Answers

Quiz 8

(Q8.1) **B** [definitions: normality of the population is required];

(Q8.2) **E** [power $= \Pr(X \geqslant 14)$, where $X \stackrel{\mathrm{d}}{=} \mathrm{Bi}(200.75)$; power $= 1 - 0.214 = 0.786$.];

(Q8.3) **D** [$\mathrm{t}_{15} = -2.125$, cf. $c_{0.975}(\mathrm{t}_{15}) = 2.131$, so $\mathrm{p} > 0.05$.];

(Q8.4) **B** [$\bar{x} = 4.5$, $''2'' \frac{s}{\sqrt{n}} = 0.4 \;\Rightarrow\; t = 1.25 \times ''2''$.
For the normal case (the z-test, equivalent to $n = \infty$), $\mathrm{p} = 2\Pr(Z.2.45) = 0.014$.
For small n, p is larger, but still in the interval $0.01 \leqslant \mathrm{p} < 0.05$.
The p-value required is actually $\mathrm{p} = 2\Pr(\mathrm{t}_{n-1} > 1.25 c_{0.975}(\mathrm{t}_{n-1}))$, for $n = 2, 3, 4, \ldots$.

n	2	3	4	5	$\cdots$	∞
p_n	0.040	0.033	0.028	0.026	$\cdots$	0.014

];

(Q8.5) **C** [Tables $\Rightarrow \mathrm{E}(Z_{(9)}) = 0.729 \;\Rightarrow\; \mathrm{E}(Z_{(3)}) = -0.729 \;\Rightarrow\; \mathrm{E}(Z_{(9)} - X_{(3)}) = 2 \times 0.729 \times \sigma$].

Homework 8

(8.1) **B** [reject H_0 if $\mathrm{p} < \alpha$];

(8.2) **C** [Tables $\Rightarrow \mathrm{E}(Z_{(8)}) = 1.424 \;\Rightarrow\; \mathrm{E}(X_{(8)} - X_{(1)}) = 2 \times 1.424 \times \sigma$];

(8.3) **B** [$\hat{\sigma} = \frac{\bar{R}}{2.848} = 3.511$; $\mathrm{UCL}(\bar{x}) = \bar{x} + 3\frac{\hat{\sigma}}{\sqrt{n}} = 36.0 + 3 \times \frac{3.511}{\sqrt{8}} = 39.72$.];

(8.4) **D** [Tables (ES p.5.11, SN p.S.6) $\Rightarrow \mathrm{UCL}(R) = 1.86\bar{R} = 18.6$.];

(8.5) **C** [$\hat{p} = \frac{55}{1000} \;\Rightarrow\; \mathrm{UCL}(p) = \hat{p} + 3\sqrt{\frac{0.055 \times 0.945}{100}} = 0.055 + 3 \times 0.0223 = 0.123$].

(8.6) (a) $n = 35$, $\bar{x} = 483.31$, $s = 16.55$;
test: $t = \frac{483.31 - 490}{16.55/\sqrt{35}} = -2.39$ [cf. t_{34}, $\mathrm{p} = 0.022$]. So we reject H_0: there is evidence in these data that mean yield stress is less than 490.
95% CI: $483.31 \pm 2.032 \times \frac{16.55}{\sqrt{35}} = (477.6, 489.0)$;

(b) We have a random sample (observations are independent and identically distributed) from a population that is (at least approximately) normally distributed.

(c) The normality assumption could be checked using a QQ-plot or a probability plot. *[The QQ-plot is close to a straight line, so the normality assumption appears reasonable.]*
The independence of the observations might be checked to see if there is any relation between successive observations. *[A time-series plot showed no obvious trends.]*