

Assignment 4.4

1. Use the package RcmdrPlugin.IPSUR.

data (RcmdrTestDrive)

and perform the below operations:

- a. Calculate the average salary by gender and smoking status.
- b. Which gender has the highest mean salary?
- c. Report the highest mean salary.
- d. Compare the spreads for the genders by calculating the standard deviation of salary by gender.

```
library(RcmdrPlugin.IPSUR)
```

```
library(TeachingDemos)
```

```
library(Hmisc)
```

```
## Loading required package: lattice
```

```
## Loading required package: survival
```

```
## Loading required package: Formula
```

```
## Loading required package: ggplot2
```

```
##
```

```
## Attaching package: 'Hmisc'
```

```
## The following objects are masked from 'package:TeachingDemos':
```

```
##
```

```
##   cnvrt.coords, subplot
```

```
## The following object is masked from 'package:RcmdrPlugin.IPSUR':
```

```
##
```

```
##   stripChart
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
##   format.pval, units
```

```
data("RcmdrTestDrive")
```

```
attach(RcmdrTestDrive)
```

```
names(RcmdrTestDrive)
```

```
## [1] "order" "smoking" "gender" "race" "before" "after"
```

```
## [7] "salary" "reduction" "parking"
```

summary(RcmdrTestDrive)

```
##   order      smoking  gender      race
## Min.   : 1.00 Nonsmoker:136 Female:70 AfricanAmer:46
## 1st Qu.: 42.75 Smoker  : 32 Male :98 Asian   :13
## Median : 84.50                Caucasian :73
## Mean   : 84.50                Hispanic  :34
## 3rd Qu.:126.25                Other    : 2
## Max.   :168.00
##   before    after      salary    reduction
## Min.   :71.30 Min.   :66.60 Min.   :377.2 Min.   : 3.00
## 1st Qu.:73.10 1st Qu.:72.50 1st Qu.: 621.1 1st Qu.: 78.75
## Median :73.90 Median :73.70 Median : 710.1 Median :139.50
## Mean   :73.97 Mean   :73.27 Mean   : 724.5 Mean   :223.63
## 3rd Qu.:74.80 3rd Qu.:74.60 3rd Qu.: 808.6 3rd Qu.:335.50
## Max.   :76.30 Max.   :76.40 Max.   :1156.2 Max.   :1632.00
## parking
## Min.   :1.000
## 1st Qu.:1.000
## Median :1.000
## Mean   :1.952
## 3rd Qu.:2.000
## Max.   :8.000
```

Smoking status---

There are 136 non-smokers and 32 smokers

print(RcmdrTestDrive)

```
##   order smoking gender      race before after salary reduction
## 1     1 Nonsmoker Female Caucasian 72.6 75.2 618.65      9
## 2     2 Nonsmoker Male AfricanAmer 75.3 73.2 544.56     62
## 3     3 Nonsmoker Female Caucasian 75.5 74.5 550.24     19
## 4     4 Nonsmoker Female Caucasian 71.3 74.6 616.16     30
## 5     5 Nonsmoker Female Hispanic 74.3 73.8 543.39    105
## 6     6 Nonsmoker Male Caucasian 73.0 73.6 692.09     43
## 7     7 Smoker Male Hispanic 72.4 70.7 800.48     229
## 8     8 Nonsmoker Male Hispanic 73.6 74.0 703.79     40
## 9     9 Nonsmoker Female Caucasian 73.7 75.9 540.06    101
## 10    10 Nonsmoker Female Hispanic 74.6 74.8 522.28    440
## 11    11 Nonsmoker Female AfricanAmer 75.8 73.1 377.17    213
## 12    12 Nonsmoker Female Caucasian 75.3 72.1 525.96    474
## 13    13 Nonsmoker Female Caucasian 75.0 72.5 548.88    144
```

## 14	14 Nonsmoker Male Asian	72.8	72.7	537.70	179
## 15	15 Nonsmoker Male Asian	74.4	75.7	500.20	63
## 16	16 Nonsmoker Female Hispanic	72.9	73.1	597.73	570
## 17	17 Nonsmoker Female Hispanic	72.3	74.0	578.95	437
## 18	18 Nonsmoker Male Caucasian	74.0	74.6	690.06	62
## 19	19 Nonsmoker Male Caucasian	73.1	72.8	748.98	437
## 20	20 Nonsmoker Male AfricanAmer	74.0	76.1	811.71	60
## 21	21 Nonsmoker Male Other	73.6	74.5	660.58	255
## 22	22 Nonsmoker Male Hispanic	73.4	75.0	586.29	133
## 23	23 Nonsmoker Male AfricanAmer	73.9	74.0	387.59	88
## 24	24 Nonsmoker Male Caucasian	73.0	73.9	524.54	116
## 25	25 Nonsmoker Female Hispanic	74.2	75.7	536.87	48
## 26	26 Nonsmoker Male Caucasian	73.6	75.4	503.64	365
## 27	27 Smoker Male AfricanAmer	74.6	68.1	496.09	73
## 28	28 Nonsmoker Male AfricanAmer	74.5	72.6	701.91	306
## 29	29 Nonsmoker Female Caucasian	72.6	73.2	595.70	497
## 30	30 Nonsmoker Male Asian	72.6	74.1	759.30	32
## 31	31 Nonsmoker Female Hispanic	72.1	73.7	717.91	497
## 32	32 Nonsmoker Male Asian	73.2	73.5	808.63	21
## 33	33 Smoker Male Caucasian	73.2	70.0	682.60	291
## 34	34 Nonsmoker Male Asian	74.3	75.2	623.09	83
## 35	35 Smoker Male AfricanAmer	74.0	68.7	550.28	55
## 36	36 Nonsmoker Male AfricanAmer	75.5	72.9	646.25	100
## 37	37 Nonsmoker Female AfricanAmer	75.4	72.6	635.43	439
## 38	38 Nonsmoker Male Caucasian	75.5	72.5	437.19	419
## 39	39 Nonsmoker Female Caucasian	74.4	73.6	619.29	23
## 40	40 Nonsmoker Male Caucasian	73.7	75.0	593.68	71
## 41	41 Nonsmoker Male AfricanAmer	75.8	73.1	546.26	109
## 42	42 Nonsmoker Female Caucasian	74.3	72.2	704.83	98
## 43	43 Nonsmoker Male Caucasian	74.7	73.1	764.15	78
## 44	44 Nonsmoker Female Caucasian	74.9	72.0	859.67	257
## 45	45 Nonsmoker Female AfricanAmer	75.3	76.2	724.25	487
## 46	46 Nonsmoker Male AfricanAmer	75.6	75.0	631.62	213
## 47	47 Nonsmoker Female Hispanic	72.7	73.4	478.39	383
## 48	48 Nonsmoker Female Caucasian	75.6	74.9	652.79	116
## 49	49 Nonsmoker Male Caucasian	73.8	71.9	545.66	1632
## 50	50 Nonsmoker Male Caucasian	74.7	75.8	515.95	151
## 51	51 Nonsmoker Male AfricanAmer	75.4	74.8	612.27	152
## 52	52 Nonsmoker Female Hispanic	74.3	73.8	633.12	390
## 53	53 Nonsmoker Male AfricanAmer	75.0	73.2	671.35	64
## 54	54 Nonsmoker Female AfricanAmer	75.3	73.8	643.83	85
## 55	55 Nonsmoker Male Hispanic	74.8	73.6	794.66	71
## 56	56 Smoker Female Asian	73.2	70.6	888.00	37
## 57	57 Nonsmoker Female Caucasian	74.0	75.8	602.94	89

## 58	58	Smoker	Male	Caucasian	75.5	74.3	716.78	172
## 59	59	Nonsmoker	Male	Caucasian	75.3	72.8	606.12	3
## 60	60	Nonsmoker	Male	AfricanAmer	73.9	73.7	704.90	247
## 61	61	Nonsmoker	Male	Caucasian	71.7	72.5	620.32	127
## 62	62	Nonsmoker	Male	Caucasian	73.6	74.7	515.92	337
## 63	63	Nonsmoker	Female	AfricanAmer	72.1	73.7	655.72	123
## 64	64	Nonsmoker	Female	Hispanic	72.7	73.1	619.44	205
## 65	65	Nonsmoker	Female	Caucasian	74.5	71.9	640.48	61
## 66	66	Smoker	Male	Caucasian	73.2	72.8	844.32	119
## 67	67	Nonsmoker	Female	Caucasian	73.3	74.9	918.03	165
## 68	68	Nonsmoker	Female	Asian	74.2	75.1	933.49	480
## 69	69	Nonsmoker	Female	Hispanic	74.7	74.2	699.63	39
## 70	70	Nonsmoker	Female	Caucasian	74.4	74.2	593.27	434
## 71	71	Smoker	Male	Caucasian	74.5	69.7	634.24	147
## 72	72	Smoker	Female	Caucasian	73.0	69.3	686.98	270
## 73	73	Nonsmoker	Female	Hispanic	73.5	72.5	618.68	384
## 74	74	Smoker	Female	Hispanic	72.3	70.6	631.20	87
## 75	75	Nonsmoker	Female	Caucasian	75.7	73.8	608.88	291
## 76	76	Smoker	Female	Hispanic	75.6	69.1	686.28	31
## 77	77	Smoker	Female	AfricanAmer	75.4	70.0	715.44	549
## 78	78	Nonsmoker	Male	Hispanic	73.4	74.8	754.66	172
## 79	79	Nonsmoker	Male	AfricanAmer	72.9	74.6	865.89	251
## 80	80	Nonsmoker	Female	Caucasian	72.3	74.0	890.88	335
## 81	81	Smoker	Male	AfricanAmer	74.4	70.7	777.91	319
## 82	82	Smoker	Male	Caucasian	72.8	70.5	680.56	519
## 83	83	Nonsmoker	Male	Caucasian	75.1	73.5	594.61	94
## 84	84	Nonsmoker	Male	AfricanAmer	73.2	75.1	651.73	15
## 85	85	Smoker	Male	Caucasian	74.0	71.3	601.11	397
## 86	86	Nonsmoker	Female	Asian	73.8	72.9	626.71	95
## 87	87	Nonsmoker	Female	Caucasian	73.5	74.8	643.80	551
## 88	88	Smoker	Male	Hispanic	72.2	66.6	724.52	89
## 89	89	Nonsmoker	Female	AfricanAmer	74.4	75.3	745.57	121
## 90	90	Smoker	Male	Caucasian	75.2	72.5	842.05	319
## 91	91	Nonsmoker	Male	AfricanAmer	73.6	74.2	880.47	424
## 92	92	Nonsmoker	Female	Caucasian	73.1	72.6	1016.21	79
## 93	93	Nonsmoker	Male	AfricanAmer	73.9	73.3	726.13	372
## 94	94	Nonsmoker	Male	Caucasian	74.9	74.4	780.21	195
## 95	95	Nonsmoker	Female	Caucasian	72.5	75.0	704.08	324
## 96	96	Nonsmoker	Female	Other	75.0	73.4	785.89	532
## 97	97	Nonsmoker	Male	AfricanAmer	73.8	75.2	662.98	91
## 98	98	Nonsmoker	Male	Caucasian	73.6	75.2	621.30	32
## 99	99	Smoker	Male	Asian	74.8	71.3	521.17	94
## 100	100	Nonsmoker	Female	Caucasian	73.8	74.3	714.58	95
## 101	101	Nonsmoker	Male	Caucasian	75.8	74.6	728.94	99

## 102	102	Smoker	Male	Caucasian	75.5	71.1	812.26	275
## 103	103	Smoker	Male	Caucasian	72.4	71.7	924.78	203
## 104	104	Nonsmoker	Female	AfricanAmer	73.6	74.3	1001.31	131
## 105	105	Nonsmoker	Male	Hispanic	73.3	74.3	724.99	116
## 106	106	Nonsmoker	Male	Hispanic	72.9	73.3	822.35	66
## 107	107	Nonsmoker	Male	Hispanic	75.7	73.1	653.58	574
## 108	108	Nonsmoker	Female	Asian	72.6	73.3	642.28	87
## 109	109	Nonsmoker	Male	AfricanAmer	73.8	73.6	730.12	149
## 110	110	Smoker	Female	AfricanAmer	72.8	70.6	708.30	538
## 111	111	Nonsmoker	Male	Caucasian	73.9	71.9	629.17	419
## 112	112	Nonsmoker	Male	Caucasian	73.2	75.1	790.33	33
## 113	113	Nonsmoker	Male	AfricanAmer	75.5	73.8	788.05	213
## 114	114	Nonsmoker	Female	Caucasian	72.4	74.5	849.25	44
## 115	115	Nonsmoker	Male	AfricanAmer	72.8	74.5	1036.06	814
## 116	116	Nonsmoker	Male	Hispanic	74.8	75.2	1149.92	131
## 117	117	Smoker	Male	Caucasian	75.6	72.4	854.31	100
## 118	118	Nonsmoker	Female	Caucasian	74.1	74.2	768.94	688
## 119	119	Smoker	Male	Caucasian	75.3	69.6	666.74	83
## 120	120	Nonsmoker	Female	Hispanic	75.1	73.2	639.72	185
## 121	121	Smoker	Male	AfricanAmer	74.1	70.3	744.38	60
## 122	122	Nonsmoker	Female	Caucasian	74.6	74.1	584.08	6
## 123	123	Nonsmoker	Male	Caucasian	74.1	72.5	712.00	60
## 124	124	Nonsmoker	Female	AfricanAmer	73.9	72.7	789.76	282
## 125	125	Smoker	Male	Hispanic	73.0	67.3	719.06	31
## 126	126	Nonsmoker	Male	AfricanAmer	75.3	73.8	903.34	82
## 127	127	Nonsmoker	Male	Caucasian	73.5	75.3	1044.98	65
## 128	128	Nonsmoker	Male	Asian	72.3	74.8	1027.36	26
## 129	129	Nonsmoker	Female	AfricanAmer	73.5	73.7	855.36	117
## 130	130	Nonsmoker	Male	Caucasian	72.9	76.2	796.51	205
## 131	131	Smoker	Male	Caucasian	72.6	70.3	771.74	99
## 132	132	Nonsmoker	Male	Caucasian	76.3	74.2	780.27	401
## 133	133	Nonsmoker	Male	AfricanAmer	73.0	75.2	808.65	8
## 134	134	Nonsmoker	Female	Caucasian	74.7	74.7	632.05	469
## 135	135	Smoker	Female	Hispanic	74.5	67.5	681.58	116
## 136	136	Nonsmoker	Male	Caucasian	71.4	74.6	823.38	298
## 137	137	Nonsmoker	Male	Hispanic	74.4	73.9	754.55	115
## 138	138	Nonsmoker	Male	Asian	72.1	73.1	938.47	721
## 139	139	Nonsmoker	Male	Caucasian	73.1	76.4	1072.65	135
## 140	140	Nonsmoker	Male	AfricanAmer	73.7	73.3	1021.69	202
## 141	141	Nonsmoker	Female	Caucasian	73.0	73.3	785.75	642
## 142	142	Nonsmoker	Female	Hispanic	73.8	74.4	882.78	95
## 143	143	Nonsmoker	Female	Caucasian	73.6	72.0	762.43	262
## 144	144	Nonsmoker	Male	Hispanic	73.1	74.2	863.78	564
## 145	145	Nonsmoker	Male	Caucasian	73.4	73.9	745.97	258

## 146	146	Nonsmoker Female	Hispanic	74.0	72.4	809.26	41
## 147	147	Nonsmoker Female	AfricanAmer	75.8	72.9	668.26	77
## 148	148	Smoker Female	Asian	74.2	67.8	780.61	429
## 149	149	Nonsmoker Female	AfricanAmer	75.4	73.3	749.43	557
## 150	150	Nonsmoker Male	Caucasian	75.1	72.9	889.55	89
## 151	151	Nonsmoker Female	Caucasian	74.6	74.9	1025.09	59
## 152	152	Smoker Male	Caucasian	75.5	69.8	1156.16	370
## 153	153	Nonsmoker Male	AfricanAmer	74.9	74.3	777.93	202
## 154	154	Nonsmoker Male	AfricanAmer	73.6	74.3	835.96	111
## 155	155	Nonsmoker Female	Caucasian	74.5	72.6	668.69	598
## 156	156	Nonsmoker Female	Caucasian	75.7	74.6	870.52	55
## 157	157	Nonsmoker Male	AfricanAmer	72.6	73.8	827.18	750
## 158	158	Smoker Male	Caucasian	74.1	70.8	689.23	83
## 159	159	Nonsmoker Female	AfricanAmer	73.6	74.2	662.17	257
## 160	160	Smoker Female	Caucasian	75.0	70.3	820.52	303
## 161	161	Nonsmoker Female	AfricanAmer	73.1	74.8	780.51	79
## 162	162	Nonsmoker Male	Hispanic	73.6	74.3	980.09	156
## 163	163	Nonsmoker Male	AfricanAmer	73.6	75.1	1084.21	166
## 164	164	Smoker Male	Hispanic	73.5	72.1	1073.50	9
## 165	165	Nonsmoker Male	AfricanAmer	73.7	72.5	908.11	409
## 166	166	Nonsmoker Male	Hispanic	73.1	73.4	793.42	424
## 167	167	Nonsmoker Male	Hispanic	74.5	74.9	804.78	205
## 168	168	Nonsmoker Male	AfricanAmer	73.7	74.1	790.82	47

parking

## 1	2
## 2	1
## 3	4
## 4	1
## 5	1
## 6	1
## 7	5
## 8	1
## 9	2
## 10	1
## 11	1
## 12	2
## 13	1
## 14	2
## 15	3
## 16	1
## 17	4
## 18	2
## 19	2
## 20	1

## 21	1
## 22	4
## 23	1
## 24	1
## 25	3
## 26	1
## 27	1
## 28	5
## 29	1
## 30	1
## 31	1
## 32	2
## 33	1
## 34	1
## 35	2
## 36	8
## 37	4
## 38	1
## 39	2
## 40	1
## 41	4
## 42	1
## 43	1
## 44	3
## 45	1
## 46	3
## 47	1
## 48	1
## 49	2
## 50	1
## 51	3
## 52	2
## 53	1
## 54	1
## 55	2
## 56	1
## 57	2
## 58	1
## 59	1
## 60	5
## 61	2
## 62	1
## 63	1
## 64	4

## 65	1
## 66	2
## 67	2
## 68	6
## 69	3
## 70	4
## 71	1
## 72	2
## 73	1
## 74	1
## 75	3
## 76	2
## 77	1
## 78	2
## 79	1
## 80	6
## 81	1
## 82	1
## 83	2
## 84	1
## 85	5
## 86	2
## 87	2
## 88	1
## 89	2
## 90	1
## 91	3
## 92	2
## 93	5
## 94	1
## 95	1
## 96	3
## 97	2
## 98	1
## 99	2
## 100	3
## 101	5
## 102	1
## 103	1
## 104	3
## 105	2
## 106	1
## 107	1
## 108	1

## 109	1
## 110	1
## 111	2
## 112	1
## 113	1
## 114	1
## 115	1
## 116	2
## 117	4
## 118	4
## 119	1
## 120	1
## 121	2
## 122	1
## 123	2
## 124	1
## 125	1
## 126	2
## 127	1
## 128	2
## 129	1
## 130	1
## 131	3
## 132	1
## 133	2
## 134	4
## 135	4
## 136	4
## 137	2
## 138	1
## 139	1
## 140	1
## 141	1
## 142	1
## 143	2
## 144	1
## 145	3
## 146	1
## 147	3
## 148	2
## 149	1
## 150	1
## 151	1
## 152	1

## 153	2
## 154	2
## 155	3
## 156	1
## 157	1
## 158	2
## 159	1
## 160	1
## 161	2
## 162	4
## 163	6
## 164	1
## 165	3
## 166	2
## 167	1
## 168	2

Calculate the average salary by gender and smoking status.

Which gender has the highest mean salary?

Report the highest mean salary?

```

x<-tapply(salary,list(gender=gender),mean)
x

## gender
## Female   Male
## 698.0911 743.3915 (Average salary by gender)

by(salary,gender,mean,na.rm=TRUE)

## gender: Female
## [1] 698.0911
## -----
## gender: Male
## [1] 743.3915

x[which(x==max(x))]

##   Male
## 743.3915

```

(Male gender has the highest mean salary and the salary is 743.3915)

Smoking status---

There are 136 non-smokers and 32 smokers

d. Compare the spreads for the genders by calculating the standard deviation of salary by gender.

```

y<-tapply(salary,list(gender=gender),sd)
y

```

```

## gender
## Female   Male
## 130.7053 158.5423

```

Item Compare the spreads for the genders by calculating the standard deviation of `salary` by `gender`. Which gender has the biggest standard deviation?

For these data, the the largest standard deviation is approximately

```

Sexpr{round(y[which(y==max(y))],2)} which was attained by the
Sexpr{names(y)[which(y==max(y))]}gender.

```

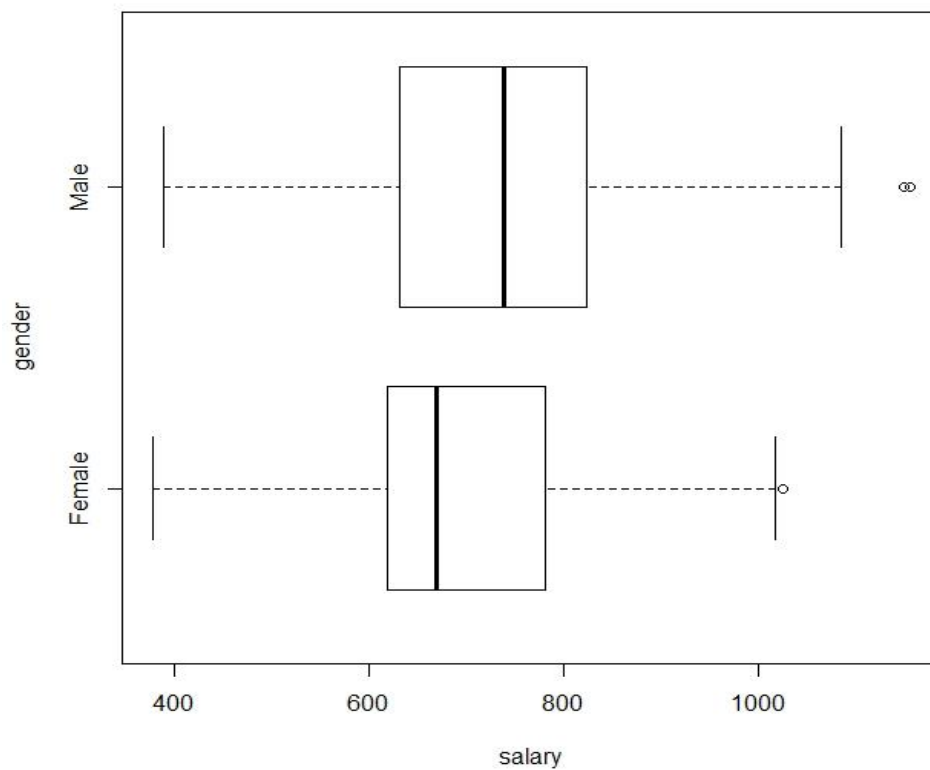
item Make boxplots of `salary` by `gender`. How does the boxplot compare to your answers to (1) and (3)?

The graph is shown below

```
\begin{center}
```

```
<<echo = FALSE, fig=true, height = 4.5, width = 6>>=boxplot(salary~gender, xlab="salary",  
ylab="gender", main="", notch=FALSE, varwidth=TRUE, horizontal=TRUE,  
data=RcmdrTestDrive)@\par\end{center}
```

Answers will vary. There should be some remarks that the center of
the box is farther to the right for the `\Sexpr{names(x)[which(x==max(x))]}`
gender, and some recognition that the box is wider for the
`\Sexpr{names(y)[which(y==max(y))]}gender`.



```
table(race)
```

```
## race
## AfricanAmer   Asian   Caucasian   Hispanic   Other
##      46      13      73      34      2
```

```
race
```

```
## [1] Caucasian AfricanAmer Caucasian Caucasian Hispanic
## [6] Caucasian Hispanic Hispanic Caucasian Hispanic
## [11] AfricanAmer Caucasian Caucasian Asian Asian
## [16] Hispanic Hispanic Caucasian Caucasian AfricanAmer
## [21] Other Hispanic AfricanAmer Caucasian Hispanic
## [26] Caucasian AfricanAmer AfricanAmer Caucasian Asian
## [31] Hispanic Asian Caucasian Asian AfricanAmer
## [36] AfricanAmer AfricanAmer Caucasian Caucasian Caucasian
## [41] AfricanAmer Caucasian Caucasian Caucasian AfricanAmer
## [46] AfricanAmer Hispanic Caucasian Caucasian Caucasian
## [51] AfricanAmer Hispanic AfricanAmer AfricanAmer Hispanic
## [56] Asian Caucasian Caucasian Caucasian AfricanAmer
## [61] Caucasian Caucasian AfricanAmer Hispanic Caucasian
## [66] Caucasian Caucasian Asian Hispanic Caucasian
## [71] Caucasian Caucasian Hispanic Hispanic Caucasian
## [76] Hispanic AfricanAmer Hispanic AfricanAmer Caucasian
## [81] AfricanAmer Caucasian Caucasian AfricanAmer Caucasian
## [86] Asian Caucasian Hispanic AfricanAmer Caucasian
## [91] AfricanAmer Caucasian AfricanAmer Caucasian Caucasian
## [96] Other AfricanAmer Caucasian Asian Caucasian
## [101] Caucasian Caucasian Caucasian AfricanAmer Hispanic
## [106] Hispanic Hispanic Asian AfricanAmer AfricanAmer
## [111] Caucasian Caucasian AfricanAmer Caucasian AfricanAmer
## [116] Hispanic Caucasian Caucasian Caucasian Hispanic
## [121] AfricanAmer Caucasian Caucasian AfricanAmer Hispanic
## [126] AfricanAmer Caucasian Asian AfricanAmer Caucasian
## [131] Caucasian Caucasian AfricanAmer Caucasian Hispanic
## [136] Caucasian Hispanic Asian Caucasian AfricanAmer
## [141] Caucasian Hispanic Caucasian Hispanic Caucasian
## [146] Hispanic AfricanAmer Asian AfricanAmer Caucasian
## [151] Caucasian Caucasian AfricanAmer AfricanAmer Caucasian
## [156] Caucasian AfricanAmer Caucasian AfricanAmer Caucasian
## [161] AfricanAmer Hispanic AfricanAmer Hispanic AfricanAmer
## [166] Hispanic Hispanic AfricanAmer
## Levels: AfricanAmer Asian Caucasian Hispanic Other
```

```
x<-tapply(salary,list(gender=gender),mean)
```

```
x
```

gender

Female Male

698.0911 743.3915