brain language control ?*(1 points)*

(b) In a randomly assigned group of five of these students, what is the probability that no one has two sided language control ? *(1 points)*

(c) In the entire first year class of 1200 students, how many would you expect to find of each type ? *(1 points)*

(d) In the entire first year class of 1200 students, what are the mean and standard deviation of the number of these students who will be right-brained in language abilities ? *(1 points)*

Question 3.*(5 points)*

In an island in pacific ocean, almost every year there is some incidence of volcanic activity. In 2007, there were five volcanic episodes, defined as either eruptions or, sizable seismic activity. Suppose the mean number of episodes is 2.4 per year. Let Y be the number of episodes in the two-year period 2011-2013.

(a) What model might you use to model Y ?*(1 points)*

(b) What is the mean number of episodes in this period ?*(1 points)*

(c) What is the probability that there will be no episodes in this period ?*(1 points)*

(d) What is the probability that there are more than three episodes in this period ?*(2 points)*

Question 4.*(4 points)*

The length of human pregnancy from conception to birth can be modeled as a distribution that is approximately normal with mean 266 days and standard deviation 16 days.

(a) According to this model, what percentage of human pregnancies last longer than 279 days? Please interpret your answer. *(2 points)*

(b) Approximately 7 % of infants are premature. Using this model, find the pregnancy time that would result in a premature birth. Please interpret your answer. *(2 points)*