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  
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## 7 5  
## 8 1  
## 9 2  
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## 15 3  
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## 17 4  
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## 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  
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## 49 2  
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## 51 3  
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## 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  
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## 88 1  
## 89 2  
## 90 1  
## 91 3  
## 92 2  
## 93 5  
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## 95 1  
## 96 3  
## 97 2  
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## 101 5  
## 102 1  
## 103 1  
## 104 3  
## 105 2  
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## 111 2  
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## 115 1  
## 116 2  
## 117 4  
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## 128 2  
## 129 1  
## 130 1  
## 131 3  
## 132 1  
## 133 2  
## 134 4  
## 135 4  
## 136 4  
## 137 2  
## 138 1  
## 139 1  
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## 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 salar?

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 \emph{salary} by \emph{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 \emph{salary} by \emph{gender}. How does the boxplot

compare to your answers to (1) and (3)?

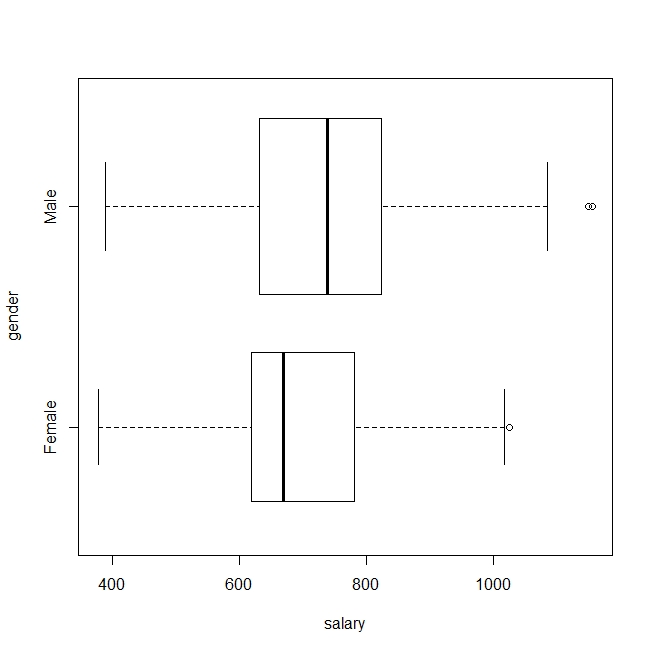
The graph is shown below

\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.\end{enumerate}

**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