SAMPEL PERCUMA

Skema Jawapan Trial STPM Mathematics T Semester 3

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

1. The following data shows the marks by 24 students in a particular test.

23	39	52	20	65	88	51	22
48	37	41	25	37	38	59	59
68	46	23	69	42	41	95	40

(a) Construct a stemplot to represent the data. [2]
(b) Determine the median and interquartile range. [4]
(c) Comment on the shape of the distribution. [1]

a	Stem | Leaf 2 | 0 2 3 3 5 3 | 7 7 8 9 4 | 0 1 1 2 6 8 5 | 1 2 9 9 6 | 5 8 9 7 | 8 | 8 9 | 5 Key : 3 | 7 means 37 marks	D1 At least one stem with the correct leaf D1 (all correct)
b)	Median $=\frac{x_{12}+x_{13}}{2}=\frac{41+42}{2}=41.5$ $Q_1=\frac{x_6+x_7}{2}=\frac{37+37}{2}=37$ or $Q_3=\frac{x_{18}+x_{19}}{2}=\frac{59+59}{2}=59$ IQR = 59 – 37 = 22	B1 M1 (either one correct) M1 A1
c)	The distribution is skewed to right / positively skewed because $Q_3-Q_2>Q_2-Q_1$	A1

2. A factory produces microchips using 3 types of machines *S*, *T* and *U*. Machines *S*, *T* and *U* produce 33%, 21% and 46% of the microchips respectively.
The quality control department finds out that the percentages of defective microchips produced by machines *S*, *T* and *U* are 3.6%, 4.3% and 3.1% respectively.
(a) Determine the probability that a microchip selected at random is defective. [2]
(b) If the microchip is defective, calculate the probability that the microchip is produced by
(i) machine *S*,
(ii) machine *T* or machine *U*. [4]

2	(a) P(defective) = 0.33 × 0.036 + 0.21 × 0.043 + 0.46 × 0.031	M1
	= 0.035170	A1
	(b) (i) P(S|D) = $\frac{0.33\times0.036}{0.03517}$	M1
	= 0.33779	A1
	(ii) P((T ∪ U)|D) = $\frac{0.21\times0.043+0.46\times0.031}{0.035170}$	M1
	= 0.66221	A1

3. The continuous random variable *X* has probability density function

$$f(x) = \begin{cases} ax + b\ , & -1 \le x \le c \\ 0\ , & otherwise \end{cases}$$

with P ($X \le -\frac{1}{2}$) = $\frac{1}{16}$ and P ($X \ge \frac{1}{2}$) = $\frac{7}{16}$.

(a) Calculate the values of a and b and show that c = 1. [5]

(b) Find the cumulative probability distribution. [3]

3 (a)	P($X \le -\frac{1}{2}$) = $\frac{1}{16}$ $\int_{-1}^{-\frac{1}{2}} ax + b\ dx = \frac{1}{16}$ $\left[\frac{ax^2}{2} + bx\right]_{-1}^{-\frac{1}{2}} = \frac{1}{16}$ $-\frac{1}{8}a - \frac{1}{2}b - \left(\frac{1}{2}a - b\right) = \frac{1}{16}$ -6a+8b = 1 ……..(1) f(x)= $\int_{-1}^{c} ax + b\ dx = 1$ ($\frac{ac^2}{2}$ +bc) – ($\frac{a}{2}$ - b)= 1 ……(3) (2) – (3) : $6a - 24b = -9$ ... (4) (1) + (4) : $-16b = -8$ From (1), (2) and (3) a = $\frac{1}{2}$, b = $\frac{1}{2}$ c = 1 (shown)	P($X \ge \frac{1}{2}$) = $\frac{7}{16}$ $\int_{\frac{1}{2}}^{c} ax + b\ dx = \frac{7}{16}$ $\left[\frac{ax^2}{2} + bx\right]_{\frac{1}{2}}^{c} = \frac{7}{16}$ ($\frac{ac^2}{2}$ + bc) – ($\frac{a}{8}$ + $\frac{b}{2}$) = $\frac{7}{16}$ ……..(2)	B1 M1 (3 equations correct) M1 A1 (a, b value) A1
b	for -1 $\le x \le$ 1 , F (x)= $\int_{-1}^{x} \frac{1}{2}t + \frac{1}{2}dt$ = $\frac{1}{4}$ (x^2 +2x+1) F(x) = $\begin{cases} 0\ , & x < -1 \\ \frac{1}{4}(x^2 + 2x + 1)\ , & -1 \le x \le 1 \\ 1\ , & x > 1 \end{cases}$		M1 A1 A1
			[8 marks]

4. In a random sample of 50 postgraduate students in a university, 36 students are satisfied with the services at the main library of the university.
   (a) Determine the smallest sample size needed to estimate the population proportion with an error not exceeding 0.1 at the 95% confidence level. State any assumption made. [6]
   (b) State the effect on the sample size
      (i) if the error is larger than 0.1 with the confidence level unchanged, [1]
      (ii) if the confidence level is higher than 95% with the error unchanged. [1]

4 (a)	$\hat{p} = \frac{36}{50} = \frac{18}{25}$	B1
	$Z_{\frac{\alpha}{2}} = Z_{0.025} = 1.960$	B1
	$1.960\sqrt{\frac{\frac{18}{25}\times\frac{7}{25}}{n}} \leq 0.1$	M1
	$n \geq \left(1.960\frac{\sqrt{\frac{18}{25}\times\frac{7}{25}}}{0.1}\right)^2$	
	$n \geq 77.447$	
	The smallest sample size needed is 78.	A1
	The number of students who are satisfied with the services is assumed to be normally distributed.	A1 B1
b(i)	The sample size decrease	B1
(ii)	The sample size increase	B1

5. A report claims that 15 percent of Malaysian teenagers play digital games on average for at least 3 hours every day. Choo is asked by his teacher to investigate his belief that a higher percentage of teenagers play digital games on average for at least 3 hours every day. Choo finds that, of the 12 students in his class, 3 of them report an average of at least 3 hours every day. Test, at the 10 % level of significance, whether the corresponding population percentage for teenagers is higher than 15 percent. [6]

5	H_o: $p = 0.15$ H_1: $p > 0.15$	B1 (Both)
	$X \sim B(12, 0.15)$ if H_o is true, $P(X \geq 3) = 1 - P(X = 0, 1, 2)$	M1
	$= 1 - {}^{12}_{0}C(0.15)^0(0.85)^{12} - {}^{12}_{1}C(0.15)^1(0.85)^{11} - {}^{12}_{2}C(0.15)^2(0.85)^{10}$	M1
	$= 0.26418$	A1
	Since 0.26418 > 0.10, do not reject H_0	M1
	There is insufficient evidence to conclude that the corresponding population percentage for teenager is higher than 15 percent at 10% significance level.	A1

6. Five geese are observed over a period of 140 days and the number of eggs collected each day is recorded and summarized as shown below.

Number of eggs (x)	0	1	2	3	4	5
Number of days (f)	2	10	27	42	39	20

Perform a chi-squared test, using a 10% significance level to test whether the above data fit a binomial model with parameter $n = 5$ and $p = \frac{2}{3}$. [10]

6.	H_o : The data fit a binomial distribution with n = 5 and $p = \frac{2}{3}$. H_1 : The data do not fit a binomial distribution with n = 5 and $p = \frac{2}{3}$. Probability : $P(X = x) = {}^5C_x \left(\frac{2}{3}\right)^x . \left(\frac{1}{3}\right)^{5-x}$ $E_i = P(X = x) \times 140$	B1
	X: 0 | 1 | 2 | 3 | 4 | 5 O_i: 2 | 10 | 27 | 42 | 39 | 20 Prob.: $\frac{1}{243}$ | $\frac{10}{243}$ | $\frac{40}{243}$ | $\frac{80}{243}$ | $\frac{80}{243}$ | $\frac{32}{243}$ E_i: 0.5761 | 5.761 | 23.05 | 46.09 | 46.09 | 18.44	B1 M1 A1
	x: 0 and 1 | 2 | 3 | 4 | 5 Observed Freq, O_i: 12 | 27 | 42 | 39 | 20 Expected Freq, E_i: 6.337 | 23.05 | 46.09 | 46.09 | 18.44	M1
	$\chi^2 = \frac{(12-6.337)^2}{6.337} + \frac{(27-23.05)^2}{23.05} + \frac{(42-46.09)^2}{46.09} + \frac{(39-46.09)^2}{46.09} + \frac{(20-18.44)^2}{18.44}$	M1
	= 7.3232	A1
	Degree of freedom, ν = 5 – 1 = 4 and $\chi^2_{0.1,4} = 7.779$	B1
	Since $\chi^2 = 7.3232 < 7.779$, do not reject H_o	M1
	There is sufficient evidence to conclude that the data fit a binomial distribution with n = 5 and $p = \frac{2}{3}$ at 10% significant level.	A1

TAMAT SAMPEL

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