



National
Qualifications
SPECIMEN ONLY

S844/76/11

**Applications of Mathematics
Data booklet**

Date — Not applicable

Duration — 2 hours 5 minutes

Pre-release material

This booklet will be issued to centres in advance of the date of examination.

Candidates will be issued with a clean copy of this booklet. Copies will be issued at the start of the examination session and collected at the end of the session. Candidates must not take their own copies of this booklet into the examination.

Centres should ensure that candidates are familiarised with any contexts and information contained in this booklet in preparation for the examination.

Some examination questions will be based on this material.

This booklet contains a set of two documents:

1. Mountain gorillas
2. Some helpful R commands.



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1. Mountain gorillas

Deforestation is happening on a massive scale throughout the world and many animals are experiencing habitat loss. Conservation teams have been campaigning against deforestation in a bid to increase wildlife populations.

One success story is the mountain gorilla. More than half of the world's mountain gorillas live in the Virunga Mountains, a range of extinct volcanoes that border the Democratic Republic of Congo, Rwanda and Uganda.

A study in 2008 showed there were only 680 mountain gorillas in the Virunga Mountains. A further study in 2020 showed that due to conservation efforts, including clamping down on illegal logging, the population of mountain gorillas had increased.

Mountain gorillas are considered adults when they are 10 years old and will live for an average of 35 years.

Mountain gorillas survive on a **mainly** vegetarian diet consisting of bamboo shoots, fruit, and berries. Given the opportunity, mountain gorillas will also eat ants and termites, but their diet will remain mostly vegetarian.

2. Some helpful R commands

Entering data to R Studio

To read in data from an Excel csv file called `excel_data.csv` to R Studio and name it `mydata`, first use the drop down menus in R Studio **Session > Set Working Directory > Choose Directory** to indicate the location of `excel_data.csv` on your computer. The following code will then read the data in to R Studio:

```
mydata<-read.csv("excel_data.csv")
attach(mydata) — this adds the variable names
```

At the end of the analysis remember to use `detach(mydata)` to disassociate the variable names.

(a) Graphics

`hist(X, col="yellow", main="Histogram of X (units)")` — this produces a histogram of the variable named 'X'

`plot(X, Y, xlab="x-axis label", ylab="y-axis label", main="Scatterplot of Y on X", pch=21, bg="black")` — produces a scatterplot of X vs Y with black dots of the size specified by 'pch'

`pie(table(X), main="Title")` — this gives a simple pie chart of the categories in variable X with the specified title

`barplot(table(X), main="title", xlab="x-axis label", col="orange")` — this gives a bar chart of the categories in the variable X with the required title, axis labels and colour

`boxplot(Y)` — produces a boxplot of the numerical variable Y

(b) Descriptive Statistics

`mean(X)` — computes the mean of X

`sd(X)` — computes the standard deviation of X

`summary(X)` — computes the mean, median, minimum, maximum and upper and lower quartiles

`table(X)` — computes the number of observations in each level of the categorical variable X

`prop.table(table(X))` — returns the proportion of observations in each level of the categorical variable X

`prop.table(table(X))*100` — returns the percentage of observations in each level of the categorical variable X

`table(X, Y)` — produces a cross-tabulation between the two categorical variables X and Y

(c) Correlation and Regression

`cor.test(age, length)` — computes the correlation between X and Y and performs a test of the null hypothesis of zero correlation

`lm(Y~X)` — fits a linear regression line to the data (`lm` command stands for linear model)

`abline(lm(Y~X))` — produces a scatterplot with the least squares linear regression line superimposed on the data

`summary(lm(Y~X))` — displays the coefficient of determination (r-squared)

`predict(lm(Y ~ X), newdata=data.frame(X=C), interval = "pred")` — computes the predicted value of Y when X=C along with a 95% prediction interval

(d) Hypothesis Testing

`t.test(X, Y)` — performs a two sample t-test between X and Y

`t.test(X, Y, paired=TRUE)` — performs a paired t-test between X and Y

`prop.test(x = c(a, b), n = c(n1, n2))` — performs a 2-sample test for equality of proportions with continuity correction

[END OF DATA BOOKLET]