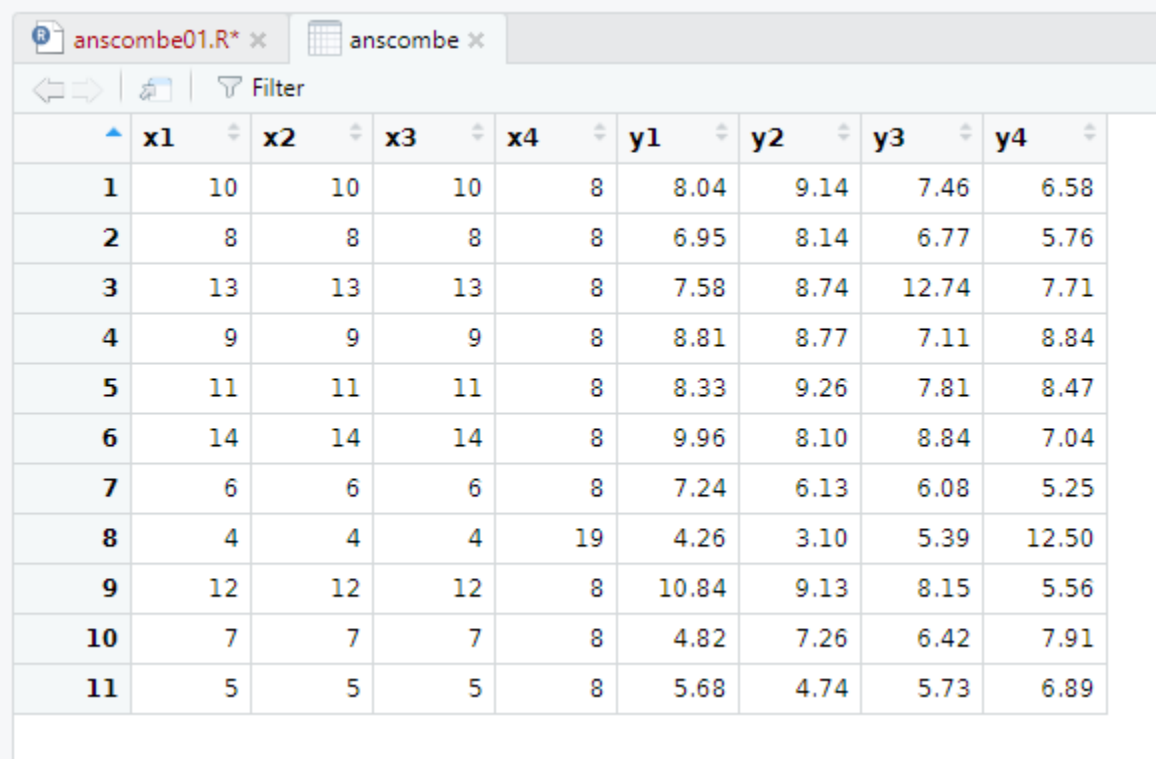
Assignment 3 – Code and Output from "anscombe01.R"
09//27/22

CODE

```
> data(anscombe)  # Load Anscombe's data

> View(anscombe) # View the data
```

OUTPUT



	x1	x2	x3	x4	y1	y2	y3	y4
1	10	10	10	8	8.04	9.14	7.46	6.58
2	8	8	8	8	6.95	8.14	6.77	5.76
3	13	13	13	8	7.58	8.74	12.74	7.71
4	9	9	9	8	8.81	8.77	7.11	8.84
5	11	11	11	8	8.33	9.26	7.81	8.47
6	14	14	14	8	9.96	8.10	8.84	7.04
7	6	6	6	8	7.24	6.13	6.08	5.25
8	4	4	4	19	4.26	3.10	5.39	12.50
9	12	12	12	8	10.84	9.13	8.15	5.56
10	7	7	7	8	4.82	7.26	6.42	7.91
11	5	5	5	8	5.68	4.74	5.73	6.89

CODE

```
> summary(anscombe)
```

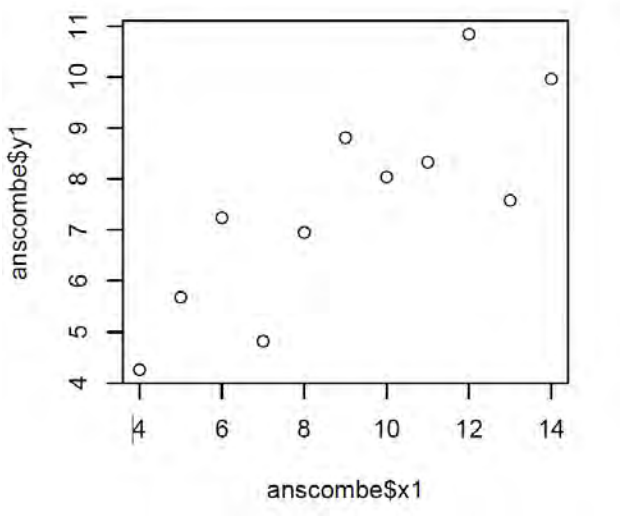
OUTPUT

```
       x1              x2              x3              x4              y1              y2              y3              y4
 Min.   : 4.0   Min.   : 4.0   Min.   : 4.0   Min.   : 8   Min.   : 4.260   Min.   :3.100   Min.   : 5.39   Min.   : 5.250
 1st Qu.: 6.5   1st Qu.: 6.5   1st Qu.: 6.5   1st Qu.: 8   1st Qu.: 6.315   1st Qu.:6.695   1st Qu.: 6.25   1st Qu.: 6.170
 Median : 9.0   Median : 9.0   Median : 9.0   Median : 8   Median : 7.580   Median :8.140   Median : 7.11   Median : 7.040
 Mean   : 9.0   Mean   : 9.0   Mean   : 9.0   Mean   : 9   Mean   : 7.501   Mean   :7.501   Mean   : 7.50   Mean   : 7.501
 3rd Qu.:11.5   3rd Qu.:11.5   3rd Qu.:11.5   3rd Qu.: 8   3rd Qu.: 8.570   3rd Qu.:8.950   3rd Qu.: 7.98   3rd Qu.: 8.190
 Max.   :14.0   Max.   :14.0   Max.   :14.0   Max.   :19   Max.   :10.840   Max.   :9.260   Max.   :12.74   Max.   :12.500
```

CODE

```
> ## Simple version
> plot(anscombe$x1,anscombe$y1)
```

OUTPUT



CODE

```
> # Create four model objects
> lm1 <- lm(y1 ~ x1, data=anscombe)
> summary(lm1)
```

OUTPUT

```
Call:
lm(formula = y1 ~ x1, data = anscombe)
Residuals:
    Min      1Q  Median      3Q     Max
-1.92127 -0.45577 -0.04136  0.70941  1.83882
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.0001     1.1247   2.667  0.02573 *
x1            0.5001     0.1179   4.241  0.00217 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Residual standard error: 1.237 on 9 degrees of freedom
Multiple R-squared:  0.6665,      Adjusted R-squared:  0.6295
F-statistic: 17.99 on 1 and 9 DF,  p-value: 0.00217
```

CODE

```
> lm2 <- lm(y2 ~ x2, data=anscombe)
> summary(lm2)
```

OUTPUT

```
Call:
lm(formula = y2 ~ x2, data = anscombe)
Residuals:
   Min     1Q  Median     3Q    Max
-1.9009 -0.7609  0.1291  0.9491  1.2691
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    3.001      1.125   2.667  0.02576 *
x2             0.500      0.118   4.239  0.00218 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Residual standard error: 1.237 on 9 degrees of freedom
Multiple R-squared:  0.6662,     Adjusted R-squared:  0.6292
F-statistic: 17.97 on 1 and 9 DF,  p-value: 0.002179
```

CODE

```
> lm3 <- lm(y3 ~ x3, data=anscombe)
> summary(lm3)
```

OUTPUT

```
Call:
lm(formula = y3 ~ x3, data = anscombe)
Residuals:
    Min      1Q  Median      3Q     Max
-1.1586 -0.6146 -0.2303  0.1540  3.2411
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.0025     1.1245   2.670  0.02562 *
x3            0.4997     0.1179   4.239  0.00218 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Residual standard error: 1.236 on 9 degrees of freedom
Multiple R-squared:  0.6663,      Adjusted R-squared:  0.6292
F-statistic: 17.97 on 1 and 9 DF,  p-value: 0.002176
```

CODE

```
> lm4 <- lm(y4 ~ x4, data=anscombe)
> summary(lm4)
```

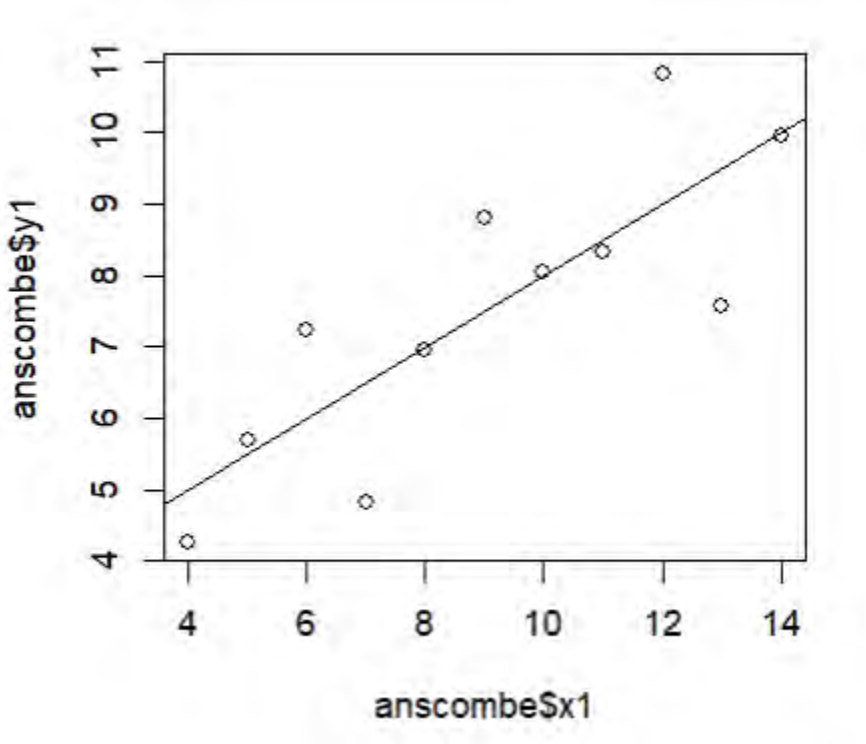
OUTPUT

```
Call:
lm(formula = y4 ~ x4, data = anscombe)
Residuals:
   Min     1Q Median     3Q    Max
-1.751 -0.831  0.000  0.809  1.839
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.0017     1.1239   2.671  0.02559 *
x4            0.4999     0.1178   4.243  0.00216 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Residual standard error: 1.236 on 9 degrees of freedom
Multiple R-squared:  0.6667,      Adjusted R-squared:  0.6297
F-statistic:    18 on 1 and 9 DF,  p-value: 0.002165
```

CODE

```
> plot(anscombe$x1,anscombe$y1)
> abline(coefficients(lm1))
```

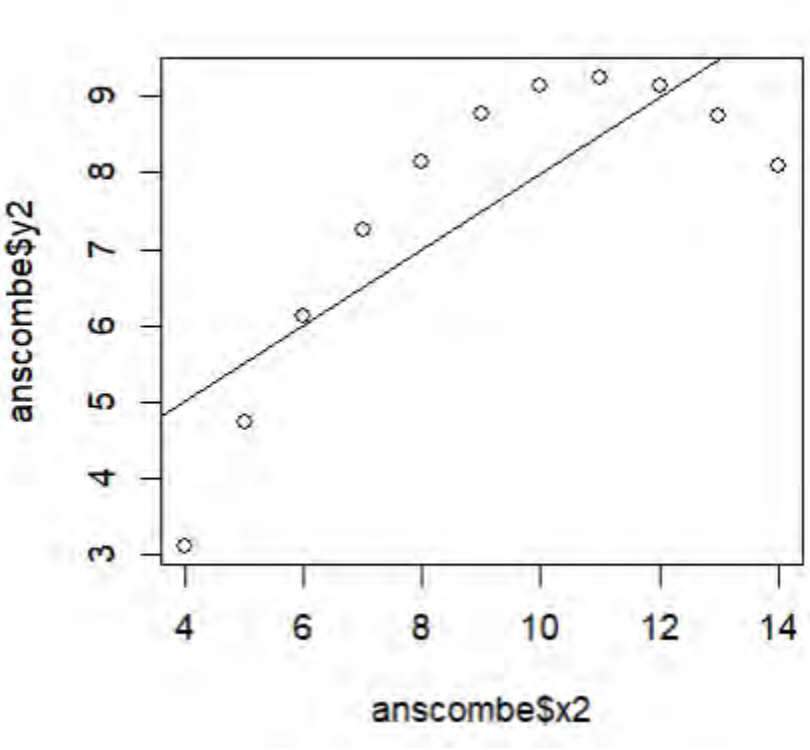
OUTPUT



CODE

```
> plot(anscombe$x2,anscombe$y2)
> abline(coefficients(lm2))
```

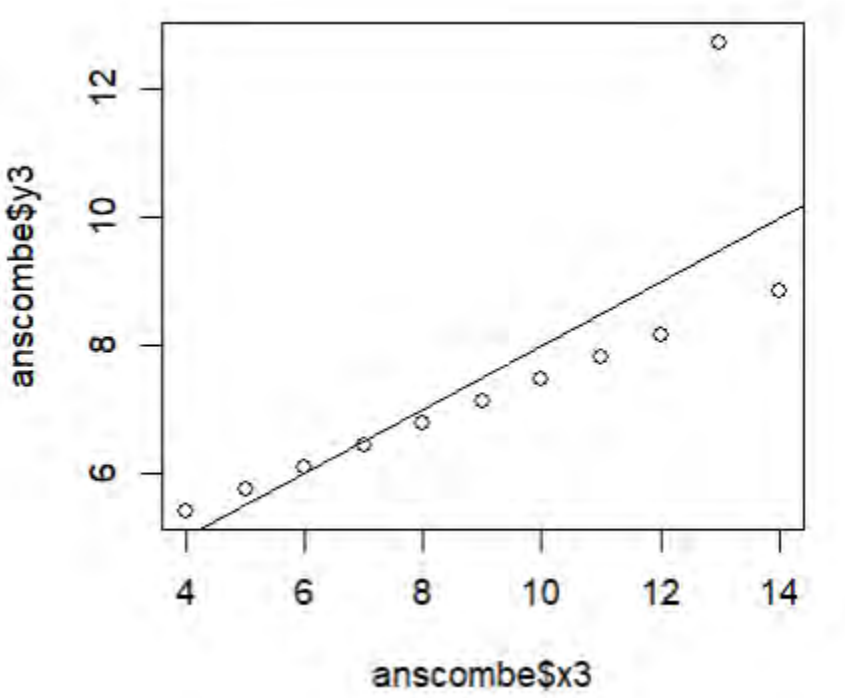
OUTPUT



CODE

```
> plot(anscombe$x3,anscombe$y3)
> abline(coefficients(lm3))
```

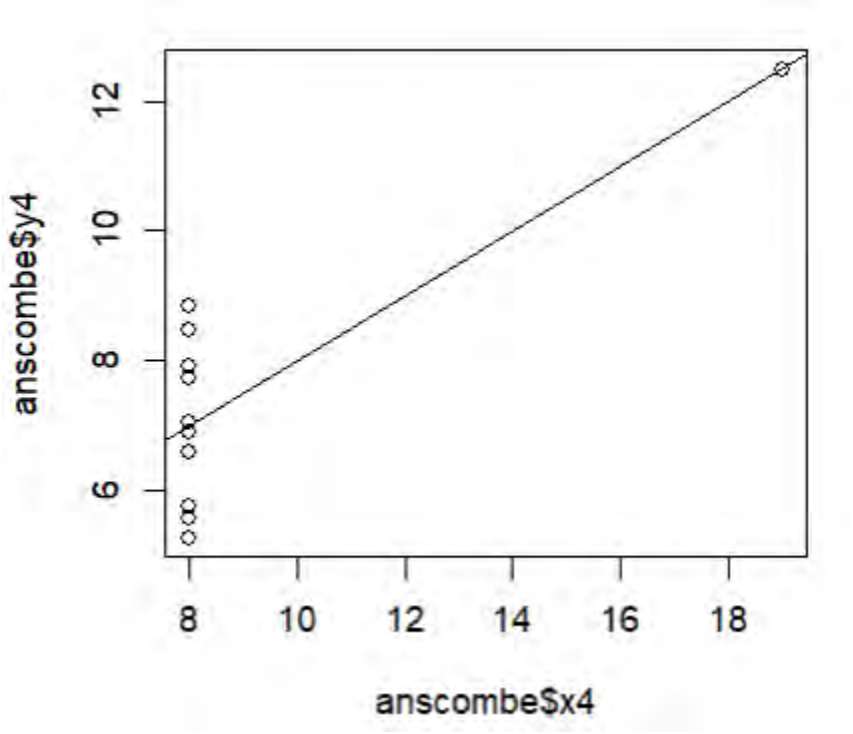
OUTPUT



CODE

```
> plot(anscombe$x4,anscombe$y4)
> abline(coefficients(lm4))
```

OUTPUT



CODE

```
> ff <- y ~ x
> mods <- setNames(as.list(1:4), paste0("lm", 1:4))
> # Plot using for loop
> for(i in 1:4) {
+   ff[2:3] <- lapply(paste0(c("y","x"), i), as.name)
+   ## or   ff[[2]] <- as.name(paste0("y", i))
+   ##      ff[[3]] <- as.name(paste0("x", i))
+   mods[[i]] <- lmi <- lm(ff, data = anscombe)
+   print(anova(lmi))
+ }
```

OUTPUT

```
Analysis of Variance Table
Response: y1
          Df Sum Sq Mean Sq F value  Pr(>F)
x1         1 27.510 27.5100   17.99 0.00217 **
Residuals  9 13.763  1.5292
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Analysis of Variance Table

Response: y2
          Df Sum Sq Mean Sq F value   Pr(>F)
x2         1 27.500 27.5000  17.966 0.002179 **
Residuals  9 13.776  1.5307
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Analysis of Variance Table
```

```
Response: y3
          Df Sum Sq Mean Sq F value   Pr(>F)
x3         1 27.470 27.4700  17.972 0.002176 **
Residuals  9 13.756  1.5285
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Analysis of Variance Table

Response: y4
          Df Sum Sq Mean Sq F value   Pr(>F)
x4         1 27.490 27.4900  18.003 0.002165 **
Residuals  9 13.742  1.5269
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> sapply(mods, coef)  # Note the use of this function
                lm1      lm2       lm3       lm4
(Intercept) 3.0000909 3.000909 3.0024545 3.0017273
x1          0.5000909 0.500000 0.4997273 0.4999091
> lapply(mods, function(fm) coef(summary(fm)))
$lm1
            Estimate Std. Error  t value    Pr(>|t|)
(Intercept) 3.0000909  1.1247468 2.667348 0.025734051
x1          0.5000909  0.1179055 4.241455 0.002169629

$lm2
            Estimate Std. Error  t value    Pr(>|t|)
(Intercept) 3.000909  1.1253024 2.666758 0.025758941
x2          0.500000  0.1179637 4.238590 0.002178816
```

$lm3

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	3.0024545	1.1244812	2.670080	0.025619109
x3	0.4997273	0.1178777	4.239372	0.002176305

$lm4

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	3.0017273	1.1239211	2.670763	0.025590425
x4	0.4999091	0.1178189	4.243028	0.002164602

CODE

```
> # Preparing for the plots
> op <- par(mfrow = c(2, 2), mar = 0.1+c(4,4,1,1), oma =  c(0, 0, 2, 0))
> # Plot charts using for loop
> for(i in 1:4) {
+   ff[2:3] <- lapply(paste0(c("y","x"), i), as.name)
+   plot(ff, data = anscombe, col = "red", pch = 21, bg = "orange", cex = 1.2,
+        xlim = c(3, 19), ylim = c(3, 13))
+   abline(mods[[i]], col = "blue")
+ }
> mtext("Anscombe's 4 Regression data sets", outer = TRUE, cex = 1.5)
> par(op)
```

OUTPUT