1 The distributions for the heights for a sample of females and males at a UK university can be modelled using normal distributions with mean 165 cm, standard deviation 9 cm and mean 178 cm, standard deviation 10 cm respectively.

A female's height of 177 cm and a male's height of 190 cm are both 12 cm above their means. By calculating z-values, or otherwise, explain which is relatively taller. **(4 marks)**

2 A certain type of cabbage has a mass M which is normally distributed with mean 900 g and standard deviation 100 g.

a Find $P(M < 850)$ **(1 mark)**

10% of the cabbages are too light and 10% are too heavy to be packaged and sold at a fixed price.

b Find the minimum and maximum weights of the cabbages that are packaged. **(3 marks)**

3 In a town, 54% of the residents are female and 46% are male. A random sample of 200 residents is chosen from the town. Using a suitable approximation, find the probability that more than half the sample are female. **(6 marks)**

4 The heights of a population of men are normally distributed with mean μ cm and standard deviation σ cm. It is known that 20% of the men are taller than 180 cm and 5% are shorter than 170 cm.

a Sketch a diagram to show the distribution of heights represented by this information. **(3 marks)**

b Find the value of μ and σ. **(7 marks)**

c Three men are selected at random, find the probability that they are all taller than 175 cm. **(2 marks**)

5 **a** State the conditions under which the normal distribution may be used as an appoximation to the binomial distribution $X \sim B(n, p)$. **(2 marks)**

b Write down the mean and variance of the normal approximation to X in terms of n and p. **(2 marks)**

A manufacturer claims that more than 55% of its batteries last for at least 15 hours of continuous use.

c Write down a reason why the manufacturer should not justify their claim by testing all the batteries they produce. **(1 mark)**

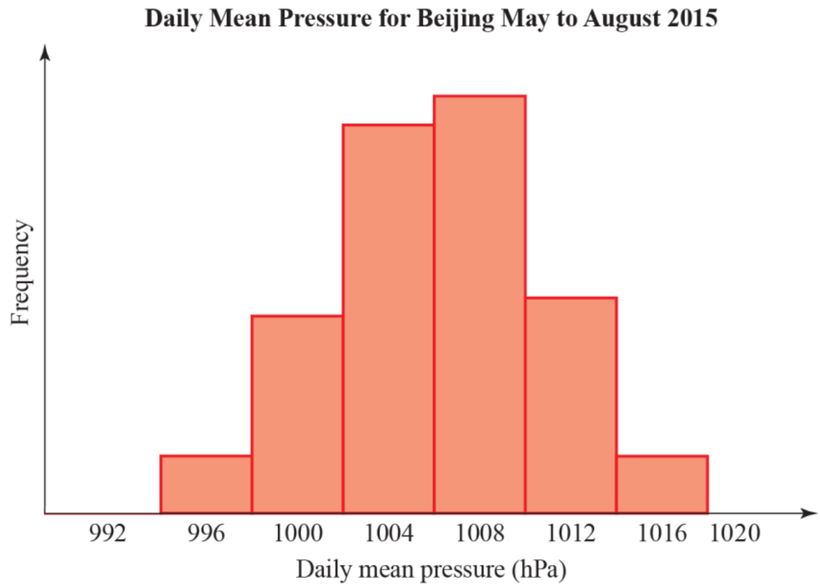
To test the manufacturer's claim, a random sample of 300 batteries were tested.

d State the hypotheses for a one-tailed test of the manufacturer's claim. **(1 mark)**

e Given that 184 of the 300 batteries lasted for at least 15 hours of continuous use a normal approximation to test, at the 5% level of significance, whether or not the manufacturer's claim is justified. **(7 marks)**

6 The summary statistics and histogram are an extract from statistical software output for the distribution of the daily mean pressure for Beijing, May to August (inclusive) 2015.

Figure 1



Variable	N	Mean	Standard deviation	Q_1	Q_2	Q_3
Daily Mean Pressure	123	1006	4.4	1003	1006	1010

a Explain why it is reasonable to model the daily mean pressure for Beijing, during May to August using a normal distribution. **(1 mark)**

The distribution for the daily mean pressure for Beijing, May to August 2015, X, can be modelled by a normal distribution.

Daily mean pressure (hPa)	Suggests
Above 1013	Good weather
Between 1013 and 1000	Fair weather
Less than 1000	Poor or bad weather
Less than 980	Hurricane

b Based on the statistical output and the information in the table above, what is the chance of poor or bad weather in Beijing during May to August? **(2 marks)**

c Although very unlikely, based on the model in part **a**, give a reason why we cannot say there is no chance of a hurricane in Beijing during May to August. **(1 mark)**

The distribution for daily mean pressure for Jacksonville during May to August can also be considered normally distributed with mean 1017 hPa and standard deviation 3.26 hPa. A student claims that you can depend on better weather in Jacksonville than in Beijing during May to August.

d State, giving reasons, whether the information in this question supports this claim. **(4 marks)**

7 The mean body temperature for women is normally distributed with mean 36.73°C with variance 0.1482 $(°\mathrm{C})^2$. Kay has a temperature of 38.1°C.

a Calculate the probability of a woman having a temperature greater than 38.1°C. **(2 marks)**

b Advise whether should Kay get medical advice. Give a reason for your advice. **(1 mark)**