HW#3

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```
# Load the data
library(faraway)
tg <- faraway::teengamb
```

Part a

```
#Fit the first model
lm1 <- lm(gamble ~ sex + status + income + verbal, data = tg)
# Create the design matrices and hat matrices
X <- model.matrix(lm1)
X1 <- X[,1]
H <- X%*%solve(t(X)%*%X)%*%t(X)
H1 <- X1%*%solve(t(X1)%*%X1)%*%t(X1)
# Define y
y = tg$gamble
# Compute yhat
yhat <- H%*%y
# Compute ybar
ybar <- H1%*%y
# Compute SSR and SST
SSR <- t(yhat - ybar)%*%(yhat - ybar)
SST <- t(y - ybar)%*%(y - ybar)
# Compute r squared
rsqrt <- SSR/SST
rsqrt
```

```
##           [,1]
## [1,] 0.5267234
```

Part b

```
# Compute the residual
tg$r = y - yhat
# Find what is the maximal residual value
rmax = max(tg$r)
rmax
```

```
## [1] 94.25222
```

```
# Find which case has largest residual
which(tg$r == rmax)
```

```
## [1] 24
```

Part c

```
# Find the mean of the residuals
mean(tg$r)
```

```
## [1] -1.359206e-14
```

```
mean(lm1$residuals)
```

```
## [1] -3.065293e-17
```

```
# Find the merdian of the residuals
median(tg$r)
```

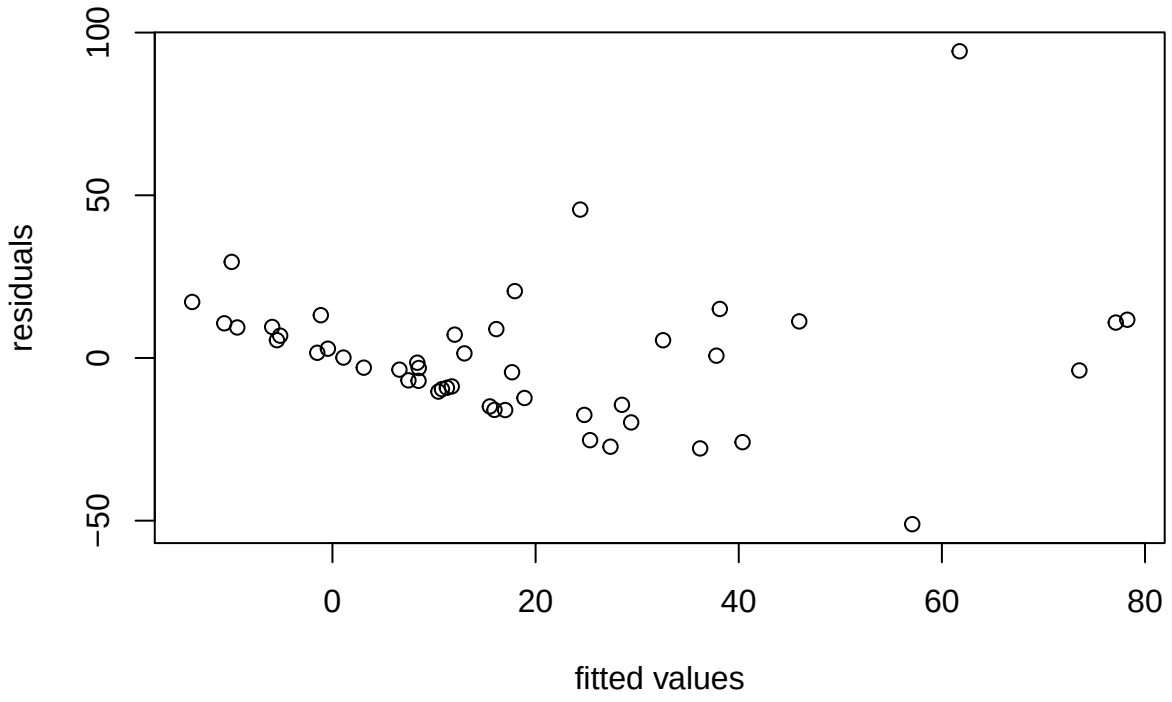
```
## [1] -1.451392
```

```
median(lm1$residuals)
```

```
## [1] -1.451392
```

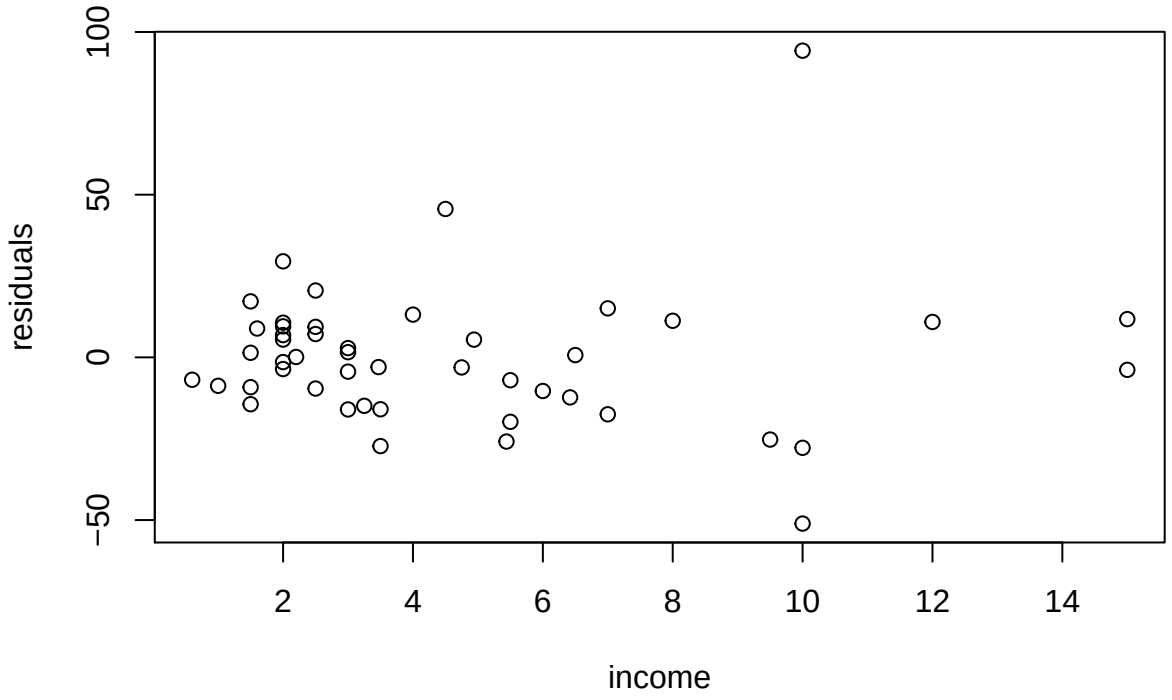
Part d

```
# Plot the residuals against the fitted values
plot(lm1$fitted,tg$r,xlab = "fitted values", ylab = "residuals")
```



Part e

```
# Plot the residuals against the variable income
plot(tg$income,tg$r,xlab = "income", ylab = "residuals")
```



Part d

```
lm1
```

```
##
## Call:
## lm(formula = gamble ~ sex + status + income + verbal, data = tg)
##
## Coefficients:
## (Intercept)          sex       status       income       verbal
##    22.55565    -22.11833      0.05223      4.96198     -2.95949
```

```
tg
```

```
##    sex status income verbal gamble           r
## 1    1     51   2.00      8   0.00  10.6507430
## 2    1     28   2.50      8   0.00   9.3711318
## 3    1     37   2.00      6   0.00   5.4630298
## 4    1     28   7.00      4   7.30 -17.4957487
## 5    1     65   2.00      8  19.60  29.5194692
## 6    1     61   3.47      6   0.10  -2.9846919
## 7    1     28   5.50      7   1.45  -7.0242994
## 8    1     27   6.42      5   6.60 -12.3060734
## 9    1     43   2.00      6   1.70   6.8496267
## 10   1     18   6.00      7   0.10 -10.3329505
## 11   1     18   3.00      6   0.10   1.5934936
## 12   1     43   4.75      6   5.40  -3.0958161
## 13   1     30   2.20      4   1.20   0.1172839
## 14   1     28   2.00      6   3.60   9.5331344
## 15   1     38   3.00      6   2.40   2.8488167
## 16   1     38   1.50      8   3.40  17.2107726
## 17   1     28   9.50      8   0.10 -25.2627227
```

```
## 18   1     18  10.00      5   8.40 -27.7998544
## 19   1     43   4.00      8  12.00  13.1446553
## 20   0     51   3.50      9   0.00 -15.9510624
## 21   0     62   3.00      8   1.00 -16.0041386
## 22   0     47   2.50      9   1.20  -9.5801478
## 23   0     43   3.50      5   0.10 -27.2711657
## 24   0     27  10.00      4 156.00  94.2522174
## 25   0     71   6.50      7  38.50   0.6993361
## 26   0     38   1.50      7   2.10  -9.1670510
## 27   0     51   5.44      4  14.50 -25.8747696
## 28   0     38   1.00      6   3.00  -8.7455549
## 29   0     51   0.60      7   0.60  -6.8803097
## 30   0     62   5.50      8   9.60 -19.8090866
## 31   0     18  12.00      2  88.00  10.8793766
## 32   0     30   7.00      7  53.20  15.0599340
## 33   0     38  15.00      7  90.00  11.7462296
## 34   0     71   2.00     10   3.00  -3.5932770
## 35   0     28   1.50      1  14.10 -14.4016736
## 36   0     61   4.50      8  70.00  45.6051264
## 37   0     71   2.50      7  38.50  20.5472529
## 38   0     28   8.00      6  57.20  11.2429290
## 39   0     51  10.00      6   6.00 -51.0824078
## 40   0     65   1.60      6  25.00   8.8669438
## 41   0     48   2.00      9   6.90  -1.4513921
## 42   0     61  15.00      9  69.70  -3.8361619
## 43   0     75   3.00      8  13.30  -4.3831786
## 44   0     66   3.25      9   0.60 -14.8940753
## 45   0     62   4.94      6  38.00   5.4506347
## 46   0     71   1.50      7  14.40   1.4092321
## 47   0     71   2.50      9  19.20   7.1662399
```

```
sumary(lm1)
```

```
##               Estimate Std. Error t value  Pr(>|t|)
## (Intercept)  22.555651  17.196803  1.3116   0.19677
## sex         -22.118330   8.211115 -2.6937   0.01011
## status        0.052234   0.281112  0.1858   0.85349
## income        4.961979   1.025392  4.8391 1.792e-05
## verbal       -2.959493   2.172150 -1.3625   0.18031
##
## n = 47, p = 5, Residual SE = 22.69034, R-Squared = 0.53
```