Daily Question

Day 4 Statistics – Mark Scheme

[Check mark scheme for answers , methods will be different with new specifications]

Question 1

(a)	$X \sim B(15, 0.5)$	B1 B1 (2)
(b)	$P(X = 8) = P(X \leq 8) - P(X \leq 7)$ or $\left(\frac{15!}{8!7!}(p)^8(1-p)^7\right)$	M1
	$= 0.6964 - 0.5$	
	$= 0.1964$ awrt 0.196	A1 (2)
(c)	$P(X \geq 4) = 1 - P(X \leq 3)$	M1
	$= 1 - 0.0176$	
	$= 0.9824$	A1 (2)
(d)	$H_0 : p = 0.5$	B1
	$H_1 : p > 0.5$	B1
	$X \sim B(15, 0.5)$	
	$P(X \geq 13) = 1 - P(X \leq 12)$ $= 1 - 0.9963$ $= 0.0037$	$[P(X \geq 12) = 1 - 0.9824 = 0.0176]$ att $P(X \geq 13)$ $P(X \geq 13) = 1 - 0.9963 = 0.0037$ CR $X \geq 13$ awrt 0.0037/ CR $X \geq 13$	M1 A1
	$0.0037 < 0.01$	$13 \geq 13$	
	Reject H_0 or it is significant or a correct statement in context from their values	M1
	There is sufficient evidence at the 1% significance level that the coin is biased in favour of heads *or* There is evidence that Sue's belief is correct	A1 (6)

Question 2

(a)	$X \sim B(25, 0.2)$	**M1** Writing or using B(25,0.2)or B(25,1/5) [allow Po(5)] May be written in full or implied by a correct CR (allow written as a probability statement)	M1
	$[P(X \geq 9) =]0.0468$ $[P(X \leq 1) =]0.0274$	**1st A1** both awrt 0.0468 and awrt 0.0274 seen.	A1
	$X = [0 \leq]\ X \leq 1$	**2nd A1** $X \leq 1$ or $X < 2$ or $0 \leq X \leq 1$ or [0,1] or 0,1 or equivalent statements. $X \leq c$ and $c = 1$	A1
	$9 \leq X\ \ [\leq 25]$	**3rd A1d** dependent on seeing a probability from the B(25, 0.2) and $X \geq 9$ or $X > 8$ or $9 \leq X \leq 25$ or 9,10,11,12,13,14,15,16,17,18,19,20,21,22, 23,24,25 or [9,25] or equivalent statements. $X \geq c$ and $c = 9$	A1d
	NB These two final 2 A marks must be for statements with "X" only(or list) – not in probability statements **SC If** a probability from the B(25, 0.2) is seen **and** they either have both CR correct but written as probability statements **or** the CR is written as $1 \geq X \geq 9$ they get A1 A0 for final 2 marks		**(4)**
b)	$H_0: p = 0.2$ $H_1: p < 0.2$	**B1** both hypotheses with p or π and clear which is H_0 and which is H_1	**B1**
	$P(X \leq 6) = 0.1034$ or CR $X \leq 5$	**1st M1** writing or using B(50, 0.2) and writing or using $P(X \leq 6)$ or $P(X \geq 7)$ on its own. May be implied by a correct CR	**M1**
		1st A1 awrt 0.103. Allow CR $X \leq 5$ or $X < 6$. or if not using CR allow awrt 0.897.	**A1**
	Insufficient evidence to reject H_0, Accept H_0, Not significant. 6 does not lie in the Critical region.	**2nd M1** dependent on previous M being awarded. A correct statement (do not allow if there are contradicting non-contextual statements). ft their Prob/CR compared with 0.05/6/(0.95 if using 0.8979). Do not follow through their hypotheses	**M1d**
	No evidence that increasing the batch size has **reduced** the **percentage** of broken **pots (oe)** **or** evidence that there is **no change** in the **percentage** of broken **pots (oe)**	**2nd A1cso** Conclusion must contain the words **reduced/ no change/not affect oe number/percentage/proportion/ probability oe**, and **pots**. All previous marks must be awarded for this mark to be awarded. Do **not** allow the potters claim /belief is wrong/true **NB** Correct contextual statement on its own scores M1A1	**A1cso** **(5)**
			(Total 9)