Solutions

Note A reference to the M246 *Handbook* and to the main course book is given for each question. For instance, Question 1 gives *H1:3; B1.3.1, 1.3.2*. This means 'Point 3 of the Chapter 1 outline in the *Handbook*; Subsections 1.3.1 and 1.3.2 in the book *Elements of Statistics*'. Some *Handbook* references say *S4* or *S5*; these refer to the tables of continuous and discrete distributions in Sections 4 and 5 of the *Handbook*.

Question 1 *(H1:3; B1.3.1, 1.3.2)*

The median of eight numbers is $x_{(\frac{1}{2}(8+1))} = x_{(4.5)} = \frac{1}{2}(x_{(4)} + x_{(5)}) = \frac{1}{2}(1.11 + 1.13) = 1.12$. The upper quartile of eight numbers is $x_{(\frac{3}{4}(8+1))} = x_{(6.75)}$ which is $\frac{3}{4}$ of the way between $x_{(6)} = 1.14$ and $x_{(7)} = 1.26$, i.e. $1.14 + \frac{3}{4}(1.26 - 1.14) = 1.23$. [2]

Question 2 *(H1:1; B1.2.4, 1.5)*

Two (or more) of the following comments would win full marks.

There appears to be a positive association between the variables; the relationship could reasonably be modelled by a straight line; the variability in 'angle when tense' appears to increase with increasing value of 'angle when relaxed'; the straight line does not go through the origin. [2]

Question 3 *(H1:1, 1:2; B1.2.3, 1.4)*

Two (or more) of the following comments would win full marks.

Boxplots are much better at comparing several groups at the same time; boxplots display certain numerical summaries (median, quartiles), whereas histograms do not; boxplots give the precise locations of outliers, whereas histograms only approximately display them; there are no bin edge or bin width specifications to make for boxplots. [2]

Question 4 *(H1:1; B1.2.3)*

The group classifications (borderlines) differ in each case. [2]

Question 5 *(H1:3; 1:4; B1.3.1, 1.4.1)*

The mean is likely to be larger than the median because of right skewness. [1]

Question 6 *(Statistical common sense)*

A decrease of 100% would mean that there were no robberies at all. No wonder the police are pleased! [1]

Question 7 *(H2:3, S5; B2.3.2)*

(a) Use a binomial distribution with parameters $n = 663$ and p: i.e. $B(663, p)$.

(b) The obvious estimate of p is $\widehat{p} = 192/663 = 0.290$. [2]

Question 8 *(H2:1; B2.2.3)*

The function is not a probability mass function because $p(5) = -1/5$ is negative. [1]

Question 9 *(H2:4; B2.2.3)*

The value of $F(2)$ needs to be 1. But $F(2) = 4k$ which implies that k must be $1/4$. [2]