Problem Sheet 6

MA1202, Introductory Statistics

Due date - 24/04/2022, 23:59 BST

General information

Please upload your work to Blackboard as a single pdf document which is of good quality. Read the **Instructions on Scanning and Uploading handwritten work**. Please name your file *PS6*YourName*Date*.pdf.

Please submit to Blackboard only solutions to questions from Section 1.

Please prepare questions from Section 2 for Feedback Session - you are expected to participate in discussion of these questions.

Section 1. [to be submitted to Blackboard by 24/04/22]

Question 1.

i) Suppose a sample of size n is to be drawn from a normal distribution where σ is known to be 14.3. How large does n have to be to guarantee that the width of the 95% confidence interval for μ is less than 3.06?

ii) What confidence level would be associated with each of the following intervals? Assume that the random variable Y is normally distributed and that σ is known.

(a) $(\bar{Y} - 1.64 \cdot \sigma/\sqrt{n}, \bar{Y} + 2.33 \cdot \sigma/\sqrt{n})$

(b) $(-\infty, \bar{Y} + 2.58 \cdot \sigma/\sqrt{n})$

Question 2.

i) Let X be the Binomial random variable with parameters p and $n = 400$. If the observed value of X is 120, find a 95% confidence interval for p.

ii)In each of the following questions a margin of error, a confidence level, and a likely range for the observed value of the sample proportion are specified. Obtain a sample size that will ensure a margin of error of at most the one specified.

a) margin of error = 0.01; confidence level = 95%; likely range = 0.2 to 0.4;

b) margin of error = 0.02; confidence level = 90%; likely range = 0.2 or less.

Section 2. [to be discussed in FS on 28/04/22]

Question 3.

An experimental laboratory developed a new fast-growing onion and they want to determine the average time μ (in days) from planting the seed to its maturity (appearance of a developed bulb, tops bent over, etc.). Taking a sample of 67 measurements they observed that $\bar{x} = 71.2$ days. What is the 95% confidence interval for these measurements, if from preliminary studies we know that the standard deviation of time-to-maturity is $\sigma = 8.3$ days.

Question 4.

In a trial of 280 patients who received 10 mg doses of a drug daily, 42 reported a headache as a side effect. Use the information above to complete parts i) through iii).

i) Justify if the true value of the proportion of population can be estimated using the approximation by standard normal random variable.

ii) Construct a 90% confidence interval for the population proportion of drug users who will report a headache as a side effect.

iii) Interpret the confidence interval.