



A2 Statistics Practice Paper B

60 Marks



1. A teacher took a random sample of 8 children from a class. For each child, the teacher recorded the length of their left foot, f cm, and their height, h cm. The results are given in the table below.

f	23	26	23	22	27	24	20	21
h	135	144	134	136	140	134	130	132

(You may use $\Sigma f = 186$ $\Sigma h = 1085$ $S_{ff} = 39.5$ $S_{hh} = 139.875$ $\Sigma fh = 25291$)

a. Calculate S_{fh} (2)

b. Find the equation of the regression line of h on f in the form $h = a + bf$. Give the value of a and the value of b correct to 3 significant figures. (5)

c. Use the equation to estimate the height of a child with a left foot length of 25 cm. (2)

(Total marks: 9)

2. A spinner is designed so that the score S is given by the following probability distribution.

s	0	1	2	4	5
$P(S = s)$	p	0.25	0.25	0.20	0.20

Find the value of p . (2)

(Total marks: 2)

3. A speed camera is set up on a stretch of road where the speed limit is 50mph.

The speeds of vehicles passing the camera can be modelled by a normal distribution with a mean of 49mph and a standard deviation of 3.5mph.

What percentage of vehicles would be expected to be exceeding 55mph? (4)

(Total marks: 4)

4. The weights of women boxers in a tournament are normally distributed with mean 64 kg and standard deviation 8 kg.

The probability that a randomly chosen woman boxer in the tournament weighs less than 51 kg is 0.0520812...

In the tournament, women boxers who weigh less than 51 kg are classified as lightweight.



Ren weighs 49 kg and she has a match against another randomly selected, lightweight woman boxer.

- a. Find the probability that Ren weighs less than the other boxer. (4)

(Total marks: 4)

5. Past records show that the times, in seconds, taken to run 100 m by children at a school can be modelled by a normal distribution with a mean of 16.12 and a standard deviation of 1.60

A child from the school is selected at random.

- a. Find the probability that this child runs 100 m in less than 15 s. (3)

On sports day the school awards certificates to the fastest 30% of the children in the 100 m race.

- b. Estimate, to 2 decimal places, the slowest time taken to run 100 m for which a child will be awarded a certificate.

(4)

(Total marks: 7)

6. In a large restaurant an average of 3 out of every 5 customers ask for water with their meal.

A random sample of 10 customers is selected.

- a. Find the probability that exactly 6 ask for water with their meal. (3)

- b. Find the probability that less than 9 ask for water with their meal. (3)

A random sample of 50 customers is selected.

- c. Find the smallest value of n such that

$$P(X < n) \geq 0.9$$

where the random variable X represents the number of these customers who ask for water. (3)

(Total marks: 9)

7. On a randomly chosen day the probability that Bill travels to school by car, by bicycle or on foot is $\frac{1}{2}$, $\frac{1}{6}$ and $\frac{1}{3}$ respectively. The probability of being late when using these methods of travel is $\frac{1}{5}$, $\frac{2}{5}$ and $\frac{1}{10}$ respectively.

- a. Draw a tree diagram to represent this information. (3)

- b. Find the probability that on a randomly chosen day Bill travels by foot and is late (2)

- c. Find the probability that on a randomly chosen day Bill is not late. (2)

d. Given that Bill is late, find the probability that he did not travel on foot. (4)

(Total marks: 11)

8. In a company the 200 employees are classified as full-time workers, part-time workers or contractors. The table below shows the number of employees in each category and whether they walk to work or use some form of transport.

	Walk	Transport
Full-time worker	2	8
Part-time worker	35	75
Contractor	30	50

The events F, H and C are that an employee is a full-time worker, part-time worker or contractor respectively. Let W be the event that an employee walks to work.

An employee is selected at random.

a. Find $P(H)$ (2)

b. Find $P((F \cap W)')$ (2)

Let B be the event that an employee uses the bus.

c. Given that 10% of full-time workers use the bus, 30% of part-time workers use the bus and 20% of contractors use the bus, draw a Venn diagram to represent the events F, H, C and B, and find the probability that a randomly selected employee uses the bus to travel to work.

(6)

(Total marks: 10)

9. The number of students attending a show is summarised in the table below.

	Year 11	Year 12	Year 13
Male	70	30	15
Female	40	80	20

The organizer wants to take a sample of size 40. Using an appropriate method, state how the 40 students will be selected.

(4)

(Total marks: 4)

Total Marks for Paper: 60

Mark Scheme

1a	$S_{fh} = 25291 - \frac{186 \times 1085}{8}$	M1
	$= 64.75$	A1
1b	$b = \frac{64.75}{39.5}$	M1
	$b = 1.6392 \dots = 1.6$	A1
	$a = \frac{1085}{8} - b \times \frac{186}{8}$	M1
	$a = 97.512$	A1
	$h = 97.5 + 1.64f$	A1
1c	$h = 97.5 + 1.64 \times 25$	M1
	$h = 138 - 139cm$	A1
2	$p + 0.25 + 0.25 + 0.20 + 0.20 = 1$	M1
	$p = 0.1$	A1
3	$X \sim N(49, 3.5^2)$	M1
	$P(X > 55)$	M1
	$P(X > 55) = 1 - P(X < 55)$	M1
	$= 4.4\%$	A1
4	$P(W > 49 \mid W < 51)$	M1
	$\frac{P(49 < W < 51)}{P(W < 51)}$	M1
	$= \frac{0.021684}{0.05208}$	A1
	$= 0.4163$	A1
	$= 0.42$	
5a	$z = \frac{15 - 16.12}{1.6} = -0.70$	M1
	$P(Z < -0.70) = 1 - 0.7580$	M1
	$= 0.2420$	A1
5b	$P(T < t) = 0.30$	M1
	$z = \frac{t - 16.12}{1.6} = -0.5244$	A1
	$\frac{t - 16.12}{1.6} = -0.5244$	M1
	$t = 15.28$	A1
6a	$X \sim B(10, 0.6)$	B1
	$P(X = 6) = (0.6)^4 (0.4)^4 \frac{10!}{6!4!}$	M1
	$= 0.2508 \dots$	A1
	$= 0.251$	
6b	$X \sim B(10, 0.6)$	B1
	$P(X < 9) = 1 - P(X = 10) + P(X = 9)$	M1
	$= 1 - (0.6)^{10} - (0.6)^9 (0.4)^1 \frac{10!}{9!1!}$	
	$= 0.9536 \dots$ $= 0.954$	A1
6c	$X \sim B(50, 0.6)$ $Y \sim B(50, 0.4)$ $P(X < n) \geq 0.9$	M1
	$P(Y > 50 - n) \geq 0.9$ $P(Y \leq 50 - n) \leq 0.1$	M1

$50 - n \leq 15$ $n \geq 35$ $n = 35$	A1
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7a		<p style="text-align: center;">Correct tree All labels Probabilities on correct branches</p>
		<p style="text-align: center;">B1 B1 B1</p>

7b	$\frac{1}{3} \times \frac{1}{10}$ $= \frac{1}{30}$	M1
		A1
7c	$CNL + BNL + FNL = \frac{1}{2} \times \frac{4}{5} + \frac{1}{6} \times \frac{3}{5} + \frac{1}{3} \times \frac{9}{10}$ $= \frac{4}{5}$	M1
		A1
7d	$P(F' L) = \frac{P(F'nL)}{P(L)}$ $= \frac{\frac{1}{6} \times \frac{2}{5} + \frac{1}{2} \times \frac{1}{5}}{1 - \frac{4}{5}}$ $= \frac{5}{6}$	M1
		A1
		A1

8a	$\frac{35+75}{200}$ $= 0.55$	M1
		A1
8b	$\frac{200-2}{200}$ $= 0.99$	M1
		A1

8c		<p style="text-align: center;">Allow diagrams with intersections between F, C and H provided these are marked with 0.</p> <p style="text-align: center;">If their diagram indicates extra empty regions do not treat a blank as 0.</p>
	$\frac{1+16+33}{200} = 0.25$	<p style="text-align: center;">(4)</p> <p style="text-align: center;">M1 B1 for 9, 1 B1 for 77,33 B1 for 64,16</p> <p style="text-align: center;">M1 A1 (2)</p>

9	Stratified sampling	M1												
	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>Year 11</th> <th>Year 12</th> <th>Year 13</th> </tr> </thead> <tbody> <tr> <th>Male</th> <td>11</td> <td>5</td> <td>2</td> </tr> <tr> <th>Female</th> <td>6</td> <td>13</td> <td>3</td> </tr> </tbody> </table>		Year 11	Year 12	Year 13	Male	11	5	2	Female	6	13	3	<p style="text-align: center;">A1 (2 VALUES)</p> <p style="text-align: center;">A1 (4 VALUES)</p> <p style="text-align: center;">A1 (6 VALUES)</p>
	Year 11	Year 12	Year 13											
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