**GREENWOOD COLLEGE**

**Mathematics Methods Units 3 & 4**

**Test 7 Interval Estimates for Proportions 2019**

Name Mark **/18**

**All electronic devices must be switched off and in bags.**

**Access to Formulae Sheet allowed. No notes.**

**No calculators allowed in this section. Time limit 20 minutes.**

1. [2,2 = 4 marks]

**a)** Under what two circumstances can you assume that the distribution of sample proportions of a distribution is normally distributed?

**b)** If has mean and standard deviation  **,** what are the mean and standard deviations of the distribution of 64 sample proportions?

2. [1,3,3 = 7 marks]

The amount of granulated coffee dispensed to make a cup of coffee is uniformly distributed from 4.5g to 5.5g.

**a)** State the probability that in any cup of coffee produced by this coffee machine that the mass of granulated coffee used is more than 5.4g

The machine was used 36 times and the proportion of times more than 5.4 g of granulated coffee was dispensed was recorded. This was repeated 100 times so that a collection of 100 sample proportions was obtained.

**b)** Describe the sampling distribution of sample proportions of size 36 for the mass of granulated coffee dispensed exceeding 5.4g, stating its mean and standard deviation.

**c)** Describe the frequency distribution of the 100 sample proportions of the mass of granulated coffee used exceeding 5.4g, stating its mean and standard deviation.

3. [3,4 = 7 marks]

A student planned to investigate what proportion of the 1260 students at their school had access to more than one computer at home.

**a)** The student thought of the following three ways to select a sample from the population. Briefly discuss the main source of bias in each method.

**i)** Wait at the bus-bay after school and ask the first 50 students who show up.

**ii)** Advertise the survey in a whole school assembly and ask the first 50 students who volunteer to stay behind.

**iii)** Select and ask every 100th student from the school roll.

**b)** Assuming that 80% of students had access to more than one computer at home, the student carried out 100 simulations in which a sample proportion was calculated from a random sample of 64 students.

(i) Explain why it is reasonable to expect that the distribution of the sample proportions would approximate normality.

(ii) Determine the mean and standard deviation of the normal distribution that the sample proportions would approximate.

END OF SECTION

**GREENWOOD COLLEGE**

**Mathematics Methods Units 3 & 4**

**Test 7 Interval Estimates for Proportions 2019**

Name Mark **/36**

**All electronic devices must be switched off and in bags.**

**Access to Formulae Sheet and one sheet of A4 notes allowed. Use of approved calculators is assumed in this section.**

**Time limit 35 minutes.**

**4.** **[ 5,1,2,2,3 = 13 marks]**

The fat content (in grams) of 30 randomly selected pasties at a local Greenwood bakery was recorded:

15.1 14.8 13.7 15.6 15.1 16.1 16.6 17.4 16.1 13.9

17.5 15.7 16.2 16.6 15.1 12.9 17.4 16.5 13.2 14.0

17.2 17.3 16.1 16.5 16.7 16.8 17.2 17.6 17.3 14.8

**a)** Determine a 90% confidence interval for the mean fat content of all pasties made at this bakery.

**b)** Make a summary statement of your findings in part **a)**.

**c)** What would be the equivalent 95% confidence interval in this situation?

**d)** Compare the margins of error in both instances.

**e)** What sample size would be required to maintain a margin of error of 0.3g with a 95% confidence interval?

**5. [ 3,1 = 4 marks]**

A regular pentagon spinner has sectors numbered 1, 1, 2, 3 , 4 . Estimate the probability that when the pentagon is spun 400 times, the result of 1 occurs:

**a)** more than 37.5% of the time

**b)** less than 43.75% of the time

**6. [ 4,3,3 = 10 marks]**

An unbiased six-sided die is rolled 75 times. This is repeated 200 times to form 200 samples each consisting of 75 rolls of the die. Event S is defined as the roll of the die that produces a six.

**a)** Calculate the probability that a randomly chosen sample has a sample proportion of event S that exceeds 15%.

**b)** Estimate with reasons the expected number of samples with sample proportions of event S that exceeds 15%.

**c)** In a separate experiment the same die was rolled times. Determine if the standard deviation of the sampling distribution of this event is not to exceed 0.04.

**7. [ 5,2,2 = 9 marks]**

The management at a conference centre was concerned about the quality of the free pens that it provided in its meeting rooms. A staff member tested a random sample of 150 pens and found that 18 of them fail to write.

**a)** If is the true proportion of pens that fail to write and is the corresponding sample proportion, use the above sample to determine

**i)** .

**ii)** the approximate margin of error for a 98% confidence interval for .

**iii)** an approximate 98% confidence interval for .

**b)** The stationery company that supplies pens to the conference centre claim that no more than 3 in 50 pens fail to write. Use your previous working to comment on the validity of this claim.

**c)** Comment on how the margin of error would change in (a) (ii) if

**i)** the quality of the pens had been better.

**ii)** the required level of confidence decreased.

END OF PAPER