Question

1. Use backward elimination, forward selection and stepwise regression to select a subset of model.
2. Write down the final model chosen by these three procedures.

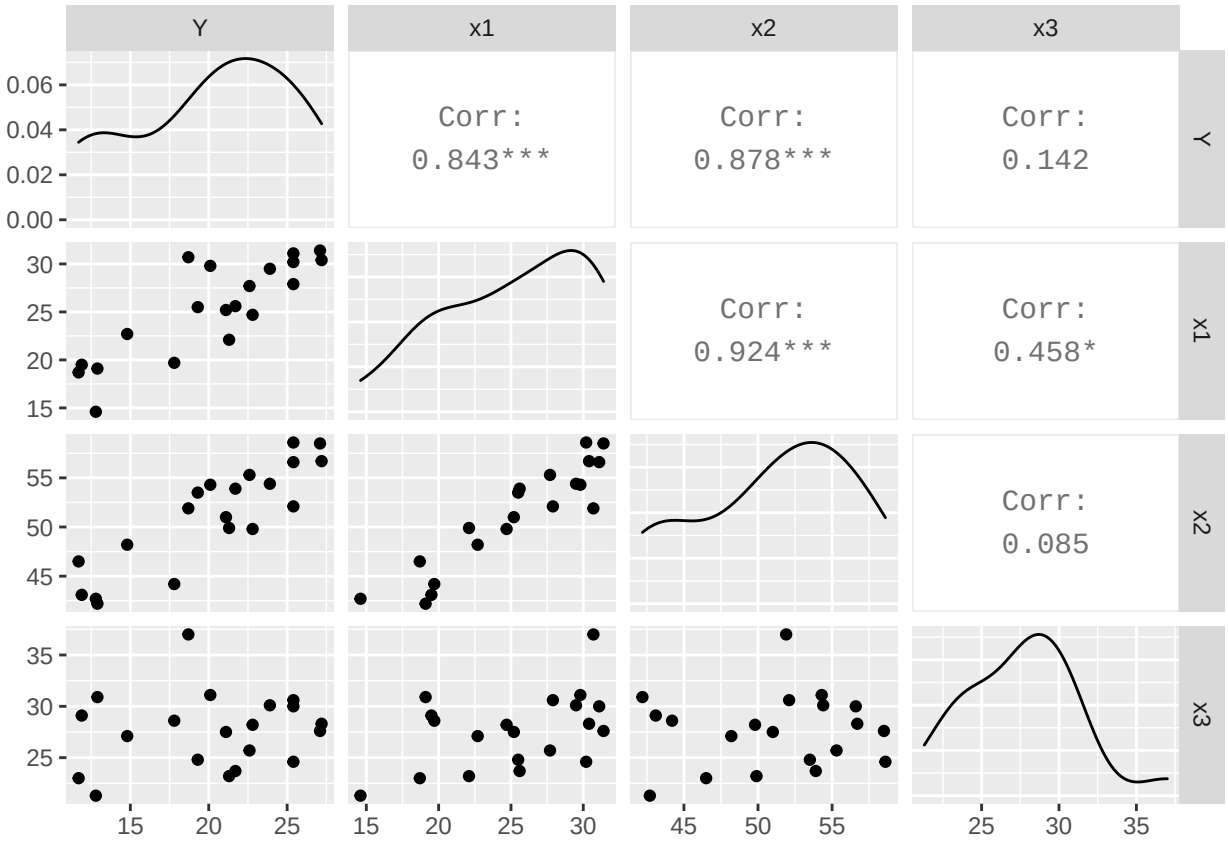
Useful R outputs

Output 1

```
      Y   x1   x2   x3
1  11.9 19.5 43.1 29.1
2  22.8 24.7 49.8 28.2
3  18.7 30.7 51.9 37.0
4  20.1 29.8 54.3 31.1
5  12.9 19.1 42.2 30.9
6  21.7 25.6 53.9 23.7
7  27.1 31.4 58.5 27.6
8  25.4 27.9 52.1 30.6
9  21.3 22.1 49.9 23.2
10 19.3 25.5 53.5 24.8
11 25.4 31.1 56.6 30.0
12 27.2 30.4 56.7 28.3
13 11.7 18.7 46.5 23.0
14 17.8 19.7 44.2 28.6
15 12.8 14.6 42.7 21.3
16 23.9 29.5 54.4 30.1
17 22.6 27.7 55.3 25.7
18 25.4 30.2 58.6 24.6
19 14.8 22.7 48.2 27.1
20 21.1 25.2 51.0 27.5
```

Output 2

```
library(GGally)
ggpairs(data)
```



Output 3

```
lm.minimal <- lm(Y ~ 1, data=data)
lm.minimal
```

```
Call:
lm(formula = Y ~ 1, data = data)

Coefficients:
(Intercept)
       20.2
```

Output 4

```
lm.all <- lm(Y ~ . , data=data)
lm.all
```

```
Call:
lm(formula = Y ~ ., data = data)
```

```
Coefficients:
(Intercept)           x1           x2           x3
    117.085        4.334       -2.857       -2.186
```

Output 5

```
step(lm.minimal, scope=list(upper = lm.all,
lower= lm.minimal), direction="forward",
trace=1)
```

```
Start:  AIC=66.19
Y ~ 1

       Df Sum of Sq    RSS    AIC
+ x2    1    381.97 113.42 38.708
+ x1    1    352.27 143.12 43.359
<none>              495.39 66.192
+ x3    1     10.05 485.34 67.782

Step:  AIC=38.71
Y ~ x2

       Df Sum of Sq    RSS    AIC
<none>              113.42 38.708
+ x1    1    3.4729 109.95 40.086
+ x3    1    2.3139 111.11 40.296


Call:
lm(formula = Y ~ x2, data = data)

Coefficients:
(Intercept)           x2
   -23.6345       0.8565
```

Output 6

```
step(lm.all, direction="backward", trace=1)
```

```
Start:  AIC=39.87
Y ~ x1 + x2 + x3

       Df Sum of Sq     RSS    AIC
- x2    1    7.5293 105.934 39.342
<none>               98.405 39.867
- x3    1   11.5459 109.951 40.086
- x1    1   12.7049 111.110 40.296

Step:  AIC=39.34
```

```
Y ~ x1 + x3

       Df Sum of Sq    RSS    AIC
<none>              105.93 39.342
- x3    1     37.19 143.12 43.359
- x1    1    379.40 485.34 67.782


Call:
lm(formula = Y ~ x1 + x3, data = data)

Coefficients:
(Intercept)           x1           x3
     6.7916       1.0006      -0.4314
```

Output 7

```
step(lm.minimal, scope=list(upper = lm.all,
lower= lm.minimal),  direction="both", trace=1)
```

```
Start:  AIC=66.19
Y ~ 1

       Df Sum of Sq    RSS    AIC
+ x2    1    381.97 113.42 38.708
+ x1    1    352.27 143.12 43.359
<none>              495.39 66.192
+ x3    1     10.05 485.34 67.782

Step:  AIC=38.71
Y ~ x2

       Df Sum of Sq    RSS    AIC
<none>              113.42 38.708
+ x1    1      3.47 109.95 40.086
+ x3    1      2.31 111.11 40.296
- x2    1    381.97 495.39 66.192


Call:
lm(formula = Y ~ x2, data = data)

Coefficients:
(Intercept)           x2
   -23.6345       0.8565
```