

Topic Y4 Statistics AS (Pre-TT A) [61] MARKSCHEME

1.

8i	$m = 26.5$ LQ = 22 or 21.5 or 21.75 UQ = 39 40 39.5 IQR = 17 18.5 17.75	B1	
		M1 A1 3	M1 for either LQ or UQ A1 must be consistent LQ, UQ & IQR
ii	Ave or overall or med or "it" similar Male spread greater or M more varied oe	B1f	or F med (or ave) higher or F mean less or M & F both have most in 20s
		B1f 2	or male range greater or more younger F or more older M
iii	Med less (or not) affected by extreme(s) or Mean (more) affected by extreme(s)	B1 1	oe; not "anomalies" ignore eg "less accurate"
iv	<u>Decode last</u> $245/49$ $= 5$ mean = 205 $\sqrt{(9849/49 - (245/49)^2)}$ $= 13.3$ (3sfs) or $4\sqrt{11}$ sd = 13.3 or $4\sqrt{11}$ <u>Decode first</u> $245 + 200 \times 49$ or 10045 B1 $10045/49$ M1 $= 205$ A1 $\Sigma x^2 = 9849 + 400 \times 10045 - 49 \times 40000$ or 2067849 B1 $\sqrt{\frac{\Sigma x^2}{49} - \bar{x}^2}$ M1 $= 13.3$ or $4\sqrt{11}$ A1	M1 A1 B1f M1 A1 B1f 6	200 + "5" dep $\sqrt{+ve}$ dep M1 or ans 176; award if not +200 allow $445/49$ or 9.08 seen dep $\sqrt{+ve}$ Σx^2 must be: attempt at Σx^2 >9849 not involve 9849^2 not $(\Sigma x)^2$ eg 10045^2 , 445^2 \bar{x} must be decoded attempt, eg 9.08
Total		12	

2.

(i)	Not all equally likely – those in range 0 to 199 more likely to be chosen	M1 A1 2	Not all equally likely stated or implied Justified by reference to numbers, no spurious reasons
(ii)	Ignore random numbers greater than 799, or 399	B1 1	Any valid resolution of this problem, no spurious reasons

3.

(i)(a)	Total area = 60 sqs Recog that total area reps 300 $8 \times 300/60$ $= 40$	M1 M1 M1 A1 4	Attempt total area, eg 15000 or 15 cm^2 eg 1 squ = 5 or $15000 \div (300 \text{ or } 50)$ or $2000/50$ cao
(b)	Splitting classes $1.2 \times 4 \times 5$ or $0.8 \times 6 \times 5$ oe 48	M1 M1 A1 3	or $0.3 \times 16 \times 5$ or $0.4 \times 12 \times 5$ or 24 NB other correct eg $2 \times 4 \times 5 + \frac{4}{5} \times 2 \times 5$ Alt method: estimate: 46-50 SC B1
(ii)(a)	Box & whisker	B1 1	
(b)	Cum freq diag	B1 1	

4.

(i)	B(5, 3/8)	M1		B(5, 3/8) stated or ${}^3_8, {}^5_8$ seen and sum of powers = 5
	${}^5C_2(3/8)^2(5/8)^3$ = 5625/16384 or 0.343	M1	3	Correct expression
		A1		Answer, a.r.t. 0.343 ISW
(ii)	$\frac{1}{2}p_1 = \frac{3}{8}$ $p_1 = \frac{3}{4}$ AG	M1		or $\frac{3}{8} / \frac{1}{2}$ or $\frac{3}{8} \times 2$
		A1	2	$\frac{3}{4}$ correctly obtained. Must see explicit step. Verification eg $\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$ or $\frac{3}{8} / \frac{1}{2} = \frac{3}{4}$: M1A1
(iii)	$\frac{1}{2}p_2 = \frac{1}{3}$ $p_2 = \frac{2}{3}$	M1		or $\frac{1}{3} / \frac{1}{2}$ or $\frac{1}{3} \times 2$
		A1	2	Answer 2/3 or a.r.t. 0.667

5.

i	590	B1	1	Allow approximately 590
ii	Graph horiz (for ≥ 55 mks) oe	B1	1	or levels off, or grad = 0, grad not increase Allow line not rise, goes flat, plateaus, stops increasing, not increase, doesn't move
iii	39 to 41	B1	1	
iv	Attempt read cf at 26 or 27 Double & attempt read x	M1		eg 26 mks \rightarrow 150 th 27 mks \rightarrow 180 th
	Max C = 29 to 31.5	M1		eg read at cf = 300 or 360 Indep of first M1 May be implied by ans
		A1	3	Answer within range, no working, M1M1A1 32 without working, sc B1
v	LQ = 25.5-26.5 or UQ = 34-35.5 IQR = 8-10	M1		M1 for one correct quartile
	(German) more spread	A1		dep ≥ 1 correct quartile or no working
		B1ft	3	or less consistent, less uniform, less similar, more varied, more variable, greater variance, more spaced apart, further apart ft their IQR; must be consistent with IQR
				Correct comment with no working: M0A0B1
Total			9	

6.

(a)	Finds correct value of k	AO1.1b	B1	$k = \frac{1}{16}$
(b)	Selects relevant probability	AO1.1a	M1	$P(\geq 2 \text{ checkouts staffed})$ $\frac{3}{16} + k = \frac{3}{16} + \frac{1}{16} = \frac{1}{4}$
	Finds correct probability FT 'their' value of k found in part (a)	AO1.1b	A1F	ALT $P(\geq 2 \text{ checkouts staffed})$ $= 1 - \frac{3}{4} = \frac{1}{4}$
	Total		3	

7.

i	0.4×0.7 $0.6 + 0.4 \times 0.7$ $= 0.88$	M1 M1 A1 3	or $0.6 + \text{prod of 2 probs}$ Condone $0.6 \times 0.7 + 0.6 \times 0.3 + 0.4 \times 0.7$ or $0.6 \times 0.6 + 0.6 \times 0.4 + 0.4 \times 0.7$	$1 - \text{prod of 2 P's}$ or 0.4×0.3 $1 - 0.4 \times 0.3$
ii	$p + (1-p) \times p = 0.51$ or $2p - p^2 = 0.51$ $p^2 - 2p + 0.51 = 0$ $(p-0.3)(p-1.7) = 0$ or $p = \frac{2 \pm \sqrt{4-4 \times 0.51}}{2}$ oe $p = 0.3$	M1 A1 M1 A1 4	or $p^2 + p \times (1-p) + (1-p) \times p$ Correct QE = 0 Condone omission of "= 0" Correct method for their 3-term QE Not $p = 0.3$ or 1.7	Condone $p + p \times 1-p$ M1, but $p + qp = 0.51$ M0 or $(1-p)^2 = 0.49$ M1A1 $1-p = \pm 0.7$ M1 must have \pm Correct ans from correct but reduced wking or T & I or verification or no wking: 4 mks Ans $p = 0.3$ or 1.7 from correct but reduced wking or T & I or no wking: M1M1M1A0 Ans $p = 0.3$ following correct wking except other solution incorrect: BOD 4 mks (eg $p = \frac{2 \pm \sqrt{4-4 \times 0.51}}{2}$ so $p = 0.3$ or -1.3 so $p = 0.3$: 4 mks) $p = 0.3$ from wrong wking but correct verification: BOD 4 mks $p = 0.3$ from wrong wking alone: M0A0M0A0
Total		7		

8.

(i)	$H_0: p = 0.35$ [or $p \geq 0.35$] $H_1: p < 0.35$ $B(14, 0.35)$ $\alpha: P(\leq 2) = 0.0839 > 0.025$ $\beta: CR \leq 1$, probability 0.0205 Do not reject H_0 . Insufficient evidence that proportion that can receive Channel C is less than 35%	B1 B1 M1 A1 B1 M1 A1 $\sqrt{7}$	Each hypothesis correct, B1+B1, allow $p \geq .35$ if .35 used [Wrong or no symbol, B1, but r or x or \bar{x} : B0] Correct distribution stated or implied, can be implied by $N(4.9, \dots)$, but <i>not</i> $Po(4.9)$ 0.0839 seen, or $P(\leq 1) = 0.0205$ if clearly using CR Compare binomial tail with 0.025, or $R = 2$ binomial CR Do not reject H_0 , $\sqrt{}$ on their probability, <i>not</i> from N or Po or $P(< 2)$; Contextualised conclusion $\sqrt{}$
(ii)	$B(8, 0.35): P(0) = 0.0319$ $B(9, 0.35): P(0) = 0.0207$ Hence largest value of n is 8	M1 A1 A1 A1 4	Attempt to find $P(0)$ from $B(n, 0.35)$ One correct probability [$P(\leq 2) = .0236, n = 18$: M1A1] Both probabilities correct Answer 8 or ≤ 8 only, needs minimum M1A1
or	$0.65^n > 0.025; n \ln 0.65 > \ln 0.025$ 8.56; largest value of $n = 8$	M1M1 A1A1	$p^n > 0.025$, any relevant p ; take \ln , or T&I to get 1 SF In range [8.5, 8.6]; answer 8 or ≤ 8 only