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|  | **MATHEMATICS METHODS UNIT 3 & 4**  **TEST 6 2018**  **Calculator Free** |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Reading Time: 1 minute Time Allowed: 20 minutes Total Marks: 20

**Question 1**  **(11 Marks)**

A sample of 900 people found that 180 were able to twitch their nose without moving any other face muscles.

(a) What is the sample proportion () for people able to twitch their nose? (1 mark)

(b) If we were to take many such samples, what would you expect the standard deviation of the sample proportions to equal? (3 marks)

(c) Describe the distribution of sample proportions for sample size 900. (2 marks)

(d) Given that 95.5% of the scores are within 2 standard deviations from the mean, what would be the 95.5% confidence interval for the sample proportion of people who could twitch their nose?

(2 marks)

(e) Using this sample proportion, if you randomly selected 3 people, what is the probability that exactly 2 could twitch their nose? (3 marks)

**Question 2 (4 marks)**

(a) State what you understand by a census. (1 mark)

Each stove produced by AK Appliances is stamped with a unique serial number. AK Appliances produces stoves in batches of 2000. Before selling them, they test a random sample of 5 to see what electric current overload they will take before breaking down.

(b) Give one reason, other than to save time and cost, why a sample is taken rather than a census.

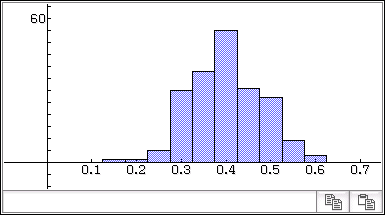
(1 mark)

(c) Suggest a suitable method to obtain this sample. (1 mark)

(d) Identify the units to be sampled using this method. (1 mark)

**Question 3 (5 marks)**

1. A number of sample proportions ( ) each of the same size (50) gave rise to the graph shown below.



Sample proportions

Number of samples

1. Approximately, how many samples were involved (1 mark)
2. Estimate , the population proportion. (2 marks)
3. A local radio station carries out regular polls of its listeners on items of current interest. In one such poll, listeners were asked to telephone the station and just answer yes or no to the following question:

*Should the AFL introduce the red card send-off rule into all games?*

The poll was carried out between 8:00 am and 9:00 am one morning.

Give two problems associated with this method of sampling and suggest why each problem might cause misleading conclusions to be drawn. (2 marks)

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Reading Time: 2 minutes Time Allowed: 37 minutes Total Marks: 37

Question 4 (8 marks)

From a random survey of 524 users of a free music streaming service, it was found that 386 would stop using it if they had to pay.

(a) Based on this survey, calculate the percentage of users who would stop using the service. (1 mark)

(b) Calculate the approximate margin of error for a 90% confidence interval estimate of the proportion of users who would stop using the service. (3 marks)

1. Determine a 90% confidence interval for the proportion of users who would stop using the service.

(2 marks)

(d) If 50 identical surveys were carried out and a 90% confidence interval for the proportion was calculated from each survey, determine the probability that exactly 48 of the intervals will contain the true value of the proportion. (2 marks)

**Question 5 (8 marks)**

A researcher wants to estimate the proportion of Western Australian school-aged students who participate in organised sport during school holidays. The researcher plans to collect sample data by visiting schools and asking students.

(a) Discuss two different sources of bias that may occur when the researcher collects their sample data and suggest a procedure to avoid bias. (4 marks)

(b) Determine, to the nearest 10, the sample size the researcher should use to ensure that the margin of error of a 90% confidence interval is no more than 6%. (3 marks)

(c) Comment on how your answer to (b) would change if the researcher had a reliable estimate that the population proportion was close to 20%. (1 mark)

Question 6 (6 marks)

A random sample of 510 rabbits from a nature reserve are captured, tagged and then set free. After a suitable interval, during which time it is assumed that the rabbit population does not change, another random sample of 300 rabbits is caught and 18 of these are observed to be tagged.

(a) Show that a point estimate for the size of the rabbit population is 8 500. (1 mark)

(b) Construct a 90% confidence interval for the proportion of rabbits in the population that are tagged.

(2 marks)

(c) Deduce an approximate 90% confidence interval for the number of rabbits in the reserve. (3 marks)

**Question 7 (9 marks)**

A Mathematics test is used to compare Year 4 students throughout the State.

8000 students sit for the test each year and are classified as competent or not.

This year a random sample of 90 students was tested, with 54 being classified as competent.

(a) What is meant by a random sample? (1 mark)

(b) Calculate a point estimate for the mean. (1 mark)

(c) Determine a 90% confidence interval for the population proportion.

Show working, including the margin of error. (4 marks)

The test was administered to two other random samples.

(d) Use the 90% confidence interval determined for the proportion of Year 4 students to

comment on the following random samples.

(i) 50 students were tested and 35 were classified as competent. (1 mark)

(ii) 120 students were tested and 71 were classified as competent. (2 marks

**Question 8 (6 marks)**

A researcher asked 100 voters from a certain town who they would be voting for in the upcoming election. The proportion who said they would vote for Dr Alexander was 35%.

(a) State the population and the sample in this case. (2 marks)

1. Explain one method that would allow to select an unbiased random sample of 100 voters.

(1 mark)

(c) Assuming the original sample of 100 was an unbiased random sample, determine the probability that in another sample of 200 voters, between 30% and 40% would vote for Dr Alexander. (3 marks)