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Applied Statistics 161.111
Assignment 1

Due date: Friday 8th April 2022

Total marks: 32 **Assessment value:** 17%

Background

Lamb birth weight is the single largest influence on survival of lambs in the first few days of life. In a trial at Massey University in the late 1990s, an equal number of Coopworth pregnant ewes (female sheep) were randomly allocated to an experiment involving two shearing treatments (shorn on day 70 vs not shorn) and four feeding regimes (HH, HM, MH, MM). The first letter refers to feed during days 70-101 of pregnancy, and the second during days 102-140. The M (maintenance) feeding group were fed at a level calculated to maintain maternal conceptus-free weight, while the H (high) feeding group were fed to gain around 100g per day above this during the relevant period.

After each lamb was born, its birthweight was recorded, as well as its rank (whether it was a single or twin), and the feeding regime and shearing treatment of its mother. The resulting dataset, to be analyzed in this assignment, contains information about 204 lambs.

The data are in the Excel file *lambs.xlsx*.

Use the data to answer the following questions in the spaces provided. You can re-size the answer spaces.

Use Excel and incorporate the output into your answers.

Part A: Exploratory analysis of the feeding regimes [10 marks]

A1: Use Excel to produce a table of counts for the different feeding regimes. [2 marks]

Row Labels	Count of feed
HH	51
HM	52
MH	50
MM	51
Grand Total	**204**

A2: Use Excel to draw an appropriate graph to display the table you created above. [2 marks]

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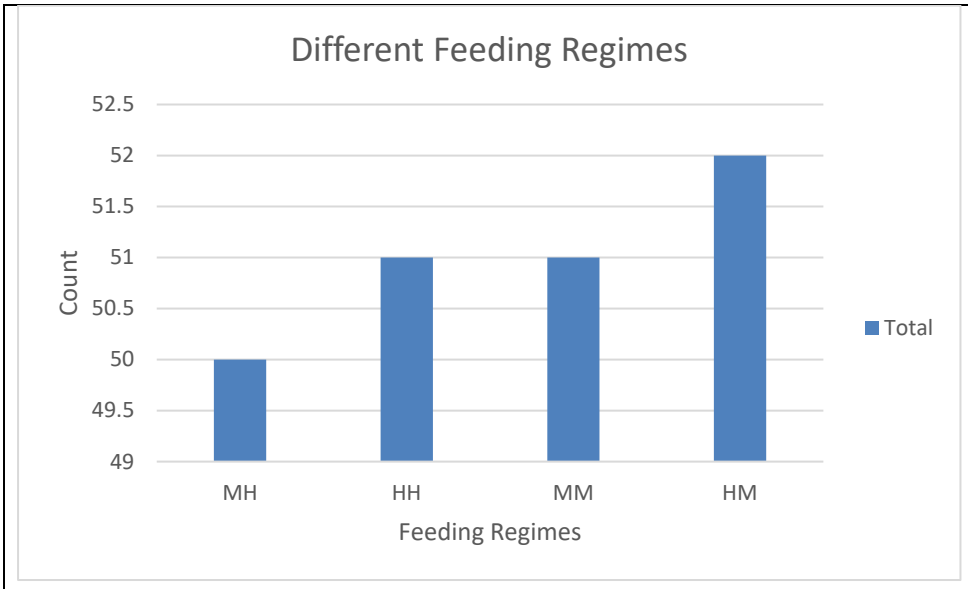

A3: What does the graph and table tell you about the numbers of lambs from ewes in the different feeding regimes? Does it suggest that the feeding regime affects the number of lambs born to a ewe? [2 marks]

The data above does not tell us about the number of lambs from the ewes. It tells us how many ewes were allocated into each feeding regime. There is no suggestion that the feeding regime affects the number of lambs born to a ewe.

A4: Why are there not equal numbers of lambs in each feeding regime? What does this tell you about the allocation of ewes to the different feeding groups? Explain. [2 marks]

This tells us that they must have used random allocation for all the lambs. This is the most effective way of splitting up the ewes into the 4 feeding regimes. However, for a more accurate result it would have been best to have the same number of ewes in each feeding regime, but having 1 ewe difference won't change the outcome.

A5: Explain why the random allocation of ewes to the different feeding regimes is an important part of the experimental design. How does this random allocation affect the conclusions? [2 marks]

The random allocation is important because it helps assign all the ewes to the different feeding regimes without any bias.

Part B: Exploratory analysis of birthweight [10 marks]

B1: Use Excel to draw a boxplot of birthweight for all the lambs. [2 marks]

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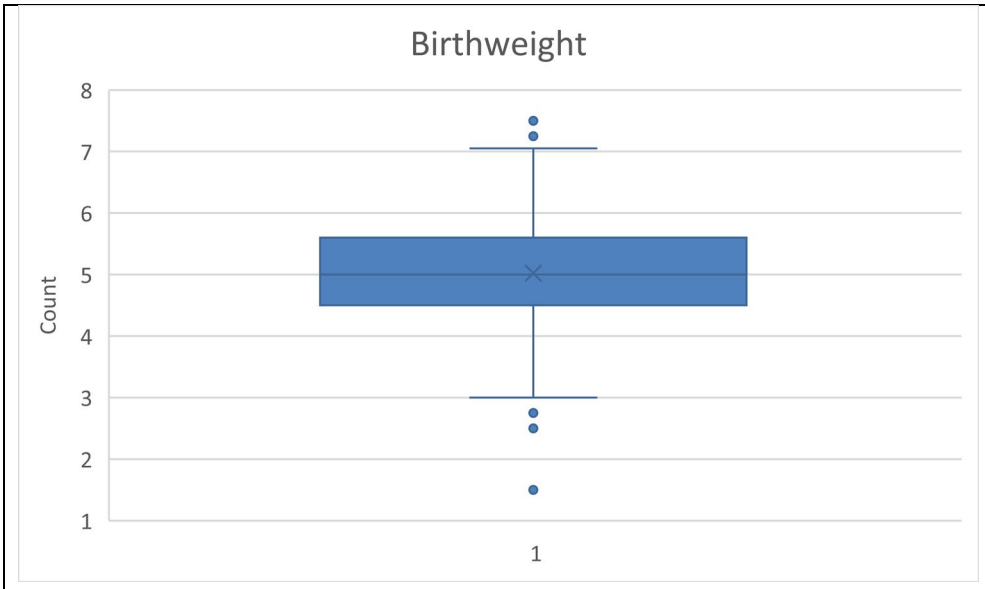
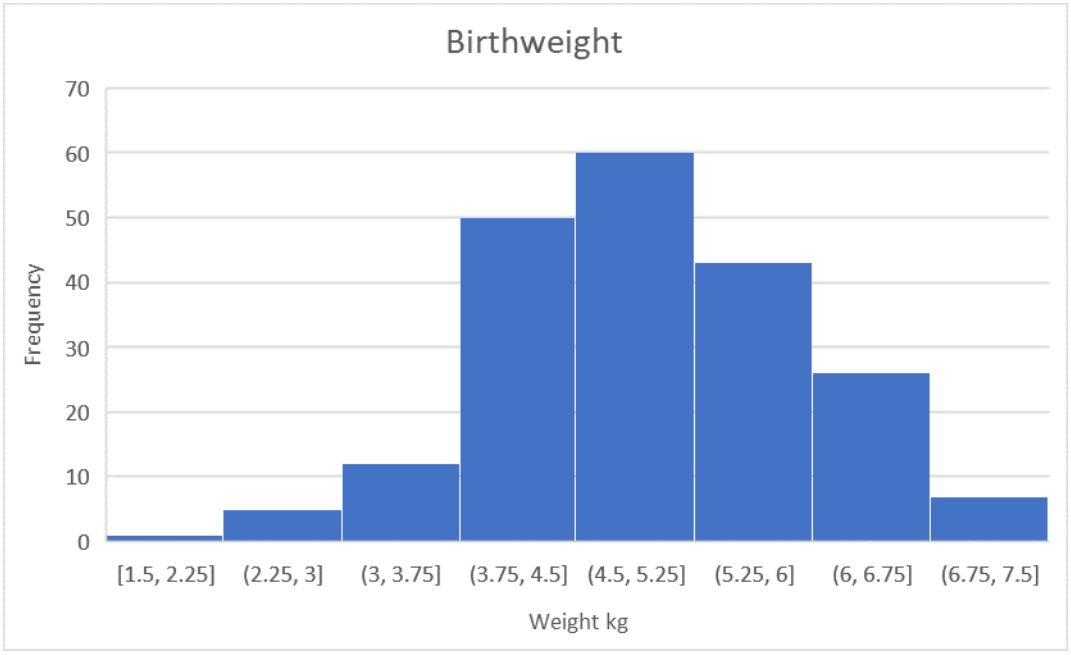


B2: Use Excel to draw a histogram of birthweight for all the lambs. [2 marks]



B3: Use Excel to calculate the numerical summaries of birthweights of the lambs. Fill in the table with the values rounded sensibly. [2 marks]

	Weight (kg)
Number of lambs	204 Lambs, collective weight 1024.31 kgs.
Mean	5.02
Standard deviation	0.97
Minimum	1.5
Lower Quartile	4.5
Median	5
Upper Quartile	5.6
Maximum	7.5

B4: What do your plots and summary statistics tell you about birthweights of the lambs? Write one or two sentences about each of the following: centre, spread, shape and outliers. [4 marks]

The results for the boxplot and histogram tell us that the centre(median) of the data is 5kgs. The spread of the data, also known as the IQR, is 1.1kgs (5.6-4.5). The shape of the data is symmetrical, this can be analysed from the median and mean score which are very close together. There are 5 outliers, 2 heavier and 3 lighter weighing lambs.

The 5 outliers were difficult to see in the histogram. The box plot does not show that the data is symmetrical or not, whereas the histogram does. Both of the plots show the symmetry of the data, the box plot displays the median, lower and upper quartile however with makes it easer for us to understand that the data is more symmetric than skewed.

Part C: Confidence interval for mean birthweight [12 marks]

C1: Calculate a 95% confidence interval for the mean birthweight of Coopworth lambs in the population. To get full marks you must show your working for the following: [4 marks]

Standard error = SD/sqrt(n). = 0.97/sqrt (204) = 0.068 kgs

Confidence interval = 2*SE. = 2*0.068 = 0.14 kgs.

Lower limit = mean – CI = 5.02-0.14 = 4.89 kgs.

Upper limit = mean + CI =5.02+0.14 = 5.16 kgs.

C2: Write a sentence to interpret your confidence interval in context. [2 marks]

The 95% confidence interval tells us that 95% of the data lies between 4.89kgs and 5.16kgs.

C3: Two conditions (normality and representativeness) need to be met for this confidence interval to be valid. Is the normality condition satisfied? Explain. [2 marks]

Yes, because random allocation was used to collect the data.
Yes, because the sample size is greater than 25.

C4: Is the representativeness condition satisfied? Could you generalize these results to other populations of lambs? Discuss. [2 marks]

Yes, it is, because the CI is being used and is valid. The data can be used to accurately reflect the characteristics of a larger group of ewes. Because the lambs were randomly selected from a larger population, we are able to generalize and say that the data would be representative of the population of ewes.

C5: A previous report claimed that the average birthweight for Coopworth lambs on NZ farms is over 5.0kg. Assuming your confidence interval is valid, does it support this claim? Explain. [2 marks]

Yes, it is more then possible for another set of data to have a larger average birthweight. As long as the average is within the CI. Considering our average was 5.02kg – 5.0kg = 0.02 kg. This answer is within the confidence interval. If the average was less than 4.89kgs or greater than 5.16kgs, than the report would have to be reassessed.

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