Homework 1

PSTAT 120C

Contents

Problem 1

```r
ex1_y <- c(9, 14, 7, 29, 45, 109, 40, 238, 60, 170)
ex1_x <- c(10, 12, 9, 27, 47, 112, 36, 241, 59, 167)

lm(ex1_y ~ ex1_x)
```

```
##
## Call:
## lm(formula = ex1_y ~ ex1_x)
##
## Coefficients:
## (Intercept)        ex1_x
##      0.7198       0.9914
```

```r
summary(lm(ex1_y ~ ex1_x))
```

```
##
## Call:
## lm(formula = ex1_y ~ ex1_x)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.7557 -2.1477 -0.4228  1.4803  3.7178
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.7198     1.1764   0.612    0.558
## ex1_x         0.9914     0.0114  86.994  3.4e-13 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.666 on 8 degrees of freedom
## Multiple R-squared:  0.9989, Adjusted R-squared:  0.9988
## F-statistic:  7568 on 1 and 8 DF,  p-value: 3.401e-13
```

```
data <- tibble(ex1_x, ex1_y)

ggplot(data, aes(ex1_x, ex1_y)) + geom_point(color = 'black') +
  geom_smooth(method = "lm", lty = 3, col = 'red',
              se = FALSE) +
  theme_bw()
```

'geom_smooth()' using formula = 'y ~ x'
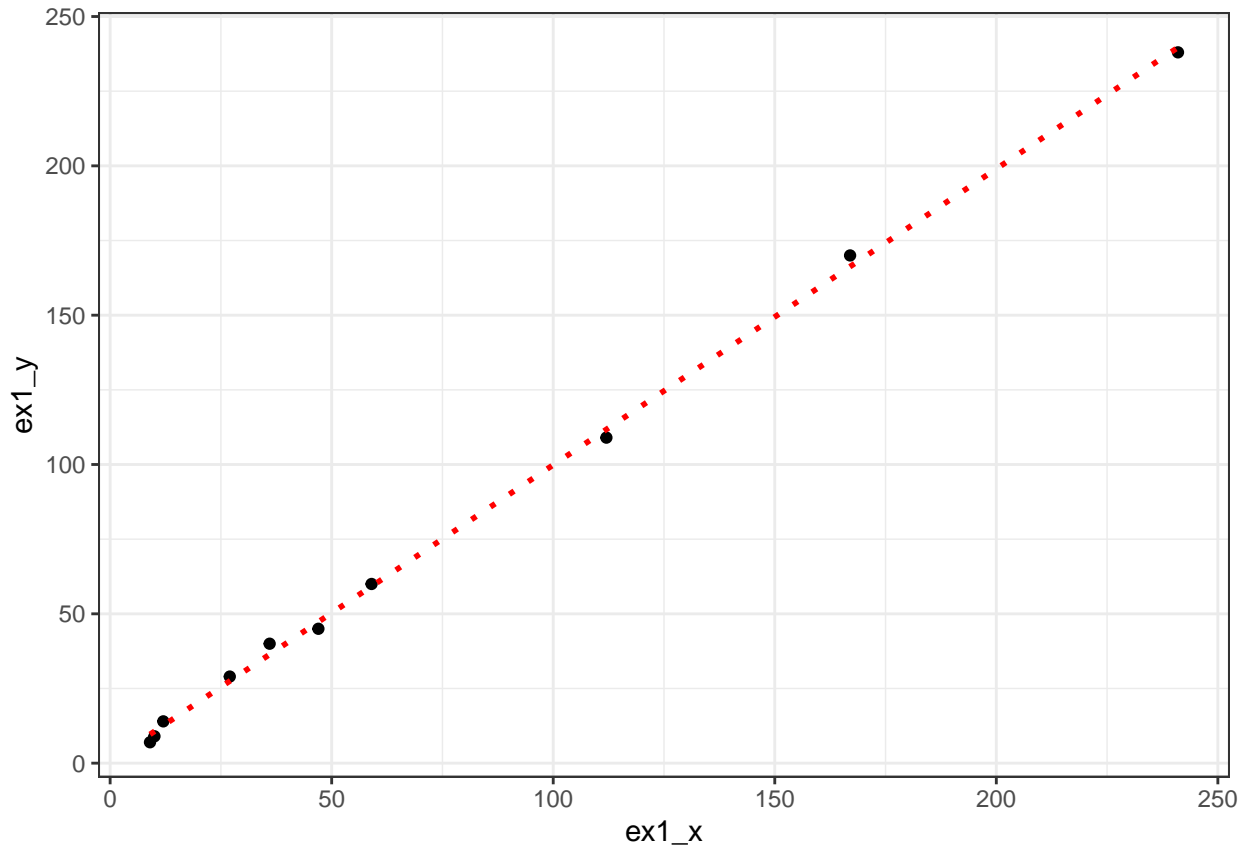

```
s_xy <- sum( (ex1_x - mean(ex1_x))*(ex1_y - mean(ex1_y)) )
s_xx <- sum( (ex1_x - mean(ex1_x))^2 )
s_yy <- sum( (ex1_y - mean(ex1_y))^2 )

b1 <- sum((ex1_x - mean(ex1_x)) * (ex1_y - mean(ex1_y))) / sum((ex1_x - mean(ex1_x))^2)
b0 <- mean(ex1_y) - b1 * mean(ex1_x)

b1_hat <- s_xy/s_xx
b0_hat <- mean(ex1_y) - b1_hat*mean(ex1_x)
y_hat <- b0 + b1 * ex1_x

sse <- s_yy - b1_hat*s_xy
sse
```

[1] 56.84544

```r
# The SSE is ~56.85
s <- sqrt(sse/(length(ex1_y) - 2))
s_2 <- 1/(length(ex1_x)-2) * sum((ex1_y - y_hat)^2)
s_2
```

```
## [1] 7.10568
```

```r
# The S^2 is ~7.11

other <- sqrt(1/s_xx)
t <- b1_hat/(s * other)

qt(p = 0.025, df = 10)
```

```
## [1] -2.228139
```

```r
pt(t, df = 10, lower.tail = F) * 2
```

```
## [1] 9.852713e-16
```

```r
# Expected change per one-unit change in book value: 0.9914

0.7198+0.9914*100
```

```
## [1] 99.8598
```

```r
# Audit value for an item with book value of $100: ~$99.86
```