A level June 2022 Predicted Paper 3A Mark Scheme

Question 1

Qu 1	Scheme	Marks	AO
(a)	Negative	B1 **(1)**	1.2
(b)	Robert's suggestion <u>is compatible</u> because it's <u>negative correlation</u>	B1 **(1)**	2.4
(c)	(r =) -0.8998… awrt **<u>– 0.900</u>**	B1 **(1)**	1.1b
(d)	$H_0: \rho = 0$ $H_1: \rho < 0$ [5% 1-tail cv =] (±) 0.4973 (significant result / reject H_0) There <u>is</u> evidence of negative <u>correlation</u> between the <u>number of hot meals sold</u> and the <u>temperature</u> outside	B1 M1 A1 **(3)**	2.5 1.1a 2.2b
		(6 marks)	

Question 2

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	IQR = 26.6 – 19.4 = 7.2	B1	This mark is given for finding the interquartile range
	19.4 – (1.5 × 7.2) = 8.6 26.6 + (1.5 × 7.2) = 37.4	M1	This mark is given for a method find the values for the whiskers of the boxplot
	Plotting 7.6°C as an outlier. With whiskers plotted at 31.6 °C as the upper and 8.6 °C (or 9.5°C) as the lower	A1	This mark for plotting both whiskers correct
(b)	October (since it is the month with the coldest temperatures between May and October in Beijing)	B1	This mark is given for a correct suggestion with a supporting reason.
(c)	$\sigma = \sqrt{\frac{S_{xx}}{n}} = \sqrt{\frac{4877.585}{166}} = \sqrt{29.38} = 5.42$	B1	This mark is given for showing the calculation for the standard deviation to three significant figures
(d)	z = (±) 1.2816	B1	This mark is given for identifying the z-value for the 10th and 90th percentiles (from tables or calculator)
	$2 \times z \times 5.42$	M1	This mark is given for a method to find the interpercentile range between the 10th and 90th value
	= 13.9	A1	This mark is given for finding a correct interpercentile range between the 10th and 90th value
(e)	Daily wind speed (Beaufort) since it is qualitative data	B1	This mark si given for stating a correct variable with a supporting reason
	Rainfall (since it is not symmetric)	B1	This mark is given for stating a correct variable with a supporting reason

Question 3

Q	Scheme	Marks	AO
(a)	$0.07 + 0.18 + \quad 0.05 \quad = \underline{\mathbf{0.3}}$	B1 **(1)**	1.1b
(b)(i)	$[P(M \cap T \cap C) = 0 \quad \Rightarrow]$ $\quad r = \underline{\mathbf{0}}$	B1	1.1b
(ii)	[P(T) = 0.41 $\Rightarrow$] $0.07 + 0.2 + s + "r" = 0.41$	M1	1.1b
	$s = \underline{\mathbf{0.14}}$	A1 **(3)**	1.1b
(c)(i)	$\left[P(M\|C) = \frac{30}{49} \quad \Rightarrow\right] \frac{q + "r"}{q + "r" + 0.14 + 0.05} = \frac{30}{49}$	M1	3.1a
		A1ft	1.1b
	$\underline{\boldsymbol{q = 0.3}}$	A1	1.1b
(ii)	$[0.07 + 0.2 + "0.14" + "0" + 0.18 + "0.3" + 0.05 + p = 1 \quad \Rightarrow]$ $\quad \underline{\boldsymbol{p = 0.06}}$	B1ft **(4)**	1.1b
(d)	$P(T \cap M') = 0.07 +$ "s" [= 0.21]	B1ft	1.1b
	$P([(T \cap M') \cap C) = "s"$ [=0.14] **and** P(C) = 0.49 **and** $P(T \cap M') \times P(C) =$ "0.21" $\times$ 0.49 = 0.1029	M1	2.1
	$P(S \cap E') \times P(G) \neq P([(S \cap E') \cap G)$ so **are NOT independent**	A1 **(3)**	2.2a
		(11 marks)	

Question 4

Question	Scheme	Marks	AOs
(a) (i) (ii)	(Use of $X \sim N(30, 2^2)$)		
	$P(X = 31) = 0$	B1	1.2
	From calculator, $P(X > 31) = 0.3085\ldots$ awrt 0.309	B1	1.1b
		(2)	
(b) (i)	$0.0668 \times (1 - 0.0668)^4$	M1	3.1b
	$=0.050665\ldots$ awrt 0.0507	A1	1.1b
		(2)	
(ii)	$Y \sim B(5, 0.0668)$	M1	3.3
	$P(Y > 1) = 1 - P(Y \leq 1)$ $= 1 - 0.9610\ldots = 0.0390$ awrt 0.039	M1 A1	3.4 1.1b
		(3)	
(c)	$H \sim N(\mu, 1.5^2)$		
	$P(H > 42) = 0.0005$ or $P(H < 42) = 0.9995$	M1	1.1b
	$z = 3.2905268\ldots$ awrt 3.29		1.1b
	$z = \frac{42 - \mu}{1.5} = 3.29\ldots$	M1	2.1
	$\mu = 37.0642\ldots$ awrt 37.1 (degree sign C)	A1	1.1b
		(3)	
		(10 marks)	

Question 5

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{27.29-28}{\sigma}$ = –1.6449	M1	This mark is given for standardising as part of a method to find σ
	σ = 0.4316	A1	This mark is given for a correct value of σ
	P($D > K$) = 0.6 or P($D < K$) = 0.4	B1	This mark is given for finding two probablilties
	$\frac{k-28}{\sigma} = \frac{k-28}{0.4316}$ = 0.2533	M1	This mark is given for using a normal model to find the probability
	k = 28.11	A1	This mark is given for a correct value for k
(b)	$Y \sim$ B(200, 0.55) so $W \sim$ N(110, 49.5)	B1	This mark is given for setting up the normal distribution approximation of the binomial
	P($Y < 100$) ≈ P($W < 99.5$) = $P\left(Z < \frac{99.5-110}{\sqrt{49.5}}\right)$	M1	This mark is given for using the normal model with a continuity correction
	= 0.0678	A1	This mark is given for finding a correct value of the probability
(c)	$H_0 : \mu = 28$ $H_1 : \mu < 28$	B1	This mark is given for both hypotheses in terms of μ found correctly
	$\overline{D} \sim N\left(28, \frac{0.7^2}{20}\right)$	M1	This mark is given for a method to set up the normal distribution
	P($\overline{D} < 27.72$) = 0.0368	A1	This mark is given for using the model to find a correct p-value
	p = 0.0368 < 0.05, so reject H_0	M1	This mark is given for a correct comparison and non-contextual conclusion
	There is sufficient evidence to support Hannah's belief that the mean amount of liquid put in each bottle is less than 28 ml	A1	This mark is given for a correct conclusion in context stated