W241 Final Project Analysis

Contents

Load the raw data

```
library(data.table)
d <- fread('./w241_survey_responses.csv')
```

Remove unnecessary columns

```
not.needed <- c("StartDate", "EndDate", "Status", "IPAddress", "Progress", "Duration (in seconds)",
                "Finished", "RecordedDate", "ResponseId", "RecipientLastName", "RecipientFirstName", "Re
                "ExternalReference", "LocationLatitude", "LocationLongitude", "DistributionChannel", "Us
                "Q3_First Click", "Q3_Last Click", "Q3_Page Submit", "Q3_Click Count",
                "Q34_First Click", "Q34_Last Click", "Q34_Page Submit", "Q34_Click Count",
```

```
                "Q37_First Click", "Q37_Last Click", "Q37_Page Submit", "Q37_Click Count",
                "Q12_First Click", "Q12_Last Click", "Q12_Page Submit", "Q12_Click Count",
                "Q16_First Click", "Q16_Last Click", "Q16_Page Submit", "Q16_Click Count",
                "Q19_First Click", "Q19_Last Click", "Q19_Page Submit", "Q19_Click Count", "MTurkCode",
d[, (not.needed) := NULL]
```

Rename columns to be more descriptive

```
q.names <- c("gender", "state", "education", "served_military",
             'weather', 'terrorists', 'marines', 'video_topic_check',
             'us_involved', 'us_send_aid', 'us_send_troops',
             'raise_tax_rate', 'join_armed_forces')

setnames(d, q.names)
```

Convert weather, terrorists and marines to dummy variables

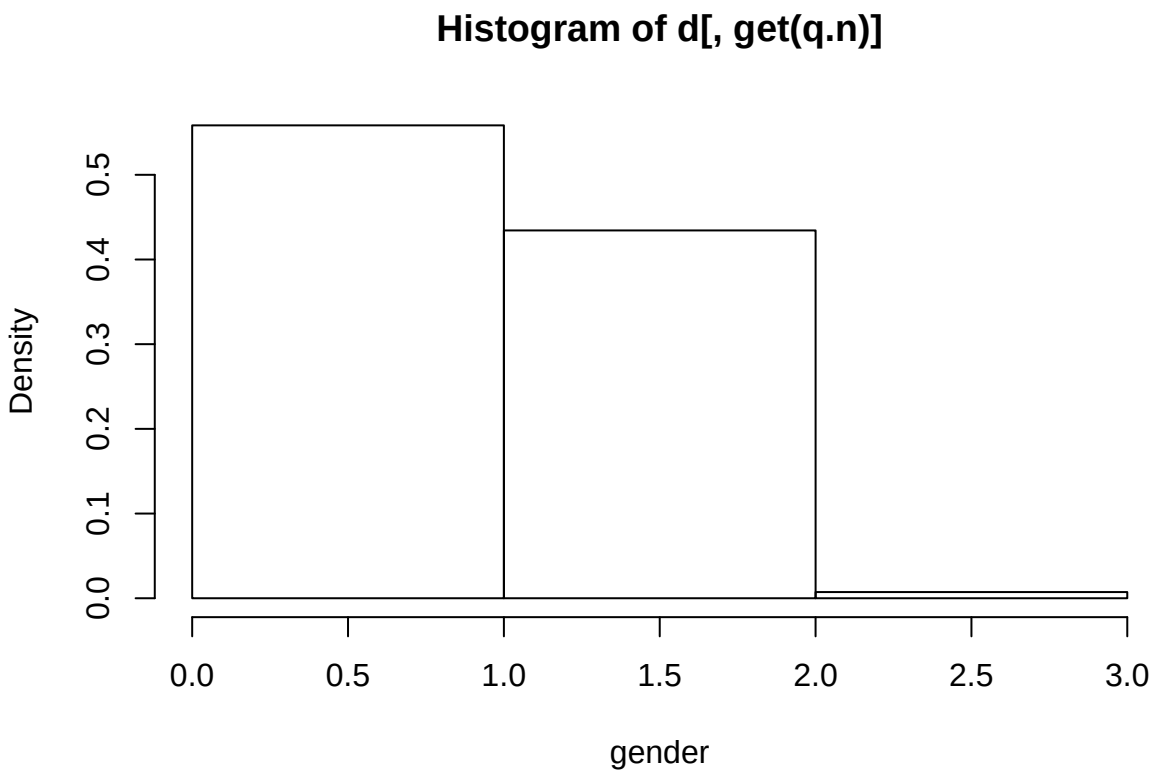
Treat non-compliers as compliers

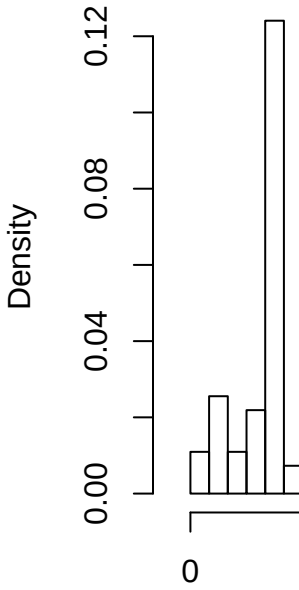
```
# Replace NA with 0
# NA means that the subject did not see the video in question
d[is.na(weather), weather := 0]
d[is.na(terrorists), terrorists := 0]
d[is.na(marines), marines := 0]
```

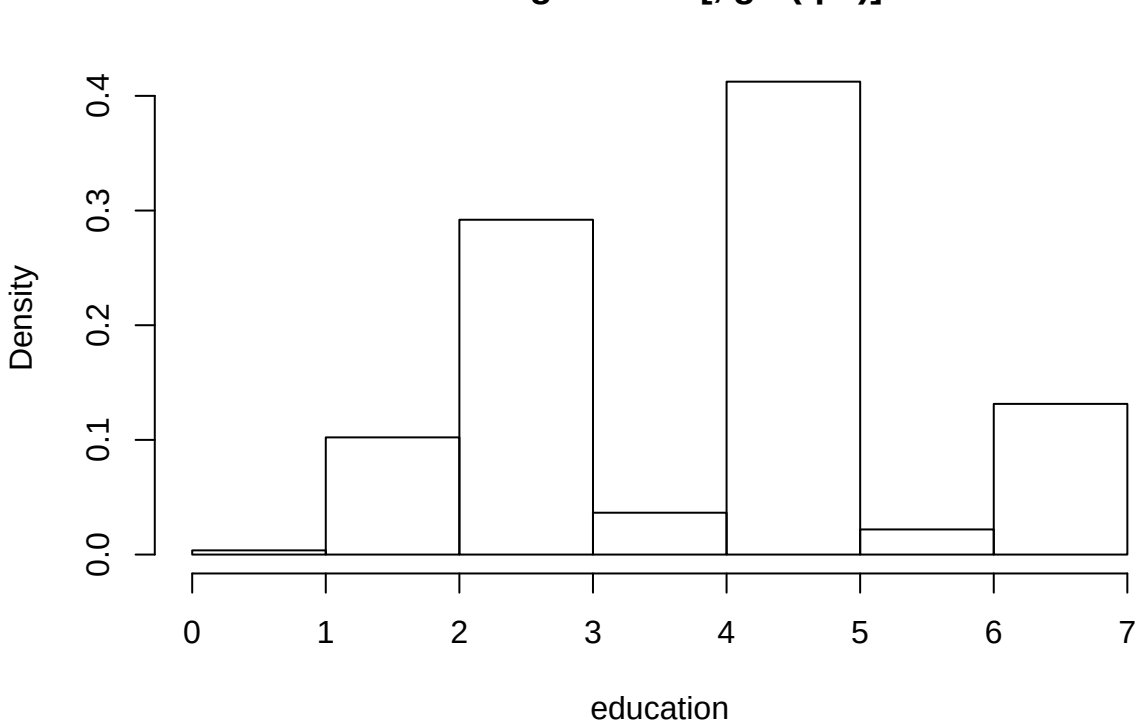
```
deps <- c('us_involved', 'us_send_aid', 'us_send_troops',
           'raise_tax_rate', 'join_armed_forces')
indeps <- c("gender", "state", "education", "served_military")
treats <- c('weather', 'terrorists', 'marines', 'treats')

# Invert responses so that 5 means strongly in favor, and 1 means strongly opposed
d[, deps] <- 6 - d[, deps, with=FALSE]
```

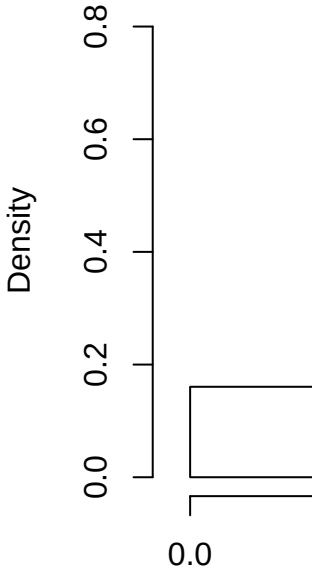
Get a descriptive summary of data

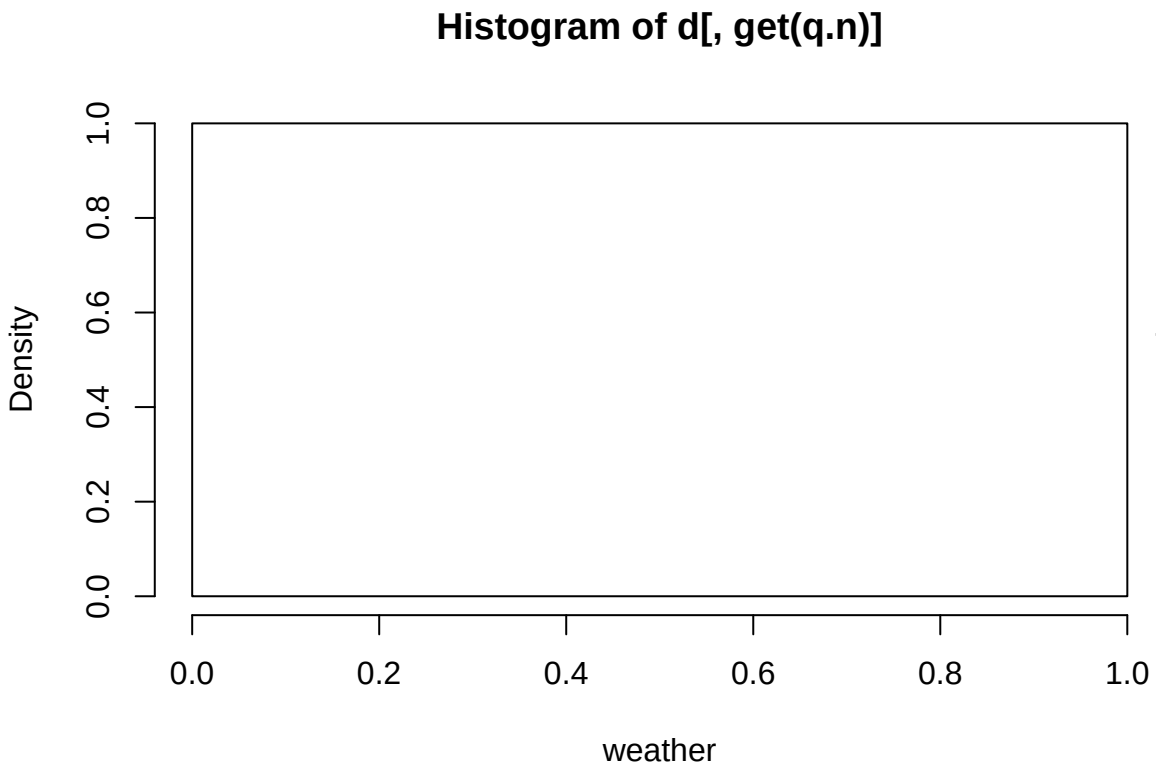
```
library(psych)
for (q.n in (q.names)) {
  hist(d[, get(q.n)], xlab = (q.n), freq = FALSE, breaks = unique(c(0, d[, get(q.n)])))
}
```

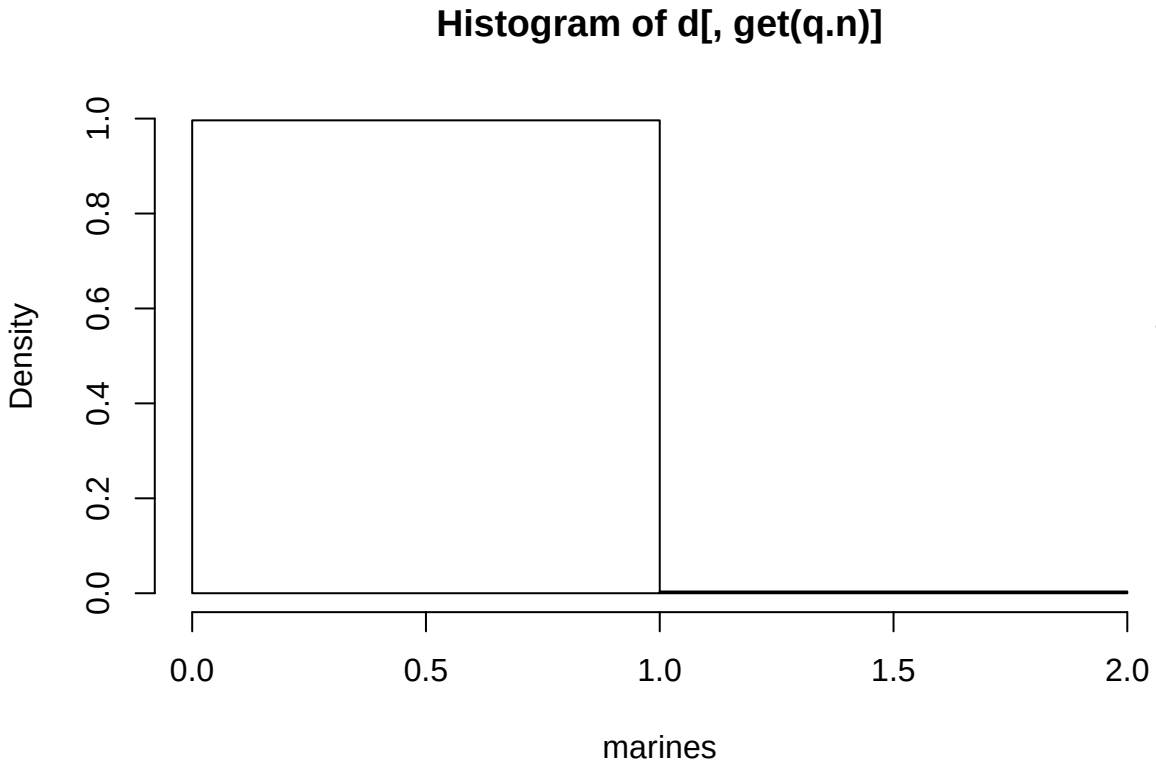

Histogram of d[, get(q.n)]
Density
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
gender

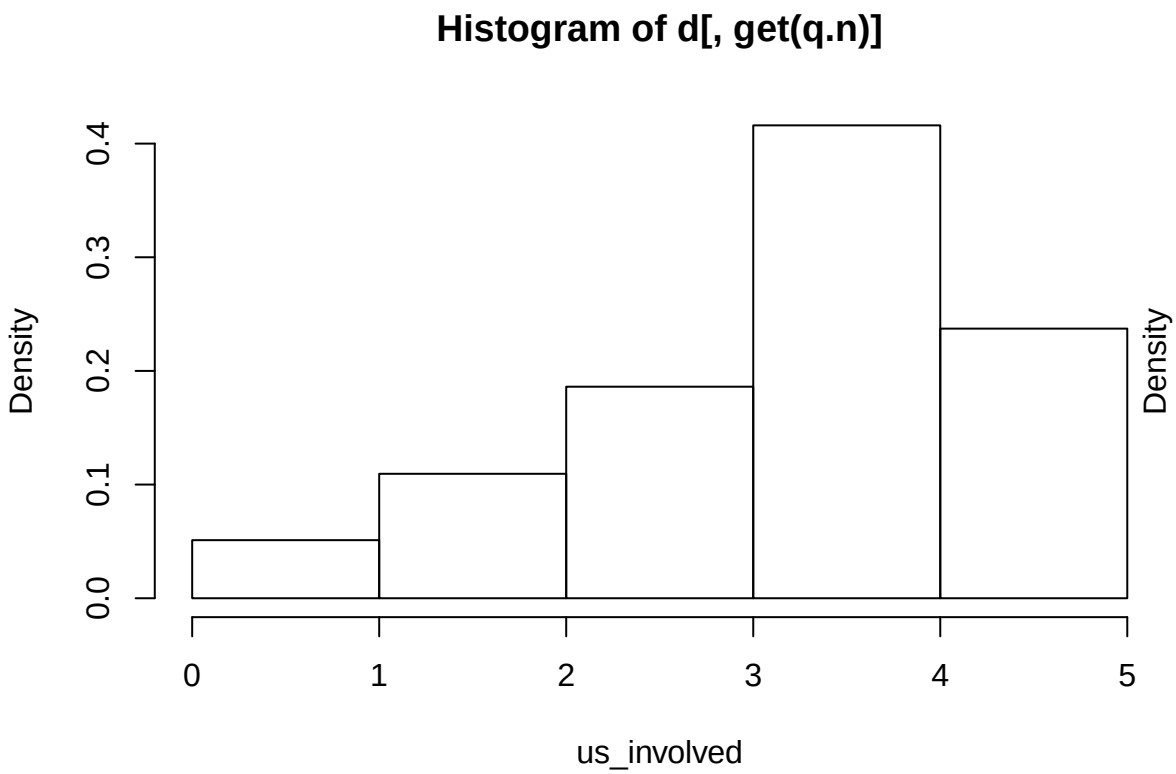

Density
0.00
0.04
0.08
0.12
0

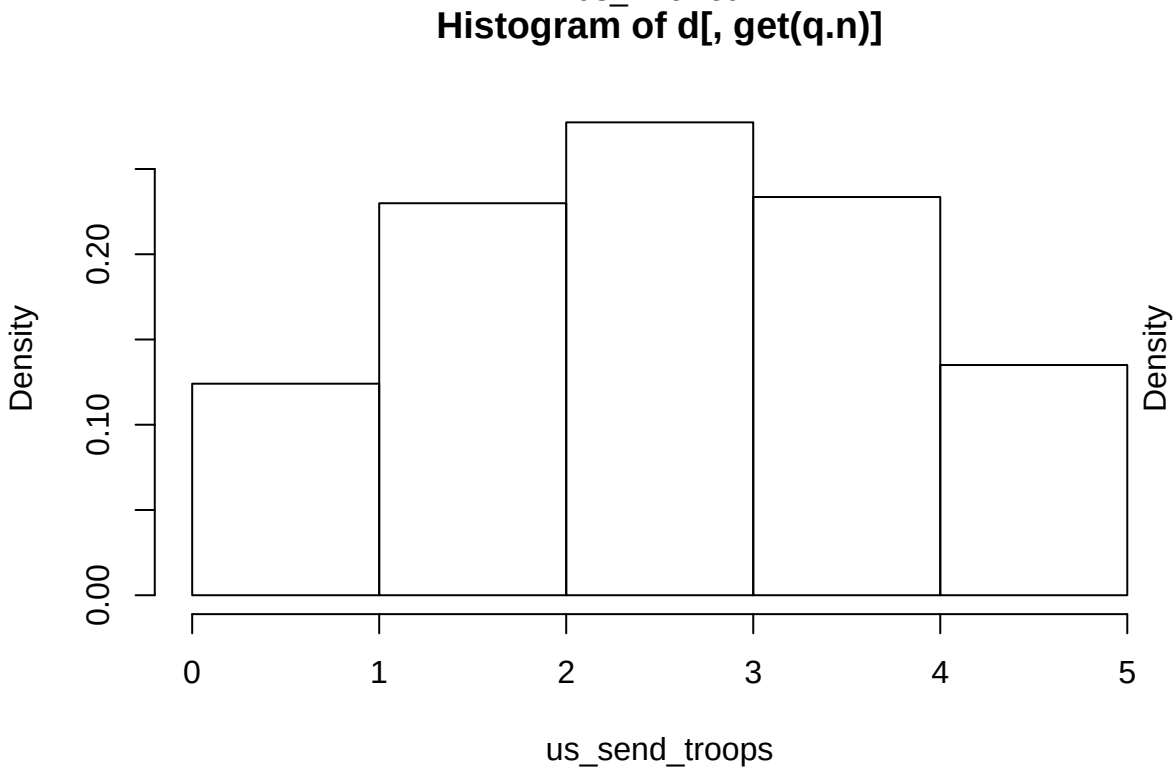

Histogram of d[, get(q.n)]
Density
0.0
0.1
0.2
0.3
0.4
0
1
2
3
4
5
6
7
education

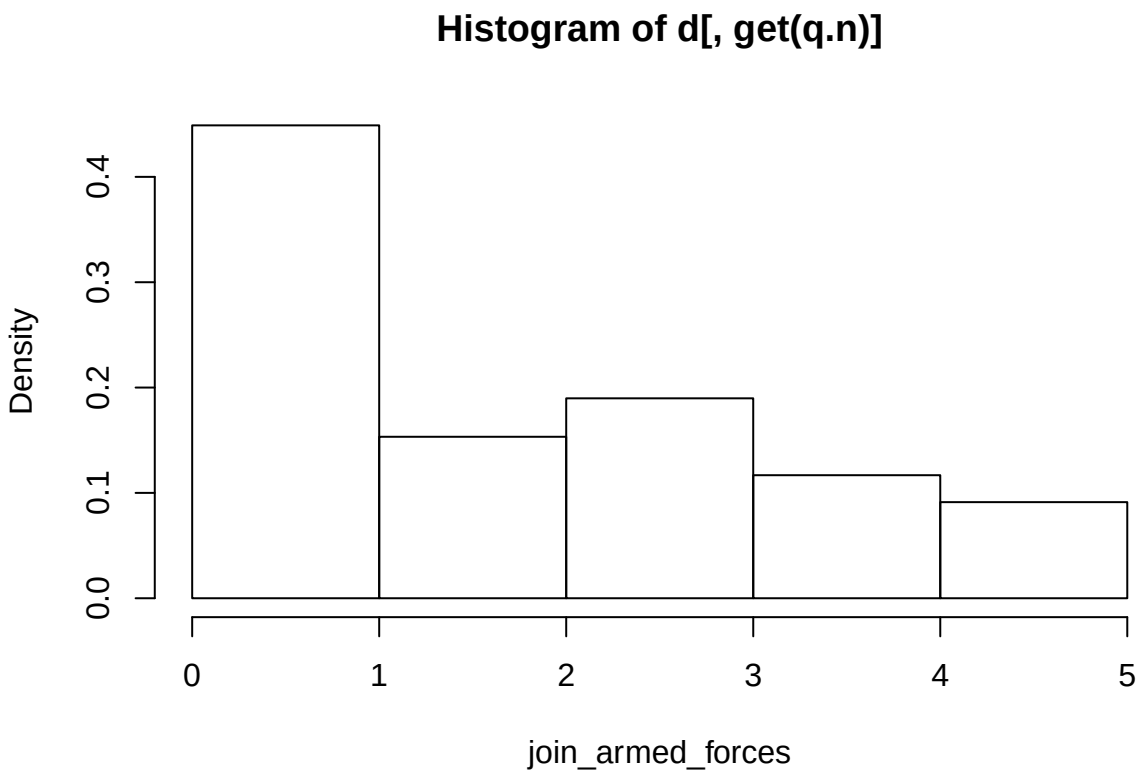

Density
0.0
0.2
0.4
0.6
0.8
0.0


Histogram of d[, get(q.n)]
Density
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0
weather


Histogram of d[, get(q.n)]
Density
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
marines


Histogram of d[, get(q.n)]
Density
0.0
0.1
0.2
0.3
0.4
0
1
2
3
4
5
us_involved


Histogram of d[, get(q.n)]
Density
0.00
0.10
0.20
0
1
2
3
4
5
us_send_troops



Check how many subjects selected the wrong video topic

And drop their responses from the data

```
# Topic choices:
# 1. marines
# 2. weather
# 3. nfl draft
# 4. terrorists
# 5. scott foster

sum(d$video_topic_check == 3)
```

```
## [1] 3
```

```
sum(d$video_topic_check == 5)
```

```
## [1] 0
```

```
d <- d[video_topic_check %in% c(1, 2, 4)]
```

Treat non-compliers as compliers

```
# 1 subject said that they did not watch the marines video.
# 1 subject said that they did not watch the terrorists video.
```

```
# We will count both of them as treatment compliers.

d[weather == 2, weather := 1]
d[terrorists == 2, terrorists := 1]
d[marines == 2, marines := 1]

sum(d$weather) # 78
```

```
## [1] 78
```

```
sum(d$terrorists) # 96
```

```
## [1] 96
```

```
sum(d$marines) # 97
```

```
## [1] 97
```

Convert gender, state, served_military, education to factors (aka. dummy variables)

```
d$gender <- as.factor(d$gender)
d$state <- as.factor(d$state)
d$served_military <- as.factor(d$served_military)
d$education <- as.factor(d$education)
```

Covariate balance check

```
library(papeR)
```

```
## Loading required package: car
```

```
##
## Attaching package: 'car'
```

```
## The following object is masked from 'package:psych':
##
##     logit
```

```
## Loading required package: xtable
```

```
##
## Attaching package: 'papeR'
```

```
## The following object is masked from 'package:utils':
##
##     toLatex
```

```
deps <- c('us_involved', 'us_send_aid', 'us_send_troops',
          'raise_tax_rate', 'join_armed_forces')
indeps <- c("gender", "state", "education", "served_military")
treats <- c('weather', 'terrorists', 'marines', 'treats')
```

```r
for (dep in deps) {
  options(digits = 2)
  cat('############', dep, '############\n')
  m <- lm(get(dep) ~ gender + state + education + served_military, data = d)
  print(summary(m))
}
```

```
## ############ us_involved ############
##
## Call:
## lm(formula = get(dep) ~ gender + state + education + served_military,
##     data = d)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.0470 -0.5550  0.0784  0.7046  2.1325
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)        4.7830     0.6996    6.84  7.8e-11 ***
## gender2            0.1254     0.1455    0.86   0.3898
## gender3            0.0246     0.7802    0.03   0.9749
## state2            -1.5401     0.7682   -2.00   0.0462 *
## state3            -1.7240     0.8754   -1.97   0.0501 .
## state4            -0.7031     0.7628   -0.92   0.3577
## state5            -0.7955     0.6517   -1.22   0.2235
## state6            -2.5905     1.0080   -2.57   0.0108 *
## state7            -0.2114     0.8859   -0.24   0.8116
## state8             0.4971     1.2416    0.40   0.6893
## state10           -0.6084     0.6598   -0.92   0.3575
## state11           -1.4190     0.6900   -2.06   0.0409 *
## state13           -1.7566     0.8385   -2.09   0.0373 *
## state14           -1.0583     0.7473   -1.42   0.1581
## state15           -1.0074     0.6904   -1.46   0.1459
## state16           -1.1475     0.9703   -1.18   0.2383
## state17           -1.4293     1.0073   -1.42   0.1573
## state18           -1.4857     0.7638   -1.95   0.0530 .
## state19            0.4654     0.9016    0.52   0.6063
## state22           -3.1262     0.9835   -3.18   0.0017 **
## state23           -0.0164     0.9928   -0.02   0.9868
## state24           -0.6107     0.8724   -0.70   0.4847
## state25           -1.2037     0.7942   -1.52   0.1311
## state26           -1.6283     1.2352   -1.32   0.1888
## state27           -0.5022     0.7125   -0.70   0.4816
## state28           -1.5651     0.7098   -2.21   0.0285 *
## state30           -0.8236     0.7595   -1.08   0.2794
## state31           -0.1175     0.9736   -0.12   0.9041
## state32           -1.5848     0.9724   -1.63   0.1046
## state33            0.0732     0.8804    0.08   0.9338
## state34           -1.0694     0.7710   -1.39   0.1668
## state35           -1.0196     0.7393   -1.38   0.1692
## state36           -1.6121     0.8673   -1.86   0.0644 .
## state37           -0.3154     0.9872   -0.32   0.7496
## state38           -0.8088     0.7757   -1.04   0.2982
```

```
## state39           -0.3955     0.6821   -0.58   0.5626
## state41           -0.5713     0.8307   -0.69   0.4923
## state43           -1.9144     0.8149   -2.35   0.0197 *
## state44           -0.9086     0.6873   -1.32   0.1876
## state45           -1.5356     0.9827   -1.56   0.1196
## state46           -1.5029     1.2416   -1.21   0.2274
## state47           -0.4952     0.7718   -0.64   0.5218
## state48           -0.5508     0.7196   -0.77   0.4448
## state50           -0.8565     0.8197   -1.04   0.2972
## education3        -0.2147     0.2520   -0.85   0.3951
## education4        -0.5171     0.4185   -1.24   0.2180
## education5        -0.2531     0.2466   -1.03   0.3060
## education6        -0.6510     0.5245   -1.24   0.2159
## education7        -0.1319     0.2817   -0.47   0.6402
## served_military2  -0.0270     0.2101   -0.13   0.8977
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.1 on 221 degrees of freedom
## Multiple R-squared:  0.235,  Adjusted R-squared:  0.0653
## F-statistic: 1.38 on 49 and 221 DF,  p-value: 0.0604
##
## ############ us_send_aid ############
##
## Call:
## lm(formula = get(dep) ~ gender + state + education + served_military,
##     data = d)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -2.880 -0.552  0.144  0.670  1.882
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)        2.9348     0.7320    4.01  8.3e-05 ***
## gender2            0.1572     0.1523    1.03    0.303
## gender3           -0.1521     0.8163   -0.19    0.852
## state2            -0.0849     0.8037   -0.11    0.916
## state3            -0.6747     0.9158   -0.74    0.462
## state4             1.0181     0.7981    1.28    0.203
## state5             0.3713     0.6819    0.54    0.587
## state6            -1.3733     1.0546   -1.30    0.194
## state7             0.5368     0.9268    0.58    0.563
## state8             1.5892     1.2990    1.22    0.222
## state10            0.2020     0.6903    0.29    0.770
## state11            0.2457     0.7219    0.34    0.734
## state13           -0.3934     0.8773   -0.45    0.654
## state14           -0.3955     0.7818   -0.51    0.613
## state15            0.0778     0.7223    0.11    0.914
## state16           -1.4507     1.0152   -1.43    0.154
## state17           -0.7944     1.0538   -0.75    0.452
## state18           -0.1151     0.7991   -0.14    0.886
## state19            0.5999     0.9433    0.64    0.525
## state22           -1.0395     1.0290   -1.01    0.313
```

```
## state23            1.1331     1.0387    1.09    0.277
## state24            0.9931     0.9127    1.09    0.278
## state25            0.4040     0.8309    0.49    0.627
## state26           -0.5680     1.2923   -0.44    0.661
## state27            0.8628     0.7454    1.16    0.248
## state28            0.1875     0.7426    0.25    0.801
## state30            0.1944     0.7946    0.24    0.807
## state31            1.2891     1.0186    1.27    0.207
## state32            0.6280     1.0173    0.62    0.538
## state33            1.1893     0.9210    1.29    0.198
## state34            0.2014     0.8066    0.25    0.803
## state35            0.3143     0.7734    0.41    0.685
## state36           -0.6925     0.9073   -0.76    0.446
## state37            0.0760     1.0328    0.07    0.941
## state38            0.2826     0.8115    0.35    0.728
## state39            0.8547     0.7136    1.20    0.232
## state41            1.0468     0.8691    1.20    0.230
## state43            0.0556     0.8525    0.07    0.948
## state44            0.4485     0.7191    0.62    0.533
## state45           -0.2496     1.0281   -0.24    0.808
## state46           -0.4108     1.2990   -0.32    0.752
## state47            0.3210     0.8075    0.40    0.691
## state48            0.5572     0.7528    0.74    0.460
## state50           -0.2200     0.8576   -0.26    0.798
## education3         0.1536     0.2636    0.58    0.561
## education4         0.2507     0.4379    0.57    0.568
## education5         0.3883     0.2580    1.50    0.134
## education6         0.8412     0.5488    1.53    0.127
## education7         0.4886     0.2947    1.66    0.099 .
## served_military2   0.0877     0.2199    0.40    0.690
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.1 on 221 degrees of freedom
## Multiple R-squared:  0.197,  Adjusted R-squared:  0.0188
## F-statistic: 1.11 on 49 and 221 DF,  p-value: 0.309
##
## ############ us_send_troops ############
##
## Call:
## lm(formula = get(dep) ~ gender + state + education + served_military,
##     data = d)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.6761 -0.8504 -0.0564  0.9449  2.5448
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       3.358307   0.811233    4.14  4.9e-05 ***
## gender2           0.130872   0.168752    0.78    0.439
## gender3           0.721336   0.904678    0.80    0.426
## state2            0.531744   0.890774    0.60    0.551
## state3           -0.748409   1.015001   -0.74    0.462
```

```
## state4            0.106737   0.884515    0.12    0.904
## state5            0.390161   0.755717    0.52    0.606
## state6           -1.054180   1.168833   -0.90    0.368
## state7            1.434760   1.027187    1.40    0.164
## state8            2.478384   1.439654    1.72    0.087 .
## state10           0.520619   0.765009    0.68    0.497
## state11           0.042869   0.800038    0.05    0.957
## state13           1.140313   0.972273    1.17    0.242
## state14           0.197886   0.866507    0.23    0.820
## state15           0.561002   0.800501    0.70    0.484
## state16           0.340423   1.125138    0.30    0.763
## state17          -0.119313   1.167968   -0.10    0.919
## state18          -0.519793   0.885665   -0.59    0.558
## state19           0.035329   1.045467    0.03    0.973
## state22          -1.620495   1.140440   -1.42    0.157
## state23           0.728823   1.151205    0.63    0.527
## state24           0.736345   1.011574    0.73    0.467
## state25          -0.041479   0.920908   -0.05    0.964
## state26           0.347512   1.432280    0.24    0.809
## state27           0.723897   0.826159    0.88    0.382
## state28           0.000735   0.822980    0.00    0.999
## state30           0.202588   0.880692    0.23    0.818
## state31           1.149208   1.128913    1.02    0.310
## state32           0.405859   1.127488    0.36    0.719
## state33           1.370763   1.020790    1.34    0.181
## state34           0.173759   0.893972    0.19    0.846
## state35          -0.173905   0.857189   -0.20    0.839
## state36          -0.618317   1.005614   -0.61    0.539
## state37           0.645285   1.144701    0.56    0.574
## state38          -0.211482   0.899436   -0.24    0.814
## state39           0.578829   0.790924    0.73    0.465
## state41           0.304164   0.963215    0.32    0.752
## state43          -1.056859   0.944854   -1.12    0.265
## state44           0.409553   0.796946    0.51    0.608
## state45           0.221734   1.139477    0.19    0.846
## state46          -0.521616   1.439654   -0.36    0.717
## state47           0.479638   0.894933    0.54    0.593
## state48           0.831986   0.834364    1.00    0.320
## state50           0.376685   0.950428    0.40    0.692
## education3       -0.323390   0.292173   -1.11    0.270
## education4       -0.488387   0.485316   -1.01    0.315
## education5       -0.337569   0.285990   -1.18    0.239
## education6       -0.403918   0.608197   -0.66    0.507
## education7       -0.270683   0.326663   -0.83    0.408
## served_military2 -0.499121   0.243670   -2.05    0.042 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.2 on 221 degrees of freedom
## Multiple R-squared:  0.18,   Adjusted R-squared:  -0.00196
## F-statistic: 0.989 on 49 and 221 DF,  p-value: 0.5
##
## ############ raise_tax_rate ############
##
```

```
## Call:
## lm(formula = get(dep) ~ gender + state + education + served_military,
##     data = d)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.1627 -0.7982 -0.0726  0.7522  2.6465
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)       2.62463    0.74597    3.52  0.00053 ***
## gender2           0.07968    0.15518    0.51  0.60811
## gender3           0.51302    0.83190    0.62  0.53808
## state2            0.63689    0.81911    0.78  0.43767
## state3           -0.29394    0.93335   -0.31  0.75311
## state4           -0.11400    0.81336   -0.14  0.88867
## state5           -0.21105    0.69492   -0.30  0.76164
## state6           -0.65491    1.07480   -0.61  0.54293
## state7           -0.67603    0.94455   -0.72  0.47493
## state8            0.01720    1.32384    0.01  0.98964
## state10           0.38370    0.70347    0.55  0.58600
## state11           0.37068    0.73568    0.50  0.61486
## state13           0.57732    0.89406    0.65  0.51912
## state14          -0.02824    0.79680   -0.04  0.97176
## state15           0.57498    0.73610    0.78  0.43557
## state16          -0.53124    1.03462   -0.51  0.60814
## state17          -1.05522    1.07401   -0.98  0.32693
## state18           0.00236    0.81442    0.00  0.99769
## state19          -0.63856    0.96136   -0.66  0.50724
## state22           0.02175    1.04869    0.02  0.98347
## state23           0.15895    1.05859    0.15  0.88078
## state24           0.72856    0.93019    0.78  0.43433
## state25           0.60026    0.84682    0.71  0.47917
## state26          -0.06248    1.31706   -0.05  0.96221
## state27           1.08051    0.75970    1.42  0.15635
## state28          -0.37262    0.75677   -0.49  0.62294
## state30           0.35515    0.80984    0.44  0.66142
## state31           0.18159    1.03809    0.17  0.86130
## state32           0.00860    1.03678    0.01  0.99339
## state33           1.98615    0.93867    2.12  0.03547 *
## state34           0.21935    0.82205    0.27  0.78984
## state35          -0.00155    0.78823    0.00  0.99843
## state36          -0.66093    0.92471   -0.71  0.47552
## state37           1.01924    1.05261    0.97  0.33395
## state38          -0.18062    0.82708   -0.22  0.82733
## state39           0.66326    0.72730    0.91  0.36279
## state41           2.59035    0.88573    2.92  0.00381 **
## state43          -0.13624    0.86884   -0.16  0.87554
## state44           0.17863    0.73283    0.24  0.80765
## state45          -1.30981    1.04781   -1.25  0.21261
## state46           1.01720    1.32384    0.77  0.44309
## state47           0.60794    0.82294    0.74  0.46084
## state48          -0.05235    0.76724   -0.07  0.94567
## state50          -0.52694    0.87397   -0.60  0.54717
```

```
## education3        0.01219    0.26867    0.05  0.96386
## education4       -0.91997    0.44627   -2.06  0.04043 *
## education5        0.07467    0.26298    0.28  0.77673
## education6        0.06014    0.55927    0.11  0.91446
## education7       -0.01411    0.30038   -0.05  0.96257
## served_military2 -0.71650    0.22407   -3.20  0.00159 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.1 on 221 degrees of freedom
## Multiple R-squared:  0.289,  Adjusted R-squared:  0.131
## F-statistic: 1.83 on 49 and 221 DF,  p-value: 0.00174
##
## ############ join_armed_forces ############
##
## Call:
## lm(formula = get(dep) ~ gender + state + education + served_military,
##     data = d)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -3.153 -0.791 -0.128  0.811  3.255
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)        4.2839     0.8426    5.08  7.9e-07 ***
## gender2           -0.1686     0.1753   -0.96    0.337
## gender3            0.4029     0.9397    0.43    0.669
## state2            -0.6056     0.9253   -0.65    0.513
## state3            -0.5036     1.0543   -0.48    0.633
## state4            -0.8650     0.9188   -0.94    0.347
## state5            -0.5698     0.7850   -0.73    0.469
## state6            -1.8806     1.2141   -1.55    0.123
## state7            -0.4268     1.0670   -0.40    0.690
## state8             1.5170     1.4954    1.01    0.311
## state10           -0.1310     0.7946   -0.16    0.869
## state11           -0.2054     0.8310   -0.25    0.805
## state13            0.6259     1.0099    0.62    0.536
## state14           -0.8119     0.9001   -0.90    0.368
## state15           -0.2739     0.8315   -0.33    0.742
## state16           -1.3239     1.1687   -1.13    0.259
## state17           -0.8970     1.2132   -0.74    0.460
## state18           -0.9568     0.9200   -1.04    0.299
## state19           -0.0820     1.0859   -0.08    0.940
## state22           -1.3909     1.1846   -1.17    0.242
## state23           -0.6857     1.1958   -0.57    0.567
## state24           -0.7676     1.0507   -0.73    0.466
## state25            0.3053     0.9566    0.32    0.750
## state26           -0.3144     1.4877   -0.21    0.833
## state27           -0.3771     0.8581   -0.44    0.661
## state28           -1.3215     0.8548   -1.55    0.124
## state30            0.3687     0.9148    0.40    0.687
## state31           -0.1203     1.1726   -0.10    0.918
## state32            0.0918     1.1711    0.08    0.938
```

```
## state33            0.9169     1.0603    0.86    0.388
## state34           -0.6585     0.9286   -0.71    0.479
## state35           -0.5376     0.8904   -0.60    0.547
## state36           -1.0499     1.0445   -1.01    0.316
## state37           -0.5044     1.1890   -0.42    0.672
## state38           -0.5970     0.9343   -0.64    0.523
## state39           -0.0205     0.8215   -0.02    0.980
## state41            0.4617     1.0005    0.46    0.645
## state43           -0.3631     0.9814   -0.37    0.712
## state44           -0.7351     0.8278   -0.89    0.375
## state45           -1.6952     1.1836   -1.43    0.153
## state46            0.5170     1.4954    0.35    0.730
## state47           -0.9770     0.9296   -1.05    0.294
## state48            0.1677     0.8667    0.19    0.847
## state50           -0.3613     0.9872   -0.37    0.715
## education3        -0.3766     0.3035   -1.24    0.216
## education4        -1.0928     0.5041   -2.17    0.031 *
## education5        -0.3955     0.2971   -1.33    0.184
## education6        -1.2303     0.6317   -1.95    0.053 .
## education7        -0.4110     0.3393   -1.21    0.227
## served_military2  -1.4053     0.2531   -5.55  8.0e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.3 on 221 degrees of freedom
## Multiple R-squared:  0.288,  Adjusted R-squared:  0.13
## F-statistic: 1.82 on 49 and 221 DF,  p-value: 0.00187
```

Multivariate regression

```
deps <- c('us_involved', 'us_send_aid', 'us_send_troops',
          'raise_tax_rate', 'join_armed_forces')
indeps <- c("gender", "state", "education", "served_military")
treats <- c('weather', 'terrorists', 'marines', 'treats')

m <- lm( cbind(us_involved, us_send_aid, us_send_troops, raise_tax_rate, join_armed_forces) ~ terrorists

# library(mvinfluence)

# influence(m, TRUE, 1)
```

Create a column of treatments

```
d$treatment <- ifelse(d$weather == 1, 0, 0)
d$treatment <- ifelse(d$terrorists == 1, 1, d$treatment)
d$treatment <- ifelse(d$marines == 1, 2, d$treatment)
# d$treatment <- factor(d$treatment)
```

Randomization Inference

```
deps <- c('us_involved', 'us_send_aid', 'us_send_troops',
            'raise_tax_rate', 'join_armed_forces')
indeps <- c("gender", "state", "education", "served_military")
treats <- c('weather', 'terrorists', 'marines', 'treats')

df <- data.frame(d)

weather.means <- apply(df[df$treatment == 0, deps], 2, mean)
terrorists.means <- apply(df[df$treatment == 1, deps], 2, mean)
marines.means <- apply(df[df$treatment == 2, deps], 2, mean)

deps.means <- data.frame(weather.means, terrorists.means, marines.means)
deps.means$TminusW <- deps.means$terrorists.means - deps.means$weather.means
deps.means$MminusW <- deps.means$marines.means - deps.means$weather.means
deps.means$TminusM <- deps.means$terrorists.means - deps.means$marines.means
deps.means
```

```
##                   weather.means terrorists.means marines.means TminusW
## us_involved                 3.6              3.6           3.9  0.0064
## us_send_aid                 3.4              3.6           3.9  0.1627
## us_send_troops              2.8              3.0           3.2  0.2107
## raise_tax_rate              2.2              2.2           2.4  0.0705
## join_armed_forces           1.9              2.2           2.5  0.2957
##                   MminusW TminusM
## us_involved          0.32   -0.31
## us_send_aid          0.52   -0.35
## us_send_troops       0.35   -0.14
## raise_tax_rate       0.19   -0.12
## join_armed_forces    0.57   -0.28
```

```
deps.means$id <- row.names(deps.means)

RandomInference <- function(vec, ate, n.trials) {
  set.seed(1234)
  rands <- replicate(n.trials, sample(c(TRUE, FALSE), length(vec), replace = TRUE))

  treats <- apply(rands, 2, FUN = function(x) {return(mean(vec[x]))})
  controls <- apply(rands, 2, FUN = function(x) {return(mean(vec[!x]))})
  rand.ate <- treats - controls
  p <- sum(rand.ate > ate) / length(rand.ate)
  std.err <- sd(rand.ate) / sqrt(length(rand.ate))
  low.bound <- ate - 1.96 * std.err
  high.bound <- ate + 1.96 * std.err


  return(c(ate, std.err, p, low.bound, high.bound))
}
```

All with correction for multiple comparisons

```
deps <- c('us_involved', 'us_send_aid', 'us_send_troops',
            'raise_tax_rate', 'join_armed_forces')
n.t = 10000

EmbellishP <- function(p.val) {
    if(p.val*15 <= 0.01) {
    return(paste0(p.val, '**'))
    }

  if(p.val*15 <= 0.05) {
    return(paste0(p.val, '*'))
  }

  return(p.val)
}

for (row.name in deps) {
  deps.sub <- deps.means[deps.means$id == row.name,]

  cat('######### ', row.name, ' ###########', '\n')
  m.ate <- deps.sub[deps.sub$id == row.name, 'TminusW']
  res <- RandomInference(df$us_involved, m.ate, n.t)
  p <- EmbellishP(res[3])
  cat(row.name, ': Terror vs. Weather: ate:', res[1], paste0('(', res[2], ')'), 'p-value: ', p, 'ci: ',

  m.ate <- deps.sub[deps.sub$id == row.name, 'MminusW']
  res <- RandomInference(df$us_involved, m.ate, n.t)
  p <- EmbellishP(res[3])
  cat(row.name, ': Marines vs. Weather: ate:', res[1], paste0('(', res[2], ')'), 'p-value: ', p, 'ci: '

  m.ate <- deps.sub[deps.sub$id == row.name, 'TminusM']
  res <- RandomInference(df$us_involved, m.ate, n.t)
  p <- EmbellishP(res[3])
  cat(row.name, ': Terror vs. Marines: ate:', res[1], paste0('(', res[2], ')'), 'p-value: ', p, 'ci: ',

  cat('#####################################\n\n')
}
```

```
## #########  us_involved  ###########
## us_involved : Terror vs. Weather: ate: 0.0064 (0.00135190409440195) p-value:  0.48 ci:  0.0038 0.009
## us_involved : Marines vs. Weather: ate: 0.32 (0.00135190409440195) p-value:  0.0084 ci:  0.32 0.32
## us_involved : Terror vs. Marines: ate: -0.31 (0.00135190409440195) p-value:  0.99 ci:  -0.32 -0.31
## #####################################
##
## #########  us_send_aid  ###########
## us_send_aid : Terror vs. Weather: ate: 0.16 (0.00135190409440195) p-value:  0.12 ci:  0.16 0.17
## us_send_aid : Marines vs. Weather: ate: 0.52 (0.00135190409440195) p-value:  1e-04** ci:  0.51 0.52
## us_send_aid : Terror vs. Marines: ate: -0.35 (0.00135190409440195) p-value:  1 ci:  -0.36 -0.35
## #####################################
##
## #########  us_send_troops  ###########
```

```
## us_send_troops : Terror vs. Weather: ate: 0.21 (0.00135190409440195) p-value:  0.056 ci:  0.21 0.21
## us_send_troops : Marines vs. Weather: ate: 0.35 (0.00135190409440195) p-value:  0.0044 ci:  0.35 0.3
## us_send_troops : Terror vs. Marines: ate: -0.14 (0.00135190409440195) p-value:  0.86 ci:  -0.15 -0.1
## ####################################
##
## #########  raise_tax_rate  ###########
## raise_tax_rate : Terror vs. Weather: ate: 0.071 (0.00135190409440195) p-value:  0.3 ci:  0.068 0.073
## raise_tax_rate : Marines vs. Weather: ate: 0.19 (0.00135190409440195) p-value:  0.079 ci:  0.19 0.19
## raise_tax_rate : Terror vs. Marines: ate: -0.12 (0.00135190409440195) p-value:  0.81 ci:  -0.12 -0.1
## ####################################
##
## #########  join_armed_forces  ###########
## join_armed_forces : Terror vs. Weather: ate: 0.3 (0.00135190409440195) p-value:  0.013 ci:  0.29 0.3
## join_armed_forces : Marines vs. Weather: ate: 0.57 (0.00135190409440195) p-value:  0** ci:  0.57 0.5
## join_armed_forces : Terror vs. Marines: ate: -0.28 (0.00135190409440195) p-value:  0.98 ci:  -0.28 -0
## ####################################
```

Results

After correcting for multiple comparisons i.e. 3 treatments x 5 dependent variables, we see that only the following results are significant.

1. **us_send_aid (placebo value 3.410256)** : Marines vs. Weather: ate: 0.5175786 (0.00135190409440195) p-value: 1e-04** ci: 0.5149289 0.5202284. For sending aid, the average effect was to move the sample from being inbetween "Neither in favor nor opposed" to "Somewhat in favor".
2. **join_armed_forces (placebo value 1.923077)** : Marines vs. Weather: ate: 0.5717684 (0.00135190409440195) p-value: 0** ci: 0.5691187 0.5744182. For joining the armed forces, the average effect was to move the sample from "Somewhat opposed" to "Neither in favor nor opposed".

That is, subjects who saw the marines video were likely to increase their support for sending Aid to countries fighting terrorists, and joining armed forces, by approx. half a category.

MANOVA

```
library(car)
m <- lm( cbind(us_involved, us_send_aid, us_send_troops, raise_tax_rate, join_armed_forces) ~ terrorists
summary(m)
```

```
## Response us_involved :
##
## Call:
## lm(formula = us_involved ~ terrorists + marines, data = df)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -2.897 -0.583  0.103  0.423  1.423
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.57692    0.12321   29.03   <2e-16 ***
## terrorists   0.00641    0.16588    0.04    0.969
```

```
## marines      0.31998    0.16549    1.93    0.054 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.1 on 268 degrees of freedom
## Multiple R-squared:  0.0193, Adjusted R-squared:  0.012
## F-statistic: 2.63 on 2 and 268 DF,  p-value: 0.0736
##
##
## Response us_send_aid :
##
## Call:
## lm(formula = us_send_aid ~ terrorists + marines, data = df)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.9278 -0.5729  0.0722  0.5897  1.5897
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.410      0.125   27.36   <2e-16 ***
## terrorists     0.163      0.168    0.97   0.3333
## marines        0.518      0.167    3.09   0.0022 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.1 on 268 degrees of freedom
## Multiple R-squared:  0.0372, Adjusted R-squared:  0.03
## F-statistic: 5.17 on 2 and 268 DF,  p-value: 0.00625
##
##
## Response us_send_troops :
##
## Call:
## lm(formula = us_send_troops ~ terrorists + marines, data = df)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.1753 -1.0313 -0.0313  0.9688  2.1795
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.821      0.138   20.38   <2e-16 ***
## terrorists     0.211      0.186    1.13    0.259
## marines        0.355      0.186    1.91    0.057 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.2 on 268 degrees of freedom
## Multiple R-squared:  0.0134, Adjusted R-squared:  0.00607
## F-statistic: 1.82 on 2 and 268 DF,  p-value: 0.163
##
##
## Response raise_tax_rate :
```

```
##
## Call:
## lm(formula = raise_tax_rate ~ terrorists + marines, data = df)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##  -1.37  -1.18  -0.25   0.75   2.82
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.1795     0.1373   15.87   <2e-16 ***
## terrorists    0.0705     0.1849    0.38      0.7
## marines       0.1916     0.1844    1.04      0.3
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.2 on 268 degrees of freedom
## Multiple R-squared:  0.00421,    Adjusted R-squared:  -0.00322
## F-statistic: 0.567 on 2 and 268 DF,  p-value: 0.568
##
##
## Response join_armed_forces :
##
## Call:
## lm(formula = join_armed_forces ~ terrorists + marines, data = df)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -1.495 -1.219 -0.495  0.781  3.077
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.923      0.153   12.56   <2e-16 ***
## terrorists     0.296      0.206    1.43   0.1527
## marines        0.572      0.206    2.78   0.0058 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.4 on 268 degrees of freedom
## Multiple R-squared:  0.0281, Adjusted R-squared:  0.0208
## F-statistic: 3.87 on 2 and 268 DF,  p-value: 0.022
```

```
summary(Anova(m))
```

```
##
## Type II MANOVA Tests:
##
## Sum of squares and products for error:
##                   us_involved us_send_aid us_send_troops raise_tax_rate
## us_involved               317         157            208            106
## us_send_aid               157         325            151            136
## us_send_troops            208         151            400            209
## raise_tax_rate            106         136            209            394
## join_armed_forces         134          70            222            253
##                   join_armed_forces
```

```
## us_involved                    134
## us_send_aid                     70
## us_send_troops                 222
## raise_tax_rate                 253
## join_armed_forces              490
##
## ----------------------------------------
##
## Term: terrorists
##
## Sum of squares and products for the hypothesis:
##                   us_involved us_send_aid us_send_troops raise_tax_rate
## us_involved            0.0018       0.045          0.058          0.019
## us_send_aid            0.0449       1.139          1.475          0.494
## us_send_troops         0.0581       1.475          1.911          0.639
## raise_tax_rate         0.0195       0.494          0.639          0.214
## join_armed_forces      0.0816       2.070          2.681          0.897
##                   join_armed_forces
## us_involved                   0.082
## us_send_aid                   2.070
## us_send_troops                2.681
## raise_tax_rate                0.897
## join_armed_forces             3.762
##
## Multivariate Tests: terrorists
##                  Df test stat approx F num Df den Df Pr(>F)
## Pillai            1      0.02     0.99      5    264    0.4
## Wilks             1      0.98     0.99      5    264    0.4
## Hotelling-Lawley  1      0.02     0.99      5    264    0.4
## Roy               1      0.02     0.99      5    264    0.4
##
## ----------------------------------------
##
## Term: marines
##
## Sum of squares and products for the hypothesis:
##                   us_involved us_send_aid us_send_troops raise_tax_rate
## us_involved               4.4         7.2            4.9            2.7
## us_send_aid               7.2        11.6            7.9            4.3
## us_send_troops            4.9         7.9            5.4            2.9
## raise_tax_rate            2.7         4.3            2.9            1.6
## join_armed_forces         7.9        12.8            8.8            4.7
##                   join_armed_forces
## us_involved                     7.9
## us_send_aid                    12.8
## us_send_troops                  8.8
## raise_tax_rate                  4.7
## join_armed_forces              14.1
##
## Multivariate Tests: marines
##                  Df test stat approx F num Df den Df Pr(>F)
## Pillai            1      0.06      3.5      5    264  0.005 **
## Wilks             1      0.94      3.5      5    264  0.005 **
## Hotelling-Lawley  1      0.07      3.5      5    264  0.005 **
```

```
## Roy               1      0.07      3.5      5    264  0.005 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```