A1 Doubles Tracking Test 4 Part B

(30 marks: 36 minutes)

1. A clay pigeon shooter hits a clay with probability 0.65. There are 25 clays in each set. To win a set, the shooter must hit at least 15 clays.

The shooter takes part in 10 sets of 25 clays. Find the probability that the shooter wins:

(a) exactly 7 of these sets **(3)**

(b) fewer than 5 of these sets **(2)**

2. Below is a table showing the average cloud cover and daily total sunshine for ten days in Leuchars in June 1987

Day	A	B	C	D	E	F	G	H	I	J
Daily Mean Total Cloud (oktas) (x)	4	6	7	7	5	7	7	8	8	6
Daily Total Sunshine (0000-2400) (hrs) (y)	7.7	6.4	0.1	5.1	10.4	0.7	4.6	1.2	0.3	6.2

a) Use your calculator to find the value of the product moment correlation coefficient.

(2)

The equation of the regression line of y on x is

$$y = -2.32x + 19.35$$

b) Interpret the values – 2.32 and 19.35

(2)

c) How realistic is the 19.35 figure in regards to Leuchars in June? You must justify your answer.

(1)

d) A scientist takes 25 valid observations in Leuchars in May 1987 of the Daily Total Rainfall and Daily Mean Total Cloud.

She calculates a product moment correlation coefficient of $r = 0.3962$.

The scientist believes there is positive correlation. Test, at the 5% level of significance, the scientist's claim, stating your hypotheses clearly.

(3)

3. In the binomial expansion of $(2 + px)^5$, where p is a constant, the coefficient of x^3 is 135.

Calculate:

(a) The value of p **(4)**

(b) The value of the coefficient of x^4 in the expansion **(2)**

4. The manager of a supermarket believes that of the customers who buy crisps, 3% buy them in "Mega Packs". The manager decides this must be wrong, they record how many of the next 300 customers who buy crisps, bought them in "Mega Packs".

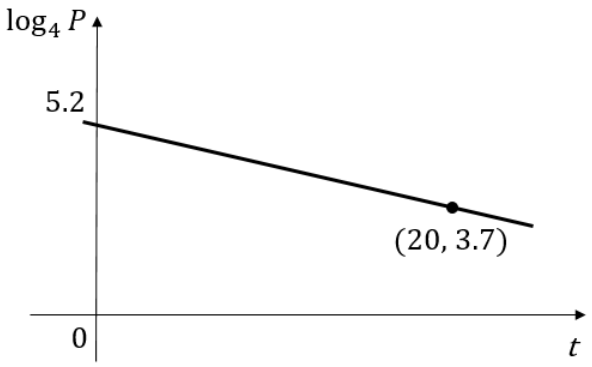
a) Stating your hypotheses clearly, find the critical region of the test at the 5% level of significance

(4)

b) State the actual significance level for a test using the critical region found in part (a).

(1)

5. The number of people, P, left in a concert venue t minutes after the band stops playing can be modelled by an equation of the form $= ab^t$. The diagram shows the graph of $\log_4 P$ against t.



a. Write down the equation of the line shown on the graph. **(2)**

b. Find the number of people at the venue immediately after the band stopped playing, correct to 3s.f. **(1)**

c. Find the values of a and b in the model correct to 3s.f. **(2)**

d. Find the number of people half an hour after the band stopped playing. **(1)**

END OF PAPER

1a	$X \sim B(25,0.65)$ $P(X \geq 15) = 1 - P(X \leq 14) = 0.7712\ (4dp)$ $Y \sim B(10, 0.7712)$ $P(Y = 7) = 0.2332\ \ (4dp)$	M1 M1 A1
1b	$P(Y < 5) = P(Y \leq 4) = 0.0127\ (4dp)$	M1 A1

2a	$r = -0.829$	M1A1
2b	For every Okta of mean total cloud there is 2.23 less hours of total sunshine If there were no clouds there would be 19.35 hours of sunshine	B1 B1
2c	There are lots of hours of possible sunlight in a Scottish June summer. So not unrealistic	B1
2d	H_0: $\rho = 0$ H_1 : ρ > 0 p-value > 0.3365 The observed value of r is in the critical region, so there is enough evidence to reject H_0. There is evidence, at the 5% level of significance, that there is correlation between Total Rainfall and Total Cloud cover	 B1 M1 A1

3.(a)	$\binom{5}{3} * (2)^2 * (p)^3 = 135$ $40p^3 = 135$ $p = \frac{3}{2}$	M1 correct structure inc. choosing coefficient A1 this equation correct M1 solving for p A1 correct value of p
3 (b)	$\binom{5}{4} * (2) * (p)^4$ $= \frac{405}{8}$	M1 this structure A1 correct value (or 50.625)

4.

$H_0: p = 0.03$ $H_1: p \neq 0.03$ $P(X \leq x_1) < 0.025$ $P(X \leq 3) = 0.1989$ $P(X \geq x_2) \leq 0.025$ $P(X \geq 16) = 0.0203$ $\therefore CR = x \leq 3 \; and \; x \geq 16$	B1 H_1 B1 (0.025) M1A1
0.04019	B1

5a	$m = \dfrac{5.2 - 3.7}{0 - 20} = -0.075$ $\log_4 P = -0.075t + 5.2$	M1 A1
5b	When $t = 0$, $\log_4 P = 5.2$ $P = 4^{5.2} = 1350 \; (3sf)$	B1
5c	$a = 1350$ $\log_4 b = -0.075$ $b = 4^{-0.075} = 0.901 \; (3sf)$ $P = 1350 \times 0.901^t$	M1 A1
5d	$P = 1350 \times 0.901^t$ When $t = 30, P = 59.66 \ldots$ Therefore there are 59 people remaining half an hour after the band stop playing	B1