

SOLUTIONS

Marks: /34

Calculator Allowed

1. [5 marks]

a) Explain what is meant by a simple random sample.

A sample such that all possible samples of required size have an equal chance of being selected.

[1]

b) Explain briefly how you could use your ClassPad to select a simple random sample of size 12 from a list of the 70 junior members of a tennis club.

Number the members from 1 – 70.

RandList (12, 1, 70)

[2]

c) Give an example of a situation in which you might choose to take a stratified sample and explain why.

Own choice + explanation

[2]

2. [4 marks]

A group of would-be card sharks are investigating the results of dealing a card from a well-shuffled pack and checking its suit. Each card shark dealt a card 50 times,

replacing and shuffling the cards before dealing the next one. They counted the number of times the card was a diamond and recorded the proportion of times out of 50.

a) State the parameters for p .

$$p = 0.25; (1 - p) = 0.75; n = 50$$

[2]

b) What would be the mean and standard deviation of these results?

$$E(p) = p = 0.25; SD(p) = \sqrt{\frac{0.25 \times 0.75}{50}} = 0.061$$

[2]

6. [6 marks]

A cinema advertising company employed a market research team to measure the effectiveness of the advertisements shown during film sessions.

The first 100 film-goers who left the 9pm session at a cinema complex were asked to recall the advertisements that they had seen. Of these, 58 recalled at least one advertisement.

a) Using the information above, calculate an approximate 90% confidence interval for the true proportion of film-goers who recalled at least one advertisement. Round your answer to 2 decimal places.

$$p = \frac{58}{100} = 0.58$$

$$CI = 0.58 \pm 1.645 \times \sqrt{\frac{0.58 \times 0.42}{100}} = [0.4988, 0.6612] = [0.50, 0.66]$$

[3]

From the information collected, the marketing research team claimed that 'more than half' of the film-goers recall cinema advertisements.

b) (Given the sampling process and the confidence interval you have calculated, do you think that this claim is fair? Give two reasons for your answer.

NO, because:

✓ The selection process is not truly random. It consisted of the first people to leave a single, late evening session and so this group may be unrepresentative of all film-goers.

✓ While 50% lies near the lower end of the CI, it is possible that less than 50% can recall an advertisement. So strictly speaking the market research claim is not justified.

[3]

7. [3 marks]

The tourist information centre staff in Elizabeth Quay want to determine the proportion of people to within 2%, at a level of confidence of 99%, to work out whether they should request a new tourist advertisement campaign.

How many enquiries, to the nearest 50, would need to be noted at the information centre?

$$Use \hat{p} = 0.5 \quad n = \frac{z^2 \hat{p}(1 - \hat{p})}{0.02^2} = \frac{2.576^2 \times 0.5 \times 0.5}{0.02^2} = 4147.36$$

$$or \quad n = \frac{E^2}{z^2 \hat{p}(1 - \hat{p})} = \frac{0.01^2}{2.576^2 \times 0.5 \times 0.5} = 16589.44$$

[3]

Would require either 4150 or 16 600 enquiries

3. [5 marks]

As part of a Biology practical testing germination rates, each student saturated and placed 300 seeds in an incubator. When Mitch checked his incubator 5 days later, he found that 250 had germinated. Dr van Lieshout asks the class to calculate a 95% confidence interval based on their findings.

a) Find the confidence interval that should be obtained by Mitch.

$$\hat{p} = \frac{250}{300} = \frac{5}{6}$$
$$CI = \frac{5}{6} \pm 1.96 \times \sqrt{\frac{\frac{5}{6} \times \frac{1}{6}}{300}} = [0.7912, 0.8755]$$

[3]

Assuming that all the students calculate their confidence interval correctly,

b) State the proportion of the students you would expect to have a confidence interval that includes the population proportion of the distribution.

$$95\% = \frac{19}{20}$$

c) Explain why the probability of any one student's confidence interval including the population proportion is not 0.95.

The confidence interval either does, or does not, include the true population proportion ∴ probability is 0 or 1.

[1]

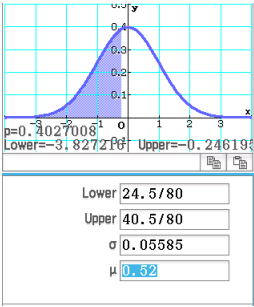
4. [5 marks]

52% of Australian students travel to school by car. What is the probability that between 25 and 40 students from a sample of 80 students travel by car?

*Check $np = 80 \times 0.52 = 41.6$
 $n(1 - p) = 80 \times 0.48 = 38.4$ } > 10 or that sample size > 30 so
can use the normal distribution as a model.*

$$X \sim N(0.52, 0.05585^2)$$
$$SD = \sqrt{\frac{p(1 - p)}{n}} = 0.05585$$

prob	0.4027008
z Low	-3.827216
z Up	-0.246195
σ	0.05585
μ	0.52



$$P\left(\frac{24.5}{80} < X < \frac{40.5}{80}\right) = 0.4027$$

[5]

5. [6 marks]

The number of customers, x, waiting in Nick's barber's shop in Angelo St is defined by this probability distribution:

x	0	1	2	3	4	5
P(x)	0.2	0.3	0.3	0.1	0.04	0.06

a) Determine the mean and the standard deviation of this distribution.

$$mean = 1.66 \quad SD = 1.336$$

[2]

Mr Purdue went to get a haircut from Nick on 10 occasions last year and the average number of customers waiting was 1.9.

b) Is he correct in assuming this sample proportion is part of a normal distribution? Justify your answer.

Not really as sample size is too small. (Should be ≥ 30)

[1]

c) Use an appropriate probability model to determine whether, for a sample of 50 customers, an average of 1.9 customers or more waiting is consistent with the data calculated in part a).

$$Z \sim N(0, 1^2) \quad Z = \frac{1.9 - 1.66}{1.336} = 0.1796$$

Yes, as it is 0.18σ above the mean.

[3]