<u>Hypothesis Tests – 2021 A2 Nov S2</u>

1	Nov	/2021	/Paper	9709	/61	/No 5
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a)		proportion of people having a particular medical condition is 1 in 100 000. A random sample 500 people is obtained. The number of people in the sample having the condition is denoted 7.
	(i)	State, with a justification, a suitable approximating distribution for X , giving the values of any parameters. [2]
	(ii)	Use the approximating distribution to calculate $P(X > 0)$. [2]
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)	The percentage of people having a different medical condition is thought to be 30%. A researcher suspects that the true percentage is less than 30%. In a medical trial a random sample of 28 people was selected and 4 people were found to have this condition.
	Use a binomial distribution to test the researcher's suspicion at the 2% significance level. [5]
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The masses, in grams, of apples from a certain farm have mean μ and standard deviation 5.2. The farmer says that the value of μ is 64.6. A quality control inspector claims that the value of μ is actually less than 64.6. In order to test his claim he chooses a random sample of 100 apples from the farm.	
(a)	The mean mass of the 100 apples is found to be 63.5 g.
	Carry out the test at the 2.5% significance level. [5]

2. Nov/2021/Paper_9709/61/No.7

(Given that the value of μ is in fact 62.7, calculate the probability of a Type II error.
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of 1	00 fireworks of this kind. Each firework in the sample is lit and the time it lasts is noted.
(a)	Give a reason why it is necessary to take a sample rather than testing all the fireworks of this kind.
It is	given that the population standard deviation of the times that fireworks of this kind last is 5 seconds.
(b)	The mean time lasted by the 100 fireworks in the sample is found to be 29 seconds.
	Test the inspector's suspicion at the 1% significance level. [5]
(c)	State with a reason whether the Central Limit theorem was needed in the solution to part (\mathbf{b}) . [1]

A certain kind of firework is supposed to last for 30 seconds, on average, after it is lit. An inspector suspects that the fireworks actually last a shorter time than this, on average. He takes a random sample

3. Nov/2021/Paper_9709/62/No.4

the probability of it producing the digit 0 is less than $\frac{1}{10}$. In order to test his suspicion he notes the number of times the digit 0 occurs in 30 digits produced by the machine. He carries out a test at the 10% significance level.	
(a)	State suitable null and alternative hypotheses. [1]
(b)	Find the rejection region for the test. [4]
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(c)	State the probability of a Type I error. [1]

A machine is supposed to produce random digits. Bob thinks that the machine is not fair and that

4. Nov/2021/Paper_9709/62/No.6

(d) Find the probability of a Type II error. [3] (e) Explain the meaning of a Type II error in this context. [1]

It is now given that the machine actually produces a 0 once in every 40 digits, on average.