Single Sample and Paired Sample Sign Tests (From OCR 4735)

Q1, (Jun 2008, Q2)

Part of Helen's psychology dissertation involved the reaction times to a certain stimulus. She measured the reaction times of 30 randomly selected students, in seconds correct to 2 decimal places. The results are shown in the following stem-and-leaf diagram.

14	1 2
15	2 4
16	0 3 6
17	1 5 7
18	3 4 5 7 9
19	2 4 6 7 8 9
20	0 1 3 4 5 7 8 9
21	7

Key: 18 | 3 means 1.83 seconds

Helen wishes to test whether the population median time exceeds 1.80 seconds.

(i) Give a reason why the Wilcoxon signed-rank test should not be used. [1]

(ii) Carry out a suitable non-parametric test at the 5% significance level. [7]

Q2, (Jun 2009, Q2)

A company wishes to buy a new lathe for making chair legs. Two models of lathe, 'Allegro' and 'Vivace', were trialled. The company asked 12 randomly selected employees to make a particular type of chair leg on each machine. The times, in seconds, for each employee are shown in the table.

Employee	1	2	3	4	5	6	7	8	9	10	11	12
Time on Allegro	162	111	194	159	202	210	183	168	165	150	185	160
Time on Vivace	182	130	193	181	192	205	186	184	192	180	178	189

The company wishes to test whether there is any difference in average times for the two machines.

(i) State the circumstances under which a non-parametric test should be used. **[1]**

(ii) Use two different non-parametric tests and show that they lead to different conclusions at the 5% significance level. **[9]**

(iii) State, with a reason, which conclusion is to be preferred. **[1]**

Q3, (Jun 2012, Q5)

A one-tail sign test of a population median is to be carried out at the 5% significance level using a sample of size n.

(i) Show by calculation that the test can never result in rejection of the null hypothesis when $n = 4$. **[2]**

The coach of a college swimming team expects Elena, the best 50 m freestyle swimmer, to have a median time less than 30 seconds. Elena found from records of her previous 72 swims that 44 were less than 30 seconds and 28 were greater than 30 seconds.

(ii) Stating a necessary assumption, test at the 5% significance level whether Elena's median time for the 50 m freestyle is less than 30 seconds. **[9]**

Q4, (Jun 2016, Q1)

Ten archers shot at targets with two types of bow. Their scores out of 100 are shown in the table.

Archer	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Bow type *P*	95	97	92	85	87	92	90	89	98	77
Bow type *Q*	91	91	88	90	80	88	93	85	94	84

(i) Use the sign test, at the 5% level of significance, to test the hypothesis that bow type P is better than bow type Q. **[7]**

(ii) Why would a Wilcoxon signed rank test, if valid, be a better test than the sign test? **[1]**
