Keys to Sample Final Exam in MA 180/418, Spring 2010

Q1: **d**	Q2: **c**	Q3: **c**	Q4: **d**	Q5: **b**
Q6: **b**	Q7: **a**	Q8: **b**	Q9: **a**	Q10: **b**

Q11: $z_{\text{SAT}} = -1.08$ and $z_{\text{ACT}} = -1.06$, so the ACT score is relatively better.

Q12: (a) $n = \frac{(2.575)^2 \cdot 0.25}{0.04^2} = 1,036.04$, round up to $1,037$.
(b) $n = \frac{(2.575)^2 \cdot 0.09 \cdot 0.91}{0.04^2} = 339.405$, round up to 340.

Q13: (a) $\mu = 580 \cdot 0.25 = 145$ and $\sigma = \sqrt{580 \cdot 0.25 \cdot 0.75} = 10.428$.
(b) $\mu + 2\sigma = 165.9$ and $\mu - 2\sigma = 124.1$.
(c) by Table A-2: $z = 0.34$ and $P = 1 - 0.6331 = 0.3669$
by calculator: **normalcdf(148.5,9999,145,10.428)=0.3686**.

Q14: $1.306 < \mu < 1.334$.

Q15: (a) $H_0\colon p = 0.75$, $H_1\colon p \neq 0.75$
(b) critical values: $z = \pm 2.33$
(c) test statistic: $z = -1.33$ initial conclusion: accept H_0;
final conclusion: accept the original claim;
(d) by Table A.2: P-value=0.1836; by calculator: P-value=0.1832.

Q16: $n = \left[\frac{1.645 \cdot 2.4}{0.14}\right]^2 = 795.24$, round up to 796.

Q17: (a) $H_0\colon \sigma = 3.0$, $H_1\colon \sigma > 3.0$
(b) critical value: $\chi^2 = 35.172$
(c) test statistic: $\chi^2 = 33.12$; initial conclusion: accept H_0;
final conclusion: reject the original claim;
[Bonus] P-value is between 0.05 and 0.10.

Q18: (a) $H_0\colon \mu_d = 0$, $H_1\colon \mu_d \neq 0$
(b) critical values: $t = \pm 2.132$
(c) test statistic: $t = -4.000$; initial conclusion: reject H_0;
final conclusion: there is a difference.

Q19: (a) $r = 0.944$; the critical value is 0.878. There is a linear correlation.
(b) $\hat{y} = -34.02 + 1.396\,x$
(c) the predicted y-value is $-34.0 + 1.396 \cdot 100 = 105.6$
(we use the regression equation, because there is a linear correlation).

Q20: (a) $r^2 = 0.8912$

(b) $s_e = 3.6073$ (by calculator)

(c) total variation: $(n-1)s_y^2 = (5-1) \cdot (9.471)^2 = 358.8$

(d) explained variation: $358.8 \cdot 0.8912 = 319.8$

(e) unexplained variation: $(n-2)s_e^2 = (5-2) \cdot (3.6073)^2 = 39.0$

[Bonus] We compute

$$\begin{aligned} E &= t_{\alpha/2} s_e \sqrt{1 + \frac{1}{n} + \frac{n(x_0 - \bar{x})^2}{n(\Sigma x^2) - (\Sigma x)^2}} \\ &= 3.182 \cdot 3.6073 \cdot \sqrt{1 + \frac{1}{5} + \frac{5 \cdot (100 - 104)^2}{5 \cdot 54244 - (520)^2}} \\ &= 13.07. \end{aligned}$$

Now the interval is 105.6 ± 13.1.

Another form for the prediction interval: $(92.5, 118.7)$.