

Sampling and Estimation 2 MS

Q1.

3 (i) Number all members Explain the selection of 3-digit random numbers Omit repeats OR omit nos. over 750 (until have 8 nos.)	B1 B1 B1 [3]	
(ii) Est $(\mu) = 20$ $\text{Est } (\sigma^2) = \frac{8}{7} \left(\frac{3636}{8} - 20^2 \right)$ $= \frac{436}{7} \text{ or } 62.3 \text{ (3 sfs)}$	B1 M1 A1 [3]	$1/7 \times (3636 - 160^2/8)$ $(7.89\dots)^2$ M1A1, but 7.89... only M1A0
(iii) Amounts spent last week in café by all club members	B1 [1]	

Q2.

1	$z = 2.326$ $494 \pm z \times \frac{23}{\sqrt{150}}$ $= 490 \text{ to } 498 \text{ (3 sfs)}$	B1 M1 A1 [3]	seen Any z
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Q3.

6 (i)	$\bar{x} = 1.96$ $(\Sigma x^2 f = 254)$ $S^2 = \frac{50}{49} x \left(\frac{254}{50} - 1.96^2 \right)$ $= \frac{1548}{1225} \text{ or } 1.2637$	B1 M1 A1 [3]	Correct sub in S^2 formula
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Q4.

3 (i)	$p = 18/50 \text{ or } 0.36 \text{ oe}$ $z = 2.326$ $0.36 \pm z \sqrt{\frac{0.36 \times (1-0.36)}{50}}$ $= 0.202 \text{ to } 0.518 \text{ (3 sfs)}$	B1 B1 M1 A1 [4]	Allow any z ($\neq 0$ or 1) Allow any brackets or none
(ii)	Sample random	B1 [1]	oe
[Total: 5]			

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Q5.

1	(i) $z = 2.574$ to 2.576 $12.5 \pm z \frac{3.2}{\sqrt{250}}$ 12.0 to 13.0 (3 sfs)	B1 M1 A1	3	Any z <i>Correct form</i> Allow 12 to 13
	(ii) 0.005 or 0.5%	B1	1	Not just 0.5
[Total 4]				

Q6.

3	(i) $\bar{x} = \frac{7520}{150} = (50.1)$ (3 sfs) $s^2 = \frac{150}{149} \left(\frac{413540}{150} - \left(\frac{7520}{150} \right)^2 \right)$ = 245 or 246 (3 sfs)	B1 M1 A1	3	Attempt at unbiased variance (either formula) Allow $s^2 = 15.7^2$ (3 sfs)
	(ii) $\frac{53 - \frac{7520}{150}}{\sqrt{\frac{245.217}{80}}}$ (= 1.637 to 1.638) $1 - \Phi('1.637')$ = 0.0488 to 0.0509	M1 M1 A1	3	For Standardising (\pm) with their mean and their variance must have $\sqrt{80}$ (ignore cc) Correct area consistent with their working Correct working only
[Total 6]				

Q7.

6	(i) Excludes children Excludes people without phones More than one person in some houses Some ex-directory	B1	[1]	or other implying directory excludes some people
	(ii) $\text{Var}(p) = \frac{38}{200} \left(1 - \frac{38}{200} \right)$ (= 0.0007695) $z = 2.576$ $\frac{38}{200} \pm z \sqrt{\frac{38}{200} \left(1 - \frac{38}{200} \right)}$ 0.119 to 0.261 (3 sfs)	M1 B1 M1 A1	[4]	Seen For correct form of CI Accept 0.262 Must be an interval
	(iii) $z \times \sqrt{0.0007695} = 0.05$ $z = 1.802$ $\Phi('1.802')$ (= 0.9642) $(0.9642 - (1 - 0.9642)) = 0.9284$ $x = 93$ (2 sfs)	M1 A1 M1 A1	[4]	$z \times$ (their sd of p) = 0.05. Allow = 0.1 Attempt Φ (their z) and find $2\Phi - 1$

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Q8.

2 $z = 2.576$ $2 \times z \times \frac{0.17}{\sqrt{n}} = 0.2$ oe $n = \left(\frac{2 \times 0.17 \times 2.576}{0.2}\right)^2$ oe (= 19.2) Smallest n is 20	B1	Seen (accept 2.574 to 2.579)
	M1	Allow without '2 ×' OR with incorrect z
	M1	Attempt to arrange equ of correct form (with correct z and '2 ×' into the form $n =$ or $\sqrt{n} =$
	A1 [4]	