13-8

a. Note that $df = 66 - 3 - 1 = 62 \approx 60$, so $t_{.025} = 2$.

X_1

95% CI $= 0.021 \pm 2 \cdot 0.019 = 0.021 \pm 0.38$
t-ratio $= 0.021/0.019 = 1.105$
p-value $> 2 \cdot 0.1 = 0.2$ (two-sided p-value)

X_2

95% CI $= 0.075 \pm 2 \cdot 0.034 = 0.075 \pm 0.068$
t-ratio $= 0.075/0.034 = 2.206$
p-value $2 \cdot 0.010 - -2 \cdot 0.025$, ie, $0.02 - -0.05$ (two-sided p-value)

X_3

95% CI $= 0.043 \pm 2 \cdot 0.018 = 0.043 \pm 0.0.036$
t-ratio $= 0.043/0.018 = 2.390$
p-value $\approx 2 \cdot 0.010 = 0.02$ (two-sided p-value)

b. We are assuming that the 66 students are a random sample for a hypothetical large population, which in this case in not so reasonable – they are very far from having been selected at random, they are just the available students at a certain time.

c. The variable X_3, because it has the largest t-ratio and smallest p-value.

d. We should keep the first regressor first because there is enough statistical evidence to support that, and second because it is very reasonable to expect that a student's rank (from the bottom) is positively related with his/her score in a test.

13-11

a. $\Delta Y = b_2 \Delta X_2 = -1.1(5-2) = -3.3$, therefore the answer should be less \$3.3 per front foot.

b. $\Delta Y = b_3 \Delta X_3 = -1.34(-1/2) = 0.67$, and we conclude that the price per front foot is \$0.67 higher if the lot is 1/2 a mile closer to the nearest paved road (other things being equal).

c. $\Delta Y = b_1 \Delta X_1 = 1.5(5-1) = 6$, so the price is \$6 per front foot higher than in 1970. (Same kind of lot: size and distance from the nearest paved road.)

14-3

a. $df = 1072 - 5 - 1 = 1066 \Rightarrow t_{.025} \approx z_{.025} = 1.96$

AGE	$-3.9 \pm 1.96 \times 1.8 = -3.9 \pm 3.53$
SMOK	$-9.0 \pm 1.96 \times 2.2 = -9.0 \pm 4.31$
CHEMW	$-350 \pm 1.96 \times 46 = -350 \pm 90.16$
FARMW	$-380 \pm 1.96 \times 53 = -380 \pm 103.88$
FIREW	$-180 \pm 1.96 \times 54 = -180 \pm 105.84$

b. age and amount of cigarettes per day; 9; lower.

c. 30; higher.

d. 39; lower.

e. $20 \times 9 = 180$; lower.

d. $180/39 \approx 4.6$ years; important variables may be omited.

14-9

a. **i.** $D_A = D_B = 0$, so $\hat{Y} = 61$.

ii. $D_A = 1,\ D_B = 0$, so $\hat{Y} = 61 + 9 = 70$.

iii. $D_A = 0,\ D_B = 1$, so $\hat{Y} = 61 + 12 = 73$.

b. $\bar{C}$ = answer **i.**, $\bar{A}$ = answer **ii.** and $\bar{B}$ = answer **iii.**.

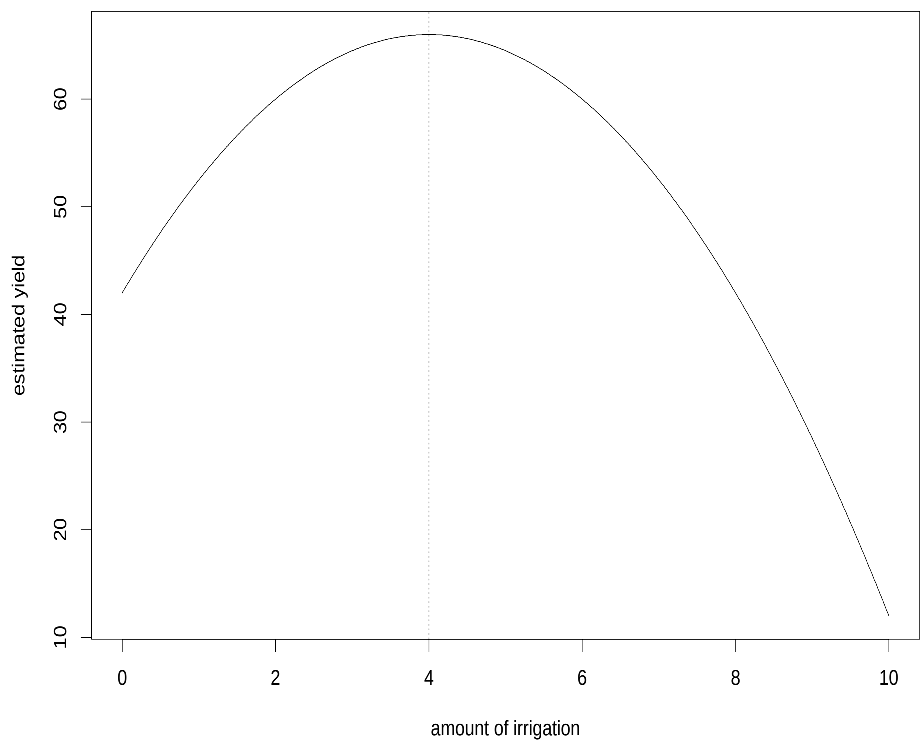
c. one factor ANOVA; "Yield" is the response, the factor is the type of fertilizer — A, B or none (C).

14-13

a. Not very credible, since too much water should have a negative effect on the yield.

b. We should test that the coefficient for I^2 is zero. $df = 14 - 2 - 1 = 11$ and the t ratio is $-1.5/.4 = -3.75$ which implies that the p-value is between $2 \times .001$ and $2 \times .0025$, that is $0.002 < p - value < 0.005$. This conveys very little evidence in support of this hypothesis, which confirms our previous answer.

c. The maximum occurs at $I = 4$, but we can use less water without decreasing too much the yield.



d. $\Delta\hat{Y} = 12 \cdot \Delta I - 1.5 \cdot \Delta I^2 = 12 \cdot (3-2) - 1.5 \cdot (3^2 - 2^2) = 4.5$

14-18

a. elasticity $= 1.3$ (slope)

b. relative change in price $\approx$ change in log price, so if price increased by 3%, the price changed 0.03. Hence, $\Delta \log Q = 1.3 \times 0.03 = 0.039$ and, for the same reason, we conclude that Q increased by 3.9%

c. relative change in Q of 10% $\approx$ change in $\log Q$ of 0.1, so,

$$0.1 = 1.3\Delta \log P \Leftrightarrow \Delta \log P = \frac{0.1}{1.3} = 0.007$$

so that the relative change in price should be approximately 7.7%.