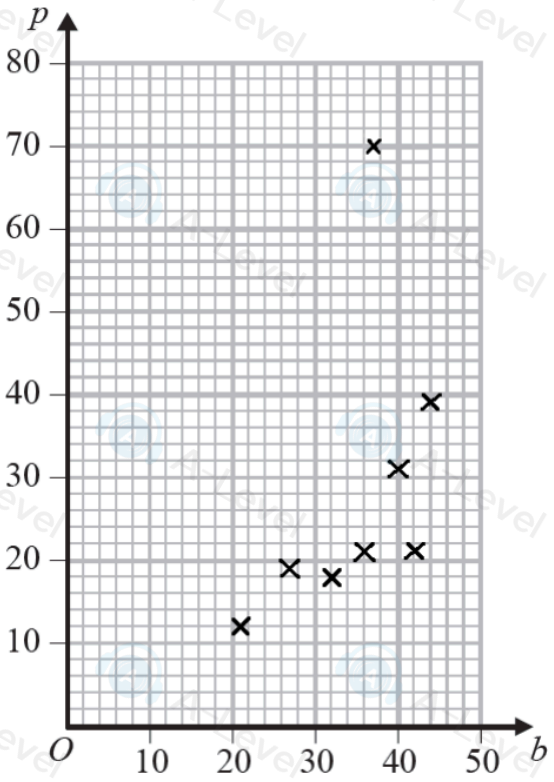
Question	Scheme	Marks
1. (a)	$S_{yy} = 39418 - \frac{560^2}{8}$	M1
	$= \underline{\mathbf{218}}$	A1cao (2)
(b)	$[r =] \frac{-710}{\sqrt{"218" \times 2587.5}}$	M1
	$= -0.945344...$ **awrt** -0.945	A1 (2)
(c)	As age increases, volume/blood (pumped) decreases (o.e.)	B1 (1)
(d)	**Yes** as r is close to -1 (if $r < -0.5$) or **Yes** as r is close to 1 (if $r > 0.5$) For ft, if $-0.5 \leq r \leq 0.5$ "**No** since r is close to 0"	B1ft (1)
(e)	$b = \frac{-710}{2587.5} = -0.27439...$ $\left(\text{allow } \frac{-284}{1035}\right)$ awrt -0.27	M1 A1
	$a = \frac{560}{8} - \text{'their } b\text{'} \times \frac{370}{8} [= 82.690...]$ so $\underline{\boldsymbol{y = 82.7 - 0.274x}}$	M1, A1 (4)
(f)(i)	$(y = 82.7 - 0.274 \times 40 =)\ 71.74..$ = awrt **72**	B1
(ii)	Should be reliable since interpolation (o.e.)	B1 (2)
		[12]

Question	Scheme	Marks
7.(a)		B1B1 (-1ee) (2)
(b)	For any sensible comment about H being far away from the other points. e.g. 'H is an outlier/anomaly', 'The blood protein/p/70 for H is much higher than the other patients', 'H does not follow the (linear) pattern', 'Data collected for H may be incorrect', etc.	B1 (1)
(c)	$r = \dfrac{369}{\sqrt{423\frac{5}{7} \times 490}} = 0.809826106$	M1A1 (2)
(d)	r would be closer to 0	B1 (1) **Total 6**

Question Number	Scheme	Marks
5. (a)	$[-2\times1000+20000]=(£)18000$	B1 (1)
(b)	$S_{wy}=2490-\frac{81\times405}{9}$ or $2490-3645$ $[=-1155]$	B1
	$r=\frac{"-1155"}{\sqrt{660\times2500}}$ or $\frac{"-1155"}{\sqrt{1650000}}=-0.899$ (*)	M1 A1cso (3)
(c)	–0.899 (or "same"); as (linear) coding does not have any effect on correlation	B1 (1)
(d)	$y=60.75-1.75\frac{(x-20000)}{1000}$	M1
	$y=95.75-0.00175x$	A1A1 (3)
(e)	$y=95.75-0.00175(21000)$ or $y=60.75-1.75(1)$	M1
	$y=59$ awrt **59**	A1 (2)
(f)	**Data:** $x=(£)18000$ to $x=(£)45000$ or **Franca:** $w=5$ to $w=20$	M1
	As this is interpolation, the estimates are reliable.	A1 (2)
		[12 marks]

2. The production cost, £c million, of a film and the total ticket sales, £t million, earned by the film are recorded for a sample of 40 films.

Some summary statistics are given below.

$$\sum c = 1634 \quad \sum t = 1361 \quad \sum t^2 = 82873 \quad \sum ct = 83634 \quad S_{cc} = 28732.1$$

(a) Find the exact value of S_{tt} and the exact value of S_{ct}

(3)

(b) Calculate the value of the product moment correlation coefficient for these data.

(2)

(c) Give an interpretation of your answer to part (b)

(1)

(d) Show that the equation of the linear regression line of t on c can be written as

$$t = -5.84 + 0.976c$$

where the values of the intercept and gradient are given to 3 significant figures.

(3)

(e) Find the expected total ticket sales for a film with a production cost of £90 million.

(2)

Using the regression line in part (d)

(f) find the range of values of the production cost of a film for which the total ticket sales are less than 80% of its production cost.

(2)

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Question Number	Scheme	Marks
4. (a)	$\sum f = 456$ or $\bar{f} = 57$ and $\sum f^2 = 26\,072$	M1, A1
	$[S_{ff}] = 26072 - \frac{456^2}{8}$ or $26\,072 - \frac{207936}{8}$ or $26\,072 - 25992 = 80$ (*)	A1 cso (3)
(b)	$[S_{hh}] = 610\,463 - \frac{2209^2}{8} = 502.875$ awrt **503**	M1, A1 (2)
(c)	$r = \frac{182}{\sqrt{80 \times "502.875"}} = 0.90739\ldots$ = awrt **0.907**	M1, A1 (2)
(d)	r is close to 1 or "strong" (positive) correlation (idea of "strong" required) … so **does** support the belief	B1ft (1)
(e)	$b = \frac{182}{80} = [2.275]$, $a = \frac{2209}{8} - b \times \frac{"456"}{8} = [276.125 - 129.675 = 146.45]$	M1, M1
	So $\boldsymbol{h = 146 + 2.28f}$ [Accept $h = 146 + 2.27f$]	A1A1 (4)
(f)	P($-3 < E < 3$) or $2P(0 < E < 3)$	M1
	$= \{2\}\ P\left(0 < Z < \frac{3}{4}\right)$	M1
	$= 2(0.7734 - 0.5) = 0.5468$ = awrt **0.547**	A1 (3)
		[Total 15]

2. (a)	$S_{dp} = 5240.8 - \frac{1029 \times 50.8}{10}$ [= 13.48]	M1
	$r = \frac{'13.48'}{\sqrt{344.9 \times 0.576}}$	M1
	= 0.9563834526.... awrt **0.956**	A1 (3)
(b)(i)	$w = 50 - p$	B1
(ii)	-1	B1 (2)
(c)	-0.956	B1ft (1)
		[6]
	Notes	

Question Number	Scheme	Marks
2 (a) (i)	$S_{yy} = 81938.5 - \frac{2015^2}{50} \left[= 734\right]$ *	B1*
(ii)	$r = \frac{219.55}{\sqrt{734 \times 72.25}} = 0.95338...$ awrt 0.953	M1 A1
		(3)
(b)	e.g. [In general] the longer the rabbit the greater the weight	B1ft
		(1)
(c)	Consistent/Yes as r/PMCC is close to 1	B1ft
		(1)
(d)	$b = \frac{219.55}{734} = 0.2991...$	M1 A1
	$a = \left(\frac{125}{50}\right) - 'b' \left(\frac{2015}{50}\right) \left[= -9.554...\right]$	M1
	$w = -9.55 + 0.299y$	A1
		(4)
(e)	$'-9.55' + '0.299' \times 45 = 3.905$ awrt 3.91	M1 A1ft
		(2)
	Notes	**Total 11**