Averages and Spread Sheet 2 Mark Scheme

Q1.

Qu	Scheme	Marks	AO
(a)	$\bar{x} = 10.2\ (2222\ldots)$ awrt **10.2**	B1 (1)	1.1b
(b)	$\sigma_x = 3.17\ (20227\ldots)$ awrt **3.17**	B1ft	1.1b
	Sight of "knots" or "kn" (condone knots/s etc)	B1 (2)	1.2
(c)	October ..... since	B1	2.2b
	it is windier in the autumn or month of the hurricane or latest month in the year	B1 (2)	2.4
(d)(i)	They represent outliers	B1	1.2
(ii)	Y has low median so expect lowish mean (but outlier so > 7) and	M1	2.4
	Y has big range/IQR or spread so expect larger st.dev Suggests B	A1 (3)	2.2b
		(8 marks)	

Q2.

Question	Scheme	Marks	AOs
(a)	Systematic (sample)	B1cao	1.2
(b)	In LDS some days have gaps because the data was not recorded	B1	2.4
(c)	$\left[\bar{t} = \frac{374}{20} = 18.7\right]$ $\sigma_t = \sqrt{\frac{7600}{20} - \bar{t}^2}$ $[= \sqrt{30.31}]$	M1	1.1a
	$= 5.5054\ldots$ awrt **5.51** (Accept use of $s_t = \sqrt{\frac{7600 - 20\bar{t}^2}{19}} = 5.6484\ldots$)	A1	1.1b
			(4 marks)

Part	Notes
(b)	B1 a correct explanation
(c)	M1 for a correct expression for $\bar{t}$ and σ_t or s_t. Ft an incorrect evaluation of $\bar{t}$
	A1 for σ_t = awrt 5.51 or s_t = awrt 5.65

Q3.

Question	Scheme	Marks	AOs
(a)	It is not possible to have a sampling frame	B1	2.3
		(1)	
(b)	Quota sampling **and** (catch 85 common carp, 45 mirror carp and 30 leather carp) **or** (ignore any fish caught of a type where the quota is full)	M1	1.1a
	Quota sampling **and** catch 85 common carp, 45 mirror carp and 30 leather carp **and** ignore any fish caught of a type where the quota is full	A1	1.1b
		(2)	
(c)	$\sigma = \sqrt{\frac{3053}{160} - \left(\frac{692}{160}\right)^2}$	M1	1.1b
	$= 0.6129\ldots$ awrt 0.613	A1	1.1b
		(2)	
(d)(i)	This would have no effect as the piece of data would remain in the same class	B1	2.2a
(ii)	This would increase the standard deviation as change in mean is small and $6.4 - 4.6 \approx 3\sigma$ therefore estimate of standard deviation will increase	B1	2.2a
		(2)	
			(7 marks)

Q4.

Question	Scheme	Marks	AOs
(a)	Tr(ace) (data needs to be converted to numbers before the calculation can be carried out)	B1	2.4
		(1)	
(b)	$[1+]\frac{138-131}{24} \times 4$	M1	2.1
	$= 2.1666\ldots$ awrt **2.17**	A1	1.1b
		(2)	
(c)	$\sigma = \sqrt{\frac{7704.1875}{184} - \left(\frac{539.75}{184}\right)^2} = 5.7676\ldots$ σ = awrt **5.77**	M1 A1	1.1b 1.1b
		(2)	
(d)(i)	Using class midpoints to estimate the mean assumes that the values are uniformly distributed **within the class(es)**.	B1	2.4
(ii)& (iii)	This is not the case here as the majority of the data (in the first class) are 0.	B1	2.3
	The actual mean is likely to be smaller than the estimate (since the first group has more values at 0 and close to 0)	dB1	2.2b
		(3)	
			(8 marks)

Q5.

	Scheme	Marks	AO
(a)	Hectopascal or hPa	B1 (1)	1.2
(b)	$\bar{x} = \bar{y} + 1010$ or $\frac{214}{30} + 1010$	M1	1.1b
	$= 1017.1333\ldots$ awrt **1017**	A1 (2)	1.1b
(c)	$\sigma_x = \sigma_y$ (or statement that standard deviation is not affected by this type of coding)	M1	3.1b
	$\left[\sigma_y =\right] \sqrt{\frac{5912}{30} - (\text{"7.13[33...]"})^2}$ or $\sqrt{146.1822\ldots}$	M1	1.1b
	$= 12.0905\ldots$ awrt **12.1**	A1 (3)	1.1b
(d)	High pressure (since approx. mean + sd) so clockwise Locations are (from North to South): Leuchars, Heathrow, Hurn	B1	2.4
	Wind direction is direction wind blows from So: Heathrow (**NE**) Hurn (**E**) Leuchars (**W**)	B1 (2)	2.2a
		(8 marks)	

Q6.

Question	Scheme	Marks
(a)	$\sum ft = 4837.5$ (allow 4838 or 4840)	B1
	$\text{Mean} = \frac{"4837.5"}{200} = 24.1875$ awrt **24.2** or $\frac{387}{16}$	M1 A1
	$\sigma = \sqrt{\frac{134281.25}{200} - \left(\frac{4837.5}{200}\right)^2}$	M1
	$= 9.293\ldots\ldots$ (accept s =9.32) awrt **9.29**	A1 (5)
(b)	$Q_2 = [20.5] + \frac{(100/100.5 - 62)}{88} \times 5 = 22.659\ldots$ awrt **22.7**	M1 A1 (2)
(c)	$Q_1 = 10.5 + \frac{(50/50.25)}{62} \times 10 [= 18.56]$ (*) ($n+1$ gives 18.604…)	B1 cso (1)
(d)	Q_3= 25.5 (Use of $n+1$ gives 25.734…) IQR = 6.9 (Use of $n+1$ gives 7.1)	B1 B1 ft (2)
(e)	The data is skewed (condone "negative skew")	B1 (1)
(f)	Mean decreases and st. dev. remains the same. [Must mention mean and st. dev.] (from(a)) The median and quartiles would decrease. [Must refer to median and at least Q_1.] ((b)(c)) The IQR would remain unchanged (from (d))	B1 B1 B1 (3)
		(14 marks)

Q7.

Question Number	Scheme	Marks
	mean $= \frac{60.8+20}{1.4}$ or $60.8 = 1.4x - 20$ (o.e.)	M1
	$= 57.7142\ldots$ awrt 57.7	A1
	standard deviation $= \frac{6.60}{1.4}$ or $6.60 = 1.4x$	M1
	$= 4.7142\ldots$ awrt **4.71**	A1
		(4)
		Total 4
	Notes	
	1st M1 sub. 60.8 for y into a correct equation. Allow use of x or any other letter or expression for mean	
	1st A1 for awrt 57.7 or $\frac{404}{7}$ (o.e.). Correct answer only is 2/2	
	2nd M1 sub. 6.60 or 6.6 for y and ignoring the 20. Allow use of x or any other letter or expression for st. dev. $6.60^2 = 1.4^2x^2$ is M0 until we see them take a square root.	
	2nd A1 for awrt 4.71 or $\frac{33}{7}$ (o.e.). Correct answer only is 2/2	

Q8.

Question Number	Scheme	Marks
(a)	$2.8 + 5.6 + 2.3 + 9.4 + 0.5 + 1.8 + 84.6 = 107$	M1
	mean $= 107 / 28$ $(= 3.821\ldots)$ **(awrt 3.8)**	A1
		(2)
(b)	It will have no effect since one is 4.5 under what it should be and the other is 4.5 above what it should be.	B1 dB1 (2)
		[4]
	Notes	
(a)	M1 for a clear attempt to add the two sums. Accept a full expression or $2.8 + 5.6 + \ldots + 84.6 = x$ where $100<x<110$ i.e. seeing at least two correct terms of Keith's and the 84.6 with a slip.	
	A1 for awrt 3.8 (Condone 1 dp/2sf here since data is given to 1 dp or 2 sf) Accept $\frac{107}{28}$ or $3\frac{23}{28}$ or any exact equivalent	
	Correct answer implies M1A1	
(b)	1st B1 for clearly stating that it will have no effect. ("roughly the same" is B0 B0)	
	2nd dB1 for a supporting reason that mentions the fact that the increase and decrease are the same and gives some numerical value(s) to support this.	
	e.g. Sum of Keith's observations is still 22.4 (or mean is still 3.2)	
	or Sum is still 107	
	or $9.4 - 4.9 = 5 - 0.5$ (o.e.)	
	This second B1 is dependent on their saying there is no effect so B0B1 is not possible.	

Q9.

Question	Scheme	Marks	AOs
(a)	tr	B1	1.2
		(1)	
(b)(i)	$\mu = \frac{174.9}{31} = 5.6419\ldots$ awrt 5.64	B1	1.1b
(ii)	$\sigma_r = \sqrt{\frac{3523.283}{31} - \mu^2}$	M1	1.1b
	$= 9.04559\ldots$ awrt 9.05	A1	1.1b
		(3)	
(c)	Leuchars is in the North and Camborne is in the South	M1	2.4
	The mean is smaller for Leuchars than Camborne therefore there is no evidence that Dian's belief is true	A1ft	2.2b
		(2)	
(d)	eg $p = 0.27$ is unlikely to be constant.	B1	2.4
		(1)	
			(7 marks)

Notes:		
(a)	B1	Allow Tr or trace or Trace
(b) (i)	B1	For a correct mean awrt 5.64
(ii)	M1	For a correct expression for sd including the $\sqrt{}$ Ft their mean
	A1	awrt 9.05 (Allow $s = 9.1932\ldots$ awrt 9.19) NB awrt to 9.05 or 9.19 with no working is M1 A1
(c)	M1	For stating Leuchars is North of Camborne oe eg Camborne is further south
	A1ft	M1 must be awarded. A correct conclusion **and** correct comment about the means ft their mean in (b) Allow No
	SC	for No **and** there are only 2 places used so there is insufficient data. Mark as M0A1 on epen
(d)	B1	A correct reason referring to • independence (needs context as to what is independent) eg consecutive 14 days unlikely to be independent. • probability [of rain] not being constant. • Allow a comment that conveys the idea that the proportion of days with no rain will be different over the year.