EDEXCEL FOUNDATION

Stewart House 32 Russell Square London WC1B 5DN

June 2002

Advanced Subsidiary /Advanced Level

General Certificate of Education

Subject **STATISTICS 6688** Paper No. **S6**

Question number	Scheme	Marks
1a	(*a*) parametric - tests the value of a parameter when you know the distribution (or can apply the central limit theorem).	B1
	non-parametric - tests the value of a parameter when you don't know the distribution	B1 (2)
	alter - if say know distribution is normal and is not normal B1 B0	
b	(*b*) The Wilcoxon rank sum test is used in two sample problems and the Wilcoxon signed-ranks test is used in one sample problems and in matched pairs problems.	B1 B1 (need one sample & matched) (2)
2.	H_0 : $m_V - m_A = 0$ H_1 : $m_V - m_A > 0$	B1 B1
	+ + + - + - + +	
	X represents the number of + signs	
	$X \sim B(8,½)$ used Bino	M1 A1
	$P(X \geq 6) = 1 - P(X \leq 5) = 0.1445 > 0.05$ $\approx$ $x \geq 6$	M1 A1 M1 comp 0.05
	There is not enough evidence to reject H_0. Objects presented visually are not recalled more accurately than objects presented aurally.	A1✓ (8)

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Question number	Scheme	Marks
3.	H_0 : median =72 H_1 : median $\neq$ 72	B1 B1
	values -12 -9 3 -2 -8 -22 -5 6 -7 1 rank 9 8 3 2 7 10 4 5 6 1	M1 M1
	$S^+ = 9$	A1
	$n = 10$. At 0.025 $S = 8$ Since 9 is not in the critical region there is not enough evidence to reject H_0 that the median = 72	B1 M1 A1√ (8)
4a	(a) $\hat{\beta} = \frac{S_{tw}}{S_{tt}} = \frac{12.5}{6.8} = 1.84$ ..... 3 s.f. $\hat{\alpha} = 0.483$ ... 3 s.f.	M1 A1 A1 (3)
b	(b) $H_0 : \beta = 1.5$ $H_1 : \beta \neq 1.5$ both	B1
	$RSS = 42.3 - \frac{(12.5)^2}{6.8} = 19.32205...$	M1 A1
	$s^2 = 2.415257...$ or $s = 1.5541...$	A1
	$t = \frac{1.838 - 1.5}{1.55/\sqrt{6.8}} = 0.56753...$ 0.567 - 0.57	M1 A1
	Since $0.5672 < 2.306$, accept H_0 that $\beta = 1.5$ comp : 2.306	M1 A1√ (8)

(b) After allow
$H_0 : \beta = 1.5$ $H_1 : \beta > 1.5$
then $0.5672 < 1.860$ accept H_0 that $\beta = 1.5$

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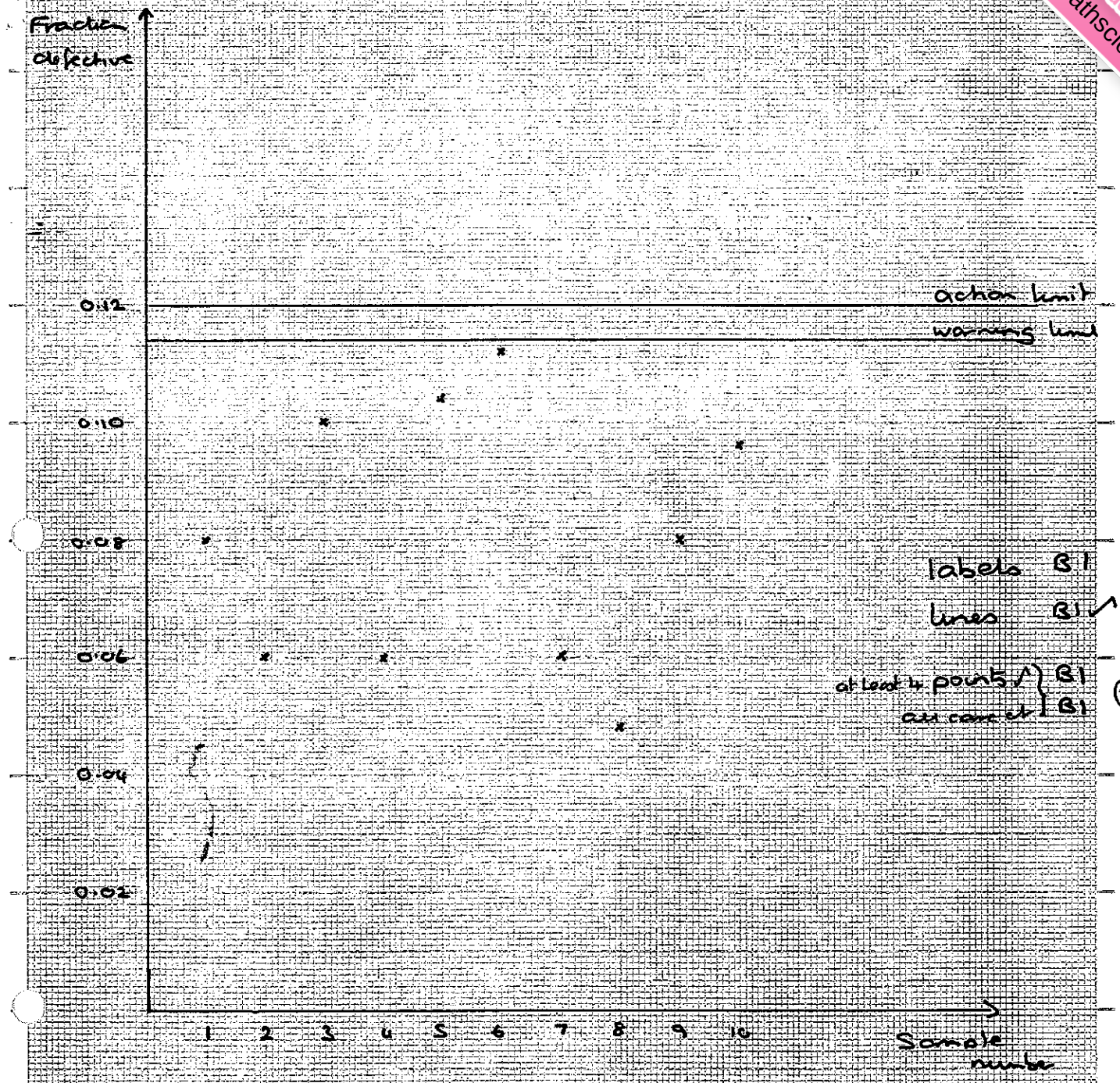
Question number	Scheme		Marks
5. a	(*a*) $p = \frac{200}{250\times10} = 0.08$	M1 A1	(2)
b	(*b*) action limits are $0.08 + 1.96\sqrt{\frac{0.08\times0.92}{250}}$	M1	
		1.96 B1	
	i.e. 0.114 awrt	A1	
	warning limits are $0.08 + 2.3263\sqrt{\frac{0.08\times0.92}{250}}$	2.3263 B1	
	i.e. 0.120 awrt	A1	
	See graph paper	(2)	(7)
c	(*c*) Points plotted	(2)	(2)
d	(*d*) The process is performing within acceptable limits so far.	B1	(1)

5 b & c)



labels B1

lines B1 ✓ (2)

at least 4 points ✓ } B1
all correct } B1 (2)

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Question number	Scheme		Marks
6a	(*a*) H_0 : median of girls = median of boys. H_1 : median of girls ≠ median of boys.	both	B1
	15 17 18 20 22 23 26 27 29 30 38 39 1 2 3 4 5 6 7 8 9 10 11 12	all rogether	M1 ↖ dep M1
	$T = 1 + 2 + 3 + 6 + 8$ $= 20$		M1 A1
	Two tail test therefore use 2½ %		
	critical value is 20		B1
	20 is in the critical region and therefore we reject H_0 in favour of H_1. There is evidence that there is a difference between the time girls and boys take to solve the puzzle.		A1√ (7)
b	(*b*) H_0 : median of girls = median of boys. H_1 : median of girls > median of boys.	both	B1
	$n_1 = 25$ $n_2 = 25$		
	N (637.5, 2656.25)		M1 A1 A1
	$T = 798$		
	$\frac{797.5 - 637.5}{\sqrt{2656.25}} = 3.104$		M1 A1 ± ½
	one tail test 5% significance level critical value = 1.645		B1
	3.104 > 1.645 there is evidence that boys are quicker at solving the puzzle than girls.		A1 ✓ (8)

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Question number	Scheme	Marks
7a	(*a*) Allocate bunches of flowers at random, 4 to each liquid.	B1 B1 (2)
b	(*b*) Randomised block design.	B1 (1)
c	(*c*)	

	A	B	C	D	Total
W	12	13	9	10	44
L & W	14	15	10	9	48
W + C	13	16	11	10	50
Total	39	44	30	29	142

$$\text{Correction Factor} = \frac{(142)^2}{12} = 1680.33\dot{3}$$

Total SS = 1742 - 1680.33 = 61.67 M1

$$\text{Type SS} = \frac{1}{3}\{39^2 + 44^2 + 30^2 + 29^2\} - 1680.33 = 52.33$$ M1

$$\text{Liquid SS} = \frac{1}{4}\{44^2 + 48^2 + 50^2\} - 1680.33 = 4.66$$ M1

Source	*df*	SS	MSS	Ratio
Between Types	3	52.33	17.44	22.43
Between Liquids	2	4.67	2.33	3.00
Residual	6	4.66	0.778	
Total	11	61.67		

3,2,6 B1

Residual M1
Ratio M1 A1 A1

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Question number	Scheme		Marks
7 cont	H_0 : Liquids do not affect length of time flowers live. ($\mu_W = \mu_L = \mu_C$) H_1 : Liquids do affect length of time flowers live. (not all means are equal)	B1	
	$F_6^2 > 10.9$	B1	
	3 is not in critical region therefore not enough evidence to reject H_0, The liquid has no affect on the length of time flowers live.	A1 ✓	(11)
d	(*d*) H_0 : Different types of flowers do not live different lengths of times. (or $\mu_A = \mu_B = \mu_C = \mu_D$) H_1 : Different types of flowers do live different lengths of times. (or not all means are equal)		
	$F_6^3 > 9.78$	B1	
	$22\frac{3}{4} = 22.25$ is in the critical region so there is evidence to	M1	
	reject H_0. Different types of flowers do live different lengths of time.	A1 ✓	(3)