SAMPEL PERCUMA

Kertas Trial STPM Semester 3 Mathematics T Pahang 2024

Set penuh: Kertas Percubaan STPM

Semester 3 · 10 subjek (2024)

Sampel ini: 4 muka surat. Set penuh ada:

- 2 fail PDF
- Semester 1: kertas percubaan (trial) negeri, subjek yang dipilih + skema
- Blueprint 30 hari Semester 1 (setiap subjek)
- Semester 3: percubaan 2024, 10 subjek, banyak negeri, soalan + skema dalam satu fail

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Sampel bermula di muka surat sebelah

4. A survey was conducted to find the proportion of student owning smart phone. 350 interviewed and 130 of them said that they owned a smart phone.
(a) Calculate an approximate 95% confidence interval for the proportion of the student who own smart phone. State any assumption you have made. [5 marks]

(b) Estimate the size of the random sample required for an approximate 95% confidence interval to have a width of 0.04. [3 marks]

5. A questionnaire was sent to a large number of people, asking for their opinions about a proposal to alter an examination syllabus. A researcher claims that at least 90% of their respondent in favour of the proposal. Of the 450 replies received, 396 were in favour of the proposal. Test the researcher's claim at 5% significance level. [6 marks]

6. A wholesaler of a popular brand of televisions offers 3 basic product lines which are plasma, LCD and LED televisions. Before a sales promotion aimed at highlighting advantages of LED televisions, the percentage sales of the 3 categories plasma, LCD and LED televisions was 20%, 30% and 50% respectively. Of a random sample of 50 televisions sold after the promotion, the number of categories plasma, LCD and LED televisions sold was 18, 12 and 20 respectively.

Perform a chi-squared test, at the 2.5% significance level, to determine whether there is an evidence that the wholesaler's claim is justified. [7 marks]

Section B [15 marks]

Answer* one *question only.

You may answer all the questions, but only the first answer will be marked.

7. The number of e-mail enquiries received per day, x , by an online customer service centre for a new company over a month is recorded in the table below.

x	0	1	2	3	4	5
Number of days	5	5	7	7	4	2

(a) Calculate the mean and variance of the data. Hence, explain why the Poisson distribution could be a suitable model for the data. [6 marks]

(b) Using the mean obtained in (a) and assuming that the data follows a Poisson distribution, find the probability that
(i) between one and two e-mails, inclusive, are received during any one day. [3 marks]
(ii) a maximum of one e-mail is received during any two-day period. [3 marks]

(c) The number of phone enquiries received per day by the company also follows a Poisson distribution with mean λ. Find the largest λ , correct to two decimal places, such that the probability at least one phone enquiry is received in any one day is not less than 0.95. [3 marks]

8. (a) A population of observations, on the duration customers spent time in a restaurant in minutes, is distributed normally with mean 100 and standard deviation 30. For a random sample with size 36,

(i) Find the probability that the difference between the sample mean and the population mean is less than 10. [4 marks]

(ii) Find the values of a and b such that the probability that the mean of the sample lies between a and b is 0.95, where $a < b$. [5 marks]

(b) A population of the weights of bags of potatoes has a normal distribution with mean 52 kg and standard deviation 8 kg.

(i) If a lorry has the capacity to carry a load of mean weight 54.4 kg, find the probability that a load consisting of 50 bags will exceed the capacity of the lorry. [3 marks]

(ii) If a load consisting of 40 bags exceeds the capacity of a lorry with a probability of only 1%, find the capacity of the lorry, correct to two decimal places. [3 marks]

MATHEMATICAL FORMULAE (RUMUS MATEMATIK)

Summary statistics (*Statistik ikhtisar*)

For ungrouped data (Bagi data tak terkumpul)

$$k^{\text{th}} \text{ percentile} \\ \text{(Persentil ke-}k\text{)} = \begin{cases} \dfrac{x_r + x_{r+1}}{2}, & \text{if } r = \left(\dfrac{k}{100}\right)n \text{ is an integer (jika } r = \left(\dfrac{k}{100}\right)n \text{ ialah integer)} \\ x_{[r]}, & \text{if } r = \left(\dfrac{k}{100}\right)n \text{ is not an integer (jika } r = \left(\dfrac{k}{100}\right)n \text{ bukan integer)} \end{cases}$$

$$\text{Standard deviation} \\ \text{(Sisihan piawai)} = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}} = \sqrt{\frac{\Sigma x^2}{n} - \bar{x}^2}$$

For grouped data (Bagi data terkumpul)

$$k^{\text{th}} \text{ percentile} \\ \text{(Persentil ke-}k\text{)} = L_k + \left[\frac{\left(\frac{k}{100}\right)n - F}{f_k}\right]c$$

$$\text{Standard deviation} \\ \text{(Sisihan piawai)} = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{\Sigma f}} = \sqrt{\frac{\Sigma f x^2}{\Sigma f} - \bar{x}^2}$$

Probability distributions (*Taburan kebarangkalian*)

Binomial distribution (Taburan binomial)

$$\mathrm{P}(X = x) = \binom{n}{x} p^x (1-p)^{n-x}, \; x = 0, 1, 2, \ldots, n$$

Poisson distribution (Taburan Poisson)

$$\mathrm{P}(X = x) = \frac{\mathrm{e}^{-\lambda}\lambda^x}{x!}, \; x = 0, 1, 2, \ldots$$

Chi-squared tests (*Ujian khi kuasa dua*)

Test statistic (Statistik ujian)

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$$

	$E(T) = [0-0] + \left(\frac{-1}{3}\right)[0-1]$	M1 sub limits
	$E(T) = \frac{1}{3}$	A1
		Total = 8 marks

4. A survey was conducted to find the proportion of student owning smart phone. 350 interviewed and 130 of them said that they owned a smart phone.

(a) Calculate an approximate 95% confidence interval for the proportion of the student who own smart phone. State any assumption you have made. [5 mark]

(b) Estimate the size of the random sample required for an approximate 95% confidence interval to have a width of 0.04. [3 marks]

Q4	**SCHEME**	**MARKS**
4(a)	$\hat{p} = \frac{130}{350} = 0.371$ / 0.3714 / 0.37143	
	95% C.I = $\left(\hat{p} \pm z\sqrt{\frac{pq}{n}}\right)$ $= (0.371 - 1.96\sqrt{\frac{0.371 \times 0.629}{350}}, 0.371 + 1.96\sqrt{\frac{0.371 \times 0.629}{350}})$ = (0.321, 0.422) / (0.3208, 0.4221) / (0.32081,0.42205)	B1 for 1.96 M1 for $\sqrt{\frac{pq}{n}}$ M1 correct formula A1 (3,4,5 s.f)
	Assumption: random sample was taken	B1
4(b)	Width = 0.04	
	$2 \times 1.96\sqrt{\frac{0.371 \times 0.629}{n}} = 0.04$	M1
	$n = 2241.2$	M1
	$n = 2242$	A1
		Total = 8 marks

5. A questionnaire was sent to a large number of people, asking for their opinions about a proposal to alter an examination syllabus. A researcher claims that at least 90% of their respondent in favour of the proposal. Of the 450 replies received, 396 were in favour of the proposal. Test the researcher's claim at 5% significance level. [6 marks]

Q5	**SCHEME**	**MARKS**
5.	$H_0 : p = 0.90$ $H_1 : p < 0.90$	B1 (both correct)
	$\hat{p} \sim N(0.90, \frac{0.90 \times 0.10}{450})$	
	$\alpha = 5\%, z = -1.645$	B1
	$\hat{p} = \frac{396}{450} = 0.88$	
	$z = \frac{0.88 - 0.90}{\sqrt{\frac{0.90 \times 0.10}{450}}}$	M1
	$z = -1.414$	A1
	$Since\ z = -1.414 > -1.645$ ∴ Do not reject H_0.	M1
	There is sufficient evidence at 5% significance level to conclude that at least 90% of their respondent in favour of the proposal.	A1
		Total = 6 marks

TAMAT SAMPEL

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