AS Statistics Practice Paper B
45 Marks

45 Minutes

1. A teacher selects a random sample of 56 students and records, to the nearest hour, the time spent watching television in a particular week.

Hours	1 – 10	11 – 20	21 – 25	26 – 30	31 – 40	41 – 59
Frequency	6	15	11	13	8	3
Mid-point	5.5	15.5		28		50

a. Find the mid-points of the 21 - 25 hour and 31 - 40 hour groups. **(2)**

A histogram was drawn to represent these data. The 11 - 20 group was represented by a bar of width 4 cm and height 6 cm.

b. Find the width and height of the 26 - 30 group. **(3)**

c. Estimate the mean and standard deviation of the time spent watching television by these students. **(5)**

d. Use linear interpolation to estimate the median length of time spent watching television by these students. **(2)**

The teacher estimated the lower quartile and the upper quartile of the time spent watching television to be 15.8 and 29.3 respectively.

e. State, giving a reason, the skewness of these data. **(2)**

(Total marks: 14)

2. A bag contains a large number of counters with one of the numbers 4, 6 or 8 written on each of them in the ratio 5: 3: 2 respectively.

A random sample of 2 counters is taken from the bag.

The random variable M represents the mean value of the 2 counters.

a. Given that $P(M = 4) = \frac{1}{4}$ and $P(M = 8) = \frac{1}{25}$ find the sampling distribution for M. **(5)**

A sample of n sets of 2 counters is taken. The random variable Y represents the number of these n sets that have a mean of 8

b. Calculate the minimum value of n such that $P(Y \geq 1) > 0.9$ **(3)**

(Total marks: 8)

3. James takes a test with 20 mutiple-choice questions, each with 4 possible answers. James got 8 questions correct.

James' teacher believe that he guessed the answers.

Test James' teacher belief at the 5% significance level. **(5)**

(Total marks: 5)

4. The lifetime, X, of a particular brand of car tyre, measured in tens of thousands of miles, can be modelled by an exponential distribution with probability density function;

$$f(x) = \begin{cases} \frac{1}{3}e^{-\frac{x}{3}} & x > 0 \\ 0 & otherwise \end{cases}$$

Find the probability that a randomly selected car tyre's life time is between 30 000 and 40 000 miles. **(4)**

(Total marks: 4)

5. A cadet fires shots at a target at distances ranging from 25 m to 90 m. The probability of hitting the target with a single shot is p. When firing from a distance d m, $p = \frac{3}{200}(90 - d)$

Each shot is fired independently.

The cadet fires 10 shots from a distance of 40 m.

a. Find the probability that exactly 6 shots hit the target. **(3)**

b. Find the probability that at least 8 shots hit the target. **(2)**

The cadet fires 20 shots from a distance of x m.

c. Find, to the nearest integer, the value of x if the cadet has an 80% chance of hitting the target at least once. **(4)**

The cadet fires 100 shots from 25 m.

d. Using a suitable approximation, estimate the probability that at least 95 of these shots hit the target. **(3)**

(Total marks: 12)

6. Charlie is studying the time it takes members of his company to travel to the office.

He stands by the door to the office from 0840 to 0850 one morning and asks workers, as they arrive, how long their journey was.

State and briefly describe an alternative method of non-random sampling Charlie could have used to obtain a sample of 40 workers. **(2)**

(Total marks: 2)

Total Marks for Paper: 45

Mark Scheme

1a	23	**B1**
	35.5	**B1**
1b	Width of 10 units is 4cm so width of 5 units is 2cm	**B1**
	Height = 2.6 x 4 = 10.4cm	**M1** **A1**
1c	$\sum fx = 1316.5$ $\bar{x} = \frac{1316.5}{56}$	**M1**
	$\bar{x} = 23.5$	**A1**
	$\sum fx^2 = 37378.35$	**B1**
	$\sigma = \sqrt{\frac{37378.25}{56} - \bar{x}^2} = 10.7$	**M1** **A1**
1d	$Q_2 = (20.5) + \frac{28-21}{11} \times 5$	**M1**
	$Q_2 = 23.7$	**A1**
1e	$Q_3 - Q_2 = 5.6$ $Q_2 - Q_1 = 7.9$	**M1**
	$7.9 > 5.6$ Therefore, negative skew	**A1**

2a

$\bar{x}$	4	5	6	7	8
		$\frac{1}{2}\times\frac{3}{10}\times 2$	$\frac{3}{10}\times\frac{3}{10}+\frac{1}{2}\times\frac{1}{5}\times 2$	$\frac{3}{10}\times\frac{1}{5}\times 2$	
$P(\bar{X}=\bar{x})$	$\frac{1}{4}$	$\frac{3}{10}$	$\frac{29}{100}$	$\frac{3}{25}$	$\frac{1}{25}$

B1
B1
M1
M1A1

B1: 4,5,6,7,8 only no extras or omissions

B1: Writing or using $P(X=4)=\frac{1}{2}$, $P(X=6)=\frac{3}{10}$ and $P(X=8)=\frac{1}{5}$ May be seen in(a)

M1: A correct method for one of P(5), P(6) or P(7) may be implied by correct answer
M1: A correct method for two of P(5), P(6) or P(7) may be implied by correct answer

A1: fully correct table/list -need 4,5,6,7, 8 and their associated probabilities

2b

$1-\left(\frac{24}{25}\right)^n > 0.9$ **or** $\left(\frac{24}{25}\right)^n < 0.1$ **oe**	M1: $1-\left(\frac{24}{25}\right)^n > 0.9$ **or** $\left(\frac{24}{25}\right)^n < 0.1$ oe seen or used may use = or $\le$ instead of < = or $\ge$ instead of > Do Not award $\left(\frac{24}{25}\right)^n > 0.1$ **oe**	M1
$n > 56.4$	A1: Ignore any $n >$, $n <$, $n =$ *etc.* Award if you see awrt 56.4 may be implied by $n = 57$	A1
$n = 57$	A1: cao $n = 57$ or 57 on its own. Do not allow $n > 57$ or $n < 57$. Do not award if alternative values are given. You must check there is no incorrect working	A1

Alternative – trial and error

50	0.87	0.13
51	0.865	0.125
52	0.88	0.12
53	0.885	0.115
54	0.89	0.11
55	0.894	0.106
56	0.898	0.102
57	0.902	0.098
58	0.906	0.094
59	0.91	0.09
60	0.94	0.086

Allow awrt

	M1 at least 2 trials for $50 \le n \le 60$ shown with correct probabilities	M1
	A1 trial for $n = 56$ and 57 shown with correct probabilities	A 1
$n = 57$	A1: cao $n = 57$ or 57 on its own. Do not allow $n > 57$ or $n < 57$. Do not award if alternative values are given	A1

3	H_0: p = 0.25	**B1**

	H_1: p > 0.25	
	$X \sim B(20, 0.25)$	**A1**
	$P(X \geq 8) = 0.102$	**B1**
	0.102 > 0.05	**A1**
	Therefore accept hypothesis	**A1**

4	0.104	**M1** **M1** **M1** **A1**

5a	$X \sim B(10, 0.75)$	**B1**
	$P(X = 6) = P(X \leq 6) - P(X \leq 5)$	**M1**
	= 0.145998... = 0.146	**A1**
5b	$X \sim B(10, 0.75)$ $P(X \geq 8) = P(X = 8) + P(X = 9) + P(X = 10)$	**M1**
	= 0.52559….	**A1**
5c	1 – P(0) = 0.8	**M1**
	$(1 - p)^{20} = 0.2$ $1 - p = 0.9227$ $p = 0.0773$	**A1**
	$\frac{3}{200}(90 - x) = 0.0773$	**M1**
	$x = 84.84$ $x = 85$	**A1**
5d	X – successes ~ B(100, 0.975)	**B1**
	Y – not successes ~ B(100, 0.025)	**M1**
	$P(Y \leq 5) = 0.958$	**M1**

6	Quota	**B1**
	Take 4 people every 10 minutes	**B1**