Q6

a) $S_{xy} = \sum x_i y_i - \frac{(\sum x_i)\sum y_i}{n} = 161.4$

$S_{xx} = \sum x_i^2 - \frac{(\sum x_i)^2}{n} = 50666.\bar{6}$

$b_1 = \hat{\beta}_1 = \frac{S_{xy}}{S_{xx}} = 0.00318 = 3.185 \times 10^{-4}$

$b_0 = \bar{y} - b_1 \bar{x} = 0.21 - (3.185 \times 10^{-4}) 433.3$

$= 0.07196$

$Y = 3.185 \times 10^{-4} X + 0.07196$

---

b) CI β_1: $\hat{\beta}_1 \pm t_{\alpha/2, n-2} \, s_{\hat{\beta}_1}$, $s_{\hat{\beta}_1} = \frac{s}{\sqrt{S_{xx}}}$

$s^2 = \frac{SSE}{df} = \frac{\sum y_i^2 - \hat{\beta}_0 \sum y_i - \hat{\beta}_1 \sum x_i y_i}{n-2} = 0.0374$

$CI = 3.185 \times 10^{-4} \pm -1.9432 \frac{0.0344}{\sqrt{161.4}}$

$= (2.164 \times 10^{-4}, 4.206 \times 10^{-4})$

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c) $H_0: \hat{B}_1 = 0$

$H_a: B_1 \neq 0$ $\therefore$ rr: $|t| > t_{\alpha/2, n-2}$

$$t = \frac{\hat{B}_1}{s_{B_1}} = \frac{\hat{B}_1}{s/\sqrt{s_{xx}}} = \frac{3.185 \times 10^{4}}{0.0344/\sqrt{161.4}}$$

$t = 6.0632$

$p = 1 - P(T < t) = 6.0732 \times 10^{-5}$

$p < \alpha$, so null hypothesis should be rejected.

The evidence does not suggest that altitude of origin (x) and respiration rate (Y) are unrelated.

(6) py 3

$E(x=720) =$

d) $\hat{y} = \hat{\beta}_1 x + \hat{\beta}_0$

$= 3*185\times10^{-4}(720) + 0.07106 = 0.3013$

$s_{\hat{y}} = s\sqrt{\frac{1}{n} + \frac{(720-\bar{x})^2}{S_{xx}}} = 0.4955$

$CI = \hat{y} \pm t_{\alpha/2, n-2} s_{\hat{y}}$

$= .3013 \pm -2.228(0.4955)$

$= (-0.8027, 1.4054)$

e) $SST = S_{yy} = \sum(y_i - \bar{y})^2 = 0.0654$

$r = 1 - \frac{SSE}{SST} = 1 - \frac{0.139}{0.0654} = \underline{0.7862}$

Q6 Calculation.

```
x <- c(90, 230, 240, 260, 330, 400, 410, 550, 590, 610, 700, 790)
y <- c(0.11, 0.20, 0.13, 0.15, 0.18, 0.16, 0.23, 0.18, 0.23, 0.26, 0.32,
0.37)

n <- length(x)

#a)

Sxy <- sum(x * y) - sum(x) * sum(y)/n

Sxx <- sum(x^2) - sum(x)^2/n

b1 <- Sxy/Sxx

y_bar <- mean(y)
x_bar <- mean(x)

b0 <- y_bar - b1 * x_bar


#b)
SSE <- sum(y^2) - b0 * sum(y) - b1*sum(x*y)
s <- sqrt(SSE/(n-2))

alpha <- 1 - 0.90
t_val <- qt(alpha/2, n/2)

ci <- c(b1 + t_val*s/sqrt(Sxx), b1 - t_val*s/sqrt(Sxx))

# c)
t <- b1 / (s / sqrt(Sxx))

p <- pt(t, n-2, lower.tail=FALSE)


#d)
x_bar <- mean(x)
yd <- b1 * 720 + b0
s_yd <- sqrt(1/n + (720 - x_bar)^2/Sxx)
t_vald <- qt(0.05/2, n-2)
cid <- c(yd + t_vald*s_yd, yd - t_vald*s_yd)


#e)
y_bar <- mean(y)
SST <- sum((y - y_bar)^2)
r <- 1 - SSE/SST
```