

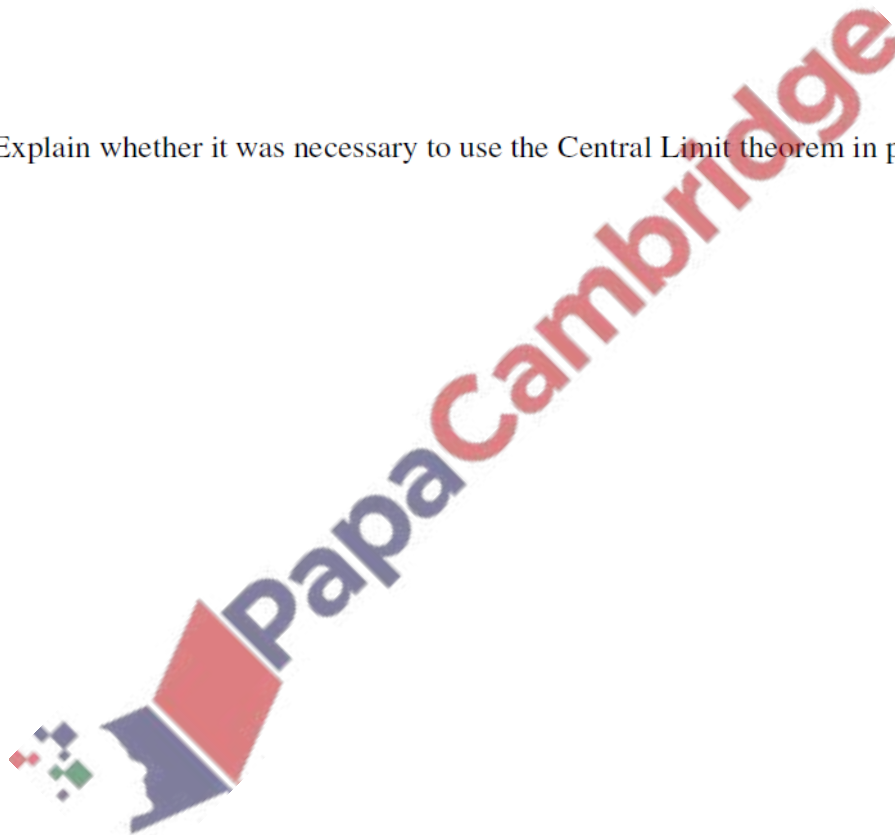
**1. Nov/2020/Paper\_9709/61/No.6**

Anjan wishes to test whether his mean journey time is different on Tuesdays. He chooses a random sample of 30 Tuesdays and finds that his mean journey time for these 30 Tuesdays is 40.2 minutes. Assume that the standard deviation for his journey time on Tuesdays is 6.9 minutes.

**(b) (i)** State, with a reason, whether Anjan should use a one-tail or a two-tail test. [1]

**(ii)** Carry out the test at the 10% significance level. [5]

**(iii)** Explain whether it was necessary to use the Central Limit theorem in part **(b)(ii)**. [1]



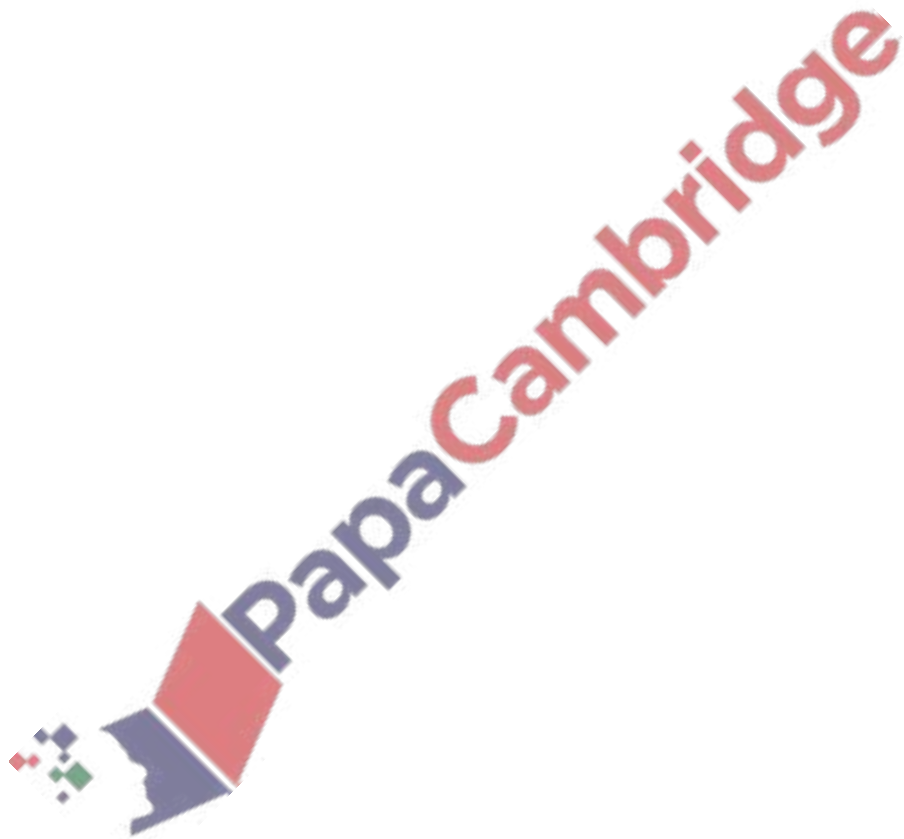
2. Nov/2020/Paper\_9709/62/No.4

The areas,  $X \text{ cm}^2$ , of petals of a certain kind of flower have mean  $\mu \text{ cm}^2$ . In the past it has been found that  $\mu = 8.9$ . Following a change in the climate, a botanist claims that the mean is no longer 8.9. The areas of a random sample of 200 petals from this kind of flower are measured, and the results are summarized by

$$\Sigma x = 1850, \quad \Sigma x^2 = 17\,850.$$

Test the botanist's claim at the 2.5% significance level.

[8]



3. Nov/2020/Paper\_9709/62/No.6

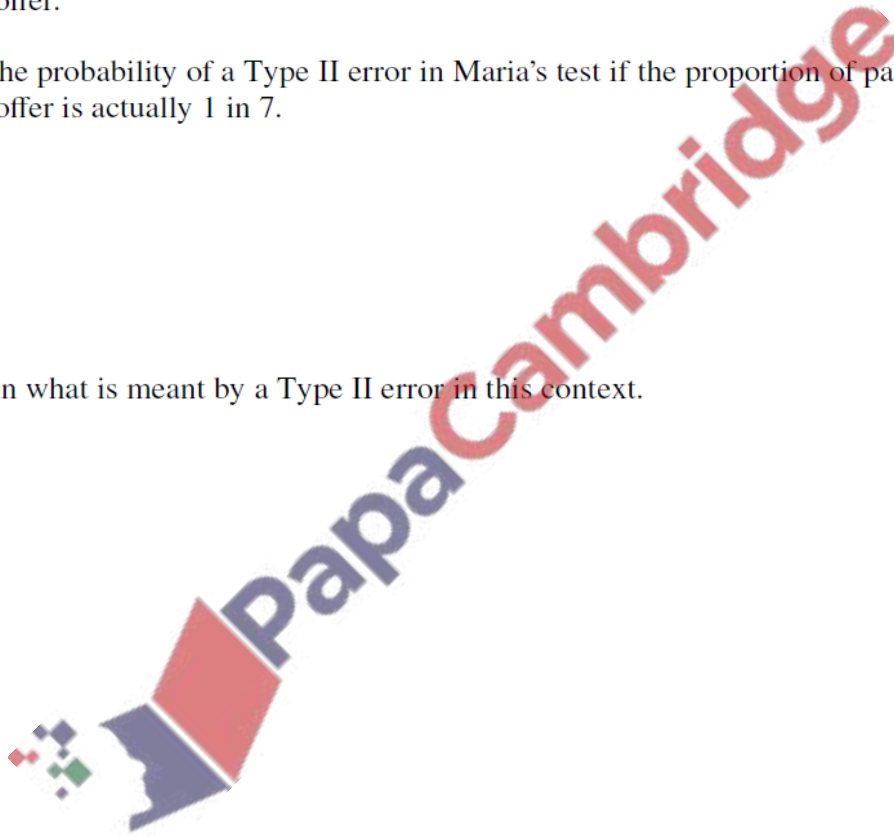
A biscuit manufacturer claims that, on average, 1 in 3 packets of biscuits contain a prize offer. Gerry suspects that the proportion of packets containing the prize offer is less than 1 in 3. In order to test the manufacturer's claim, he buys 20 randomly selected packets. He finds that exactly 2 of these packets contain the prize offer.

(a) Carry out the test at the 10% significance level. [5]

(b) Maria also suspects that the proportion of packets containing the prize offer is less than 1 in 3. She also carries out a significance test at the 10% level using 20 randomly selected packets. She will reject the manufacturer's claim if she finds that there are 3 or fewer packets containing the prize offer.

Find the probability of a Type II error in Maria's test if the proportion of packets containing the prize offer is actually 1 in 7. [3]

(c) Explain what is meant by a Type II error in this context. [1]

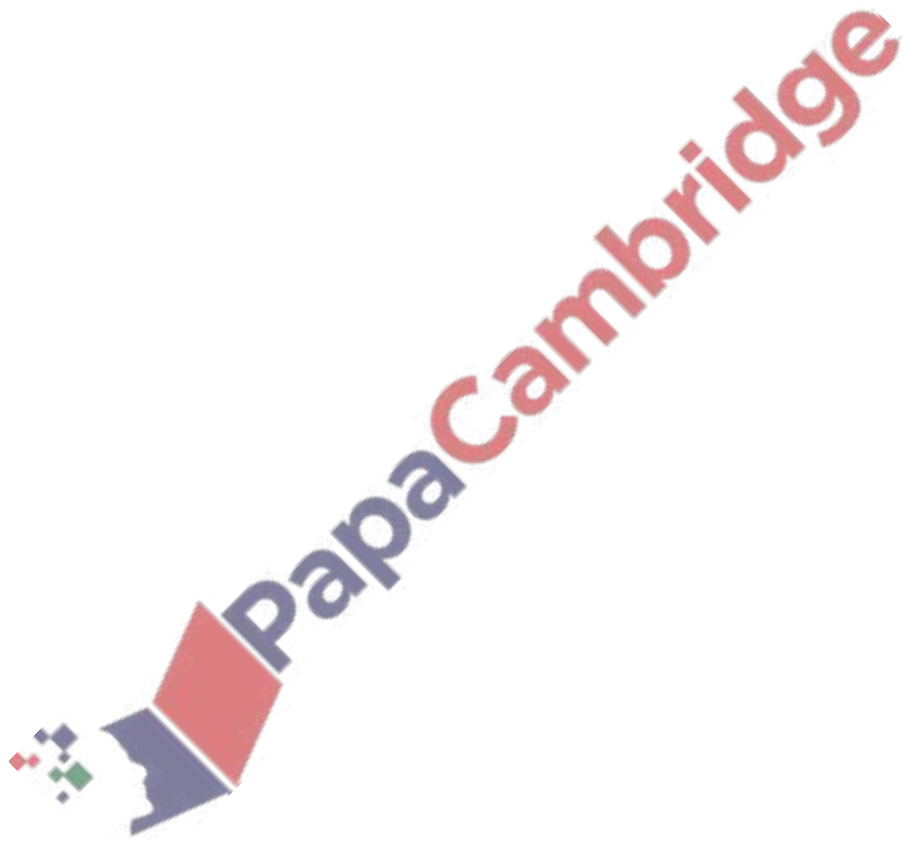


4. June/2020/Paper\_9709/61/No.2

In the past the yield of a certain crop, in tonnes per hectare, had mean 0.56 and standard deviation 0.08. Following the introduction of a new fertilizer, the farmer intends to test at the 2.5% significance level whether the mean yield has increased. He finds that the mean yield over 10 years is 0.61 tonnes per hectare.

(a) State two assumptions that are necessary for the test. [2]

(b) Carry out the test. [5]



5. June/2020/Paper\_9709/61/No.4

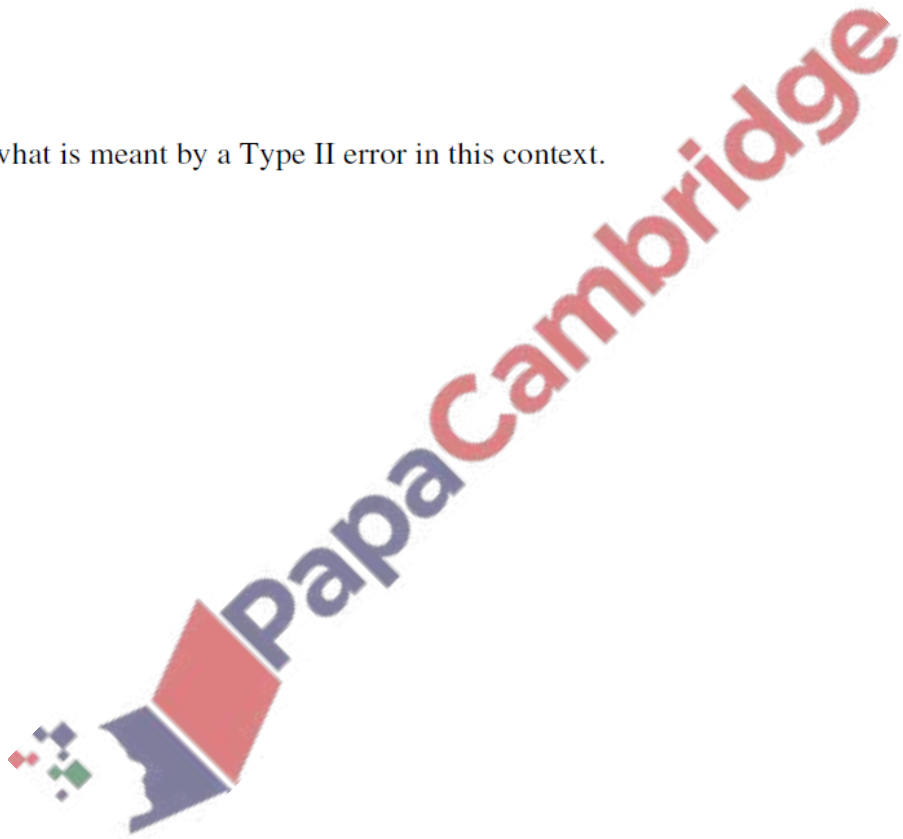
A fair spinner has five sides numbered 1, 2, 3, 4, 5. The score on one spin is denoted by  $X$ .

(a) Show that  $\text{Var}(X) = 2$ . [1]

Fiona has another spinner, also with five sides numbered 1, 2, 3, 4, 5. She suspects that it is biased so that the expected score is less than 3. In order to test her suspicion, she plans to spin her spinner 40 times. If the mean score is less than 2.6 she will conclude that her spinner is biased in this way.

(b) Find the probability of a Type I error. [4]

(c) State what is meant by a Type II error in this context. [1]



6. June/2020/Paper\_9709/62/No.2

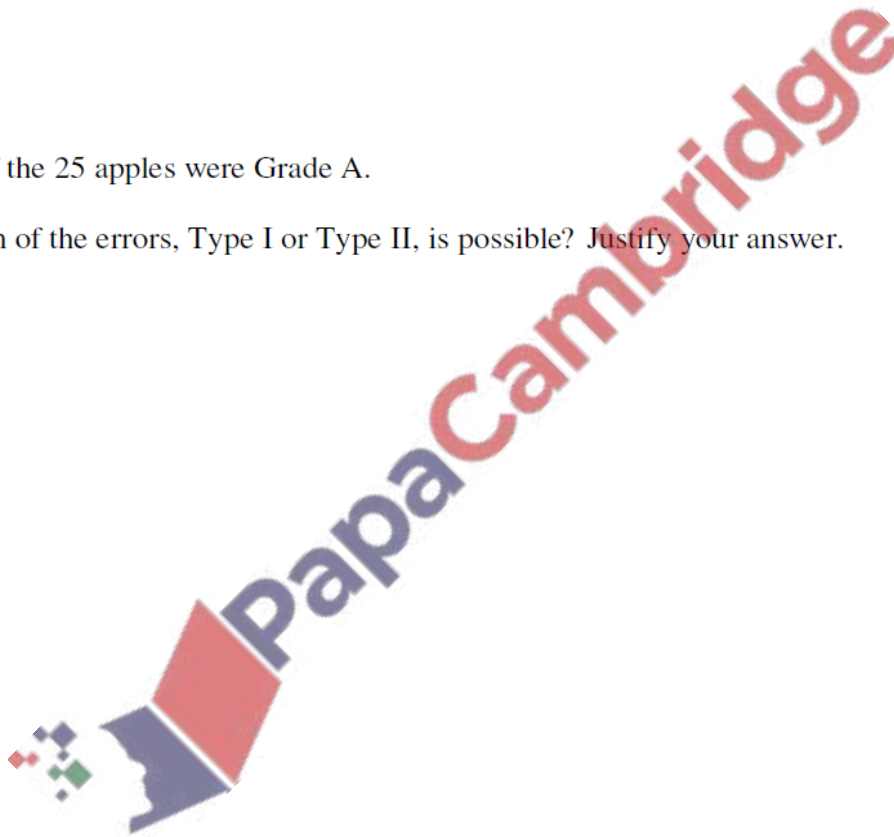
A shop obtains apples from a certain farm. It has been found that 5% of apples from this farm are Grade A. Following a change in growing conditions at the farm, the shop management plan to carry out a hypothesis test to find out whether the proportion of Grade A apples has increased. They select 25 apples at random. If the number of Grade A apples is more than 3 they will conclude that the proportion has increased.

(a) State suitable null and alternative hypotheses for the test. [1]

(b) Find the probability of a Type I error. [3]

In fact 2 of the 25 apples were Grade A.

(c) Which of the errors, Type I or Type II, is possible? Justify your answer. [2]



7. June/2020/Paper\_9709/63/No.7

A market researcher is investigating the length of time that customers spend at an information desk. He plans to choose a sample of 50 customers on a particular day.

- (a) He considers choosing the first 50 customers who visit the information desk.

Explain why this method is unsuitable.

[1]

The actual lengths of time, in minutes, that customers spend at the information desk may be assumed to have mean  $\mu$  and variance 4.8. The researcher knows that in the past the value of  $\mu$  was 6.0. He wishes to test, at the 2% significance level, whether this is still true. He chooses a random sample of 50 customers and notes how long they each spend at the information desk.

- (b) State the probability of making a Type I error and explain what is meant by a Type I error in this context.

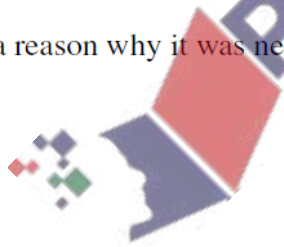
[2]

- (c) Given that the mean time spent at the information desk by the 50 customers is 6.8 minutes, carry out the test.

[5]

- (d) Give a reason why it was necessary to use the Central Limit theorem in your answer to part (c).

[1]



8. March/2020/Paper\_9709/62/No.7

A national survey shows that 95% of year 12 students use social media. Arvin suspects that the percentage of year 12 students at his college who use social media is less than the national percentage. He chooses a random sample of 20 students at his college and notes the number who use social media. He then carries out a test at the 2% significance level.

(a) Find the rejection region for the test. [4]

(b) Find the probability of a Type I error. [1]

(c) Jimmy believes that the true percentage at Arvin's college is 70%. Assuming that Jimmy is correct, find the probability of a Type II error. [3]

