SAMPEL PERCUMA

Kertas Trial STPM Semester 3 Mathematics T Johor 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

5. An egg producer sets a target that 70% of his egg production should be Grade A. In a random sample of 80 eggs, 46 are found to be Grade A.

(a) Perform a test, at 5% significant level, to determine whether the egg production is failing to reach the target. [6]

(b) Explain what you understand by the 5% significant level in the context of the question. [1]

6. The grades in a statistics examination for a group of students in a particular school is shown on the table below.

Grade	A	B	C	D	E
Number of students	13	27	21	8	11

Perform a test at the 2.5% significance level to determine whether the distribution of grades is uniform. [8]

Section B (15 marks)

Answer **any one** *questions in this section*

7. A farmer grows a type of seed, with each seed having an 8% probability of failing to germinate.

(a) Twenty seeds are selected randomly.

(i) State the distribution that is suitable to model this situation. [2]

(ii) Calculate the probability that exactly 6 seeds fail to germinate. [2]

(iii) Find the probability that at least 4 seeds fail to germinate. [3]

(b) Out of 150 seeds selected at random, find, using a suitable approximation, the probability that between 10 to 16 seeds fail to germinate. Justify the choice of your approximation. [8]

8. A particular factory is known to produce candles with longer burning times. A random sample of 100 candles is tested, and their burning times, in hours, are summarized as follows.

$$\sum(x-30) = -153\,, \quad \sum(x-30)^2 = 1375.11$$

(a) What do you understand by a 95% confidence interval for the population mean, μ? [1]

(b) State with a reason, whether it is necessary to assume the mean burning times of the candles to have a normal distribution. [2]

(c) Find the unbiased estimate of the mean and variance of the burning times of the candles. [4]

(d) Find the percentage associated with a confidence interval that is constructed based on the above data to estimate the mean burning times of the candles to be within ± 0.9. Hence, state the confidence interval. [7]

(e) For the same percentage of confidence interval, it is desired to reduce the width of the confidence interval constructed above. Suggest a way to achieved it. [1]

2. A survey was implemented on 400 students at a private university in order to collect information on the popular choice of minor subjects (Language, Statistics and Information Technology) by students of various major of study (Medicine, Engineering and Economics). The following table describes the data collected from the survey.

Minor \ Major	Medicine (Me)	Engineering (En)	Economic (Ec)	Total
Language (L)	30	80	30	140
Statistics (S)	10	30	10	50
Information Technology (I)	60	120	30	210
Total	100	230	70	400

If a student from the group is selected at random, what is the probability that he

(a) is either majoring in Medicine or doing a minor in Information Technology? [2]

(b) choose a minor in Statistics knowing that he is an Economics student? [2]

(c) is neither an Engineering student who does a minor Statistic nor is an Economics student who does a minor in Language? [3]

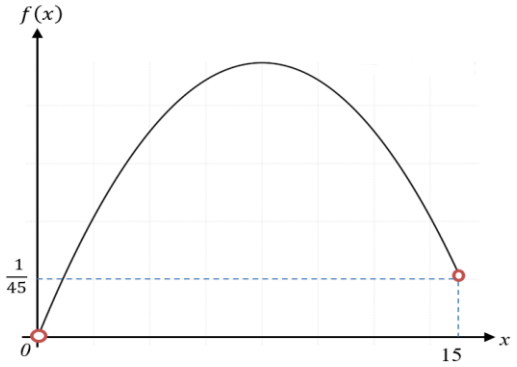
No.	Answers	Mark	Remarks
(a)	$P(\text{Me} \cup \text{I}) = P(\text{Me}) + P(\text{I}) - P(\text{Me} \cap \text{I})$		
	$= \frac{100}{400} + \frac{210}{400} - \frac{60}{400}$	M1	Use the formula for $P(\text{Me} \cup \text{I})$ correctly.
	$= \frac{5}{8}$	A1	
(b)	$\text{P}(\text{S}\|\text{Ec}) = \frac{\text{P}(\text{S} \cap \text{Ec})}{\text{P}(\text{Ec})}$		
	$= \frac{\frac{10}{400}}{\frac{70}{400}}$	M1	Use the formula for $\text{P}(\text{S}\|\text{Ec})$ correctly.
	$= \frac{1}{7}$	A1	
(c)	$\text{P}[(\text{En} \cap \text{S})' \cap (\text{Ec} \cap \text{L})']$		
	$= \text{P}[(\text{En} \cap \text{S}) \cup (\text{Ec} \cap \text{L})]'$ $= 1 - \text{P}[(\text{En} \cap \text{S}) \cup (\text{Ec} \cap \text{L})]$	M1	Use the formula for $\text{P}[(\text{En} \cap \text{S})' \cap (\text{Ec} \cap \text{L})']$ correctly.
	$= 1 - \left(\frac{30}{400} + \frac{30}{400}\right)$	M1	
	$= \frac{17}{20}$	A1	
Q2	Total	7	

3. Let X be a continuous random variable representing the lifespan, in years, of a new type of handphone memory card such that

$$P(X \geq x) = \begin{cases} 1 & , \quad x \leq 0 \\ 1 - \frac{1}{2025}(24x^2 - x^3) & , \quad 0 < x < 15 \\ 0 & , \quad x \geq 15 \end{cases}$$

(a) Determine the probability density function, $f(x)$ and sketch its graph. [5]

(b) Find the expected lifespan of a randomly chosen memory card. [3]

No	Answers	Mark	Remarks
(a)	$P(X \leq x) = 1 - P(X > x)$		
	$= 1 - \left[1 - \frac{1}{2025}(24x^2 - x^3)\right]$	M1	Find cumulative distribution function correctly.
	$P(X \leq x) = \frac{1}{2025}(24x^2 - x^3), 0 < x < 15$ or $F(x) = \frac{1}{2025}(24x^2 - x^3), 0 < x < 15$	A1	Ignore $0 < x < 15$.
	For $0 < x < 15$, $f(x) = \frac{d}{dx}\left[\frac{1}{2025}(24x^2 - x^3)\right] = \frac{1}{2025}(48x - 3x^2)$	M1	Depend on 1st M1
	$f(x) = \begin{cases} \frac{x}{675}(16 - x) & , \quad 0 < x < 15 \\ 0 & , \quad \text{otherwise} \end{cases}$	A1	All correct. Accept $\frac{1}{675}(16x - x^2)$
		D1	A maximum curve from $0 < x < 15$. 0 and 15 seen. Indicate end point $\left(15, \frac{1}{45}\right)$ or (15,0.0222) At least one circle seen at $x = 0$ or $x = 15$.
(b)	$E(X) = \int_0^{15} xf(x)dx$		
	$= \int_0^{15} \frac{x}{675}(16x - x^2)dx$	B1	
	$= \frac{1}{675}\int_0^{15} (16x^2 - x^3)dx$		
	$= \frac{1}{675}\left[\frac{16x^3}{3} - \frac{x^4}{4}\right]_0^{15}$	M1	Find the integral correctly. Subs. limits
	$= \frac{1}{675}\left[\frac{16(15)^3}{3} - \frac{(15)^4}{4} - 0\right]$		
	$= \frac{95}{12}$ or $7\frac{11}{12}$	A1	Accept 7.917 // 7.9167
Q3	Total	8	

Suggested Answer Scheme

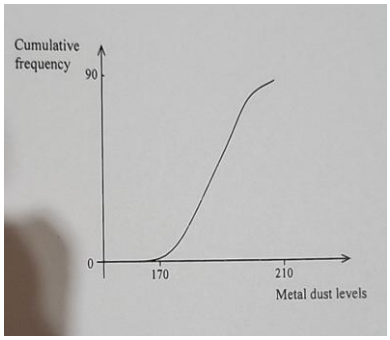
1 Overexposure to a certain metal dust at the workplace of a factory is detrimental to the health of its workers. The workplace is considered safe if the level of the metal dust is less than 198 $\mu g\ m^{-3}$. The level of the metal dust at the workplace is recorded at a particular time of day for a period of 90 consecutive working days.

The results are summarized in the table below.

Metal dust level ($\mu g\ m^{-3}$)	Number of days
170 – 174	8
175 – 179	11
180 – 184	25
185 – 189	22
190 – 194	15
195 – 199	7
200 – 204	2

(a) State what does the number 15 in the table means. [1]

(b) Plot a cumulative frequency curve of the above data. Hence, estimate the percentage of days for which the workplace is considered unsafe. [5]

a) There are **15 days** which the **levels of metal dust** lie between **189.5 $\mu g\ m^{-3}$ and 194.5 $\mu g\ m^{-3}$**	1
b)  <table><tr><th>Metal dust level ($\mu g\ m^{-3}$)</th><th>Number of days</th></tr><tr><td>< 169.5</td><td>0</td></tr><tr><td>< 174.5</td><td>8</td></tr><tr><td>< 179.5</td><td>19</td></tr><tr><td>< 184.5</td><td>44</td></tr><tr><td>< 189.5</td><td>66</td></tr><tr><td>< 194.5</td><td>81</td></tr><tr><td>< 199.5</td><td>88</td></tr><tr><td>< 204.5</td><td>90</td></tr></table>	1 (Upper boundaries and corresponding cumulative frequencies) 1 (A smooth curve passes through all points **on graph** with suitable scale and labels)
Number of days above safety level = 4	1 (Obtained from graph at 198 $\mu g\ m^{-3}$. Accept 3 -4)
Percentage $= \frac{4}{90} \times 100\%$	1 (Allow 'his')
$= 4.44\%$	1✓

2 In a restaurant, the following information has been obtained:

65% of the employees are full-time employees,
55% of the employees are female,
35% of the employees are male full-time employees.
Find the probability that

(i) an employee chosen at random from all the employees in the restaurant is a part-time employee. [1]

(ii) an employee chosen at random from all the employees in the restaurant is female and a part-time employee [3]

(iii) an employee chosen at random from all the female employees in the college is a part-time employee. [2]

(i) P(part-time employee) $= 1 - 0.65$ $= 0.35$	1
(ii) P(Full-time) = P(male ∩ full-time)+P(female ∩ full-time) $0.65 = 0.35 +$P(female ∩ full-time) P(female ∩ full-time)=0.30 P(female and part time)=0.25	1 1 1
(iii) P(part-time | female) $= \frac{0.25}{0.55}$ $= \frac{5}{11}$ or 0.45455	1 1

TAMAT SAMPEL

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