ACADGILD

SESSION 8: Exploratory Data Analytics

Assignment 1

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Data Analytics

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1. Problem Statement

i. 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.

2. Solution

a. Calculate the average salary by gender and smoking status.

The R-script for the given problem is as follows:

```
library(Rcmdr)
library(RcmdrPlugin.IPSUR)
data(RcmdrTestDrive)
RcmdrTestDrive

#a. Calculate the average salary by gender and smoking status.
library(dplyr)
str(RcmdrTestDrive)

#Data <- RcmdrTestDrive

AvgSalary <- RcmdrTestDrive%>%group_by(gender, smoking)%>%
  select(smoking, gender, salary)%>%summarise(mean(salary))
AvgSalary <- as.data.frame(AvgSalary)
AvgSalary$meansalary <- AvgSalary$`mean(salary)`
AvgSalary                          # Data Frame

stripchart(meansalary ~ gender, vertical=TRUE, method="jitter",
        ylab="meansalary", data=AvgSalary)          #For  Graph
```

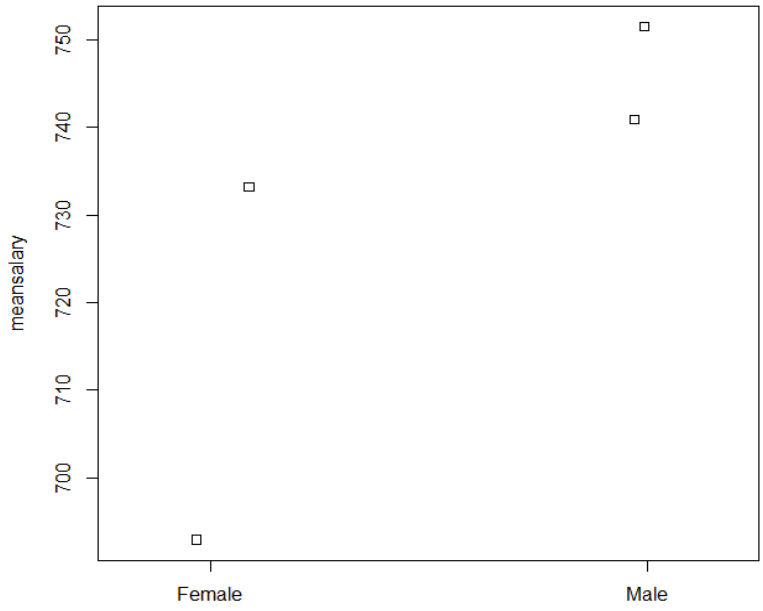
The output of the R-Script (from Console window) is given as follows:

```
> library(Rcmdr)
> library(RcmdrPlugin.IPSUR)
> data(RcmdrTestDrive)
> RcmdrTestDrive
    order   smoking gender        race before after  salary reduction parking
1       1 Nonsmoker Female   Caucasian   72.6  75.2  618.65         9       2
2       2 Nonsmoker   Male AfricanAmer   75.3  73.2  544.56        62       1
3       3 Nonsmoker Female   Caucasian   75.5  74.5  550.24        19       4
4       4 Nonsmoker Female   Caucasian   71.3  74.6  616.16        30       1
5       5 Nonsmoker Female    Hispanic   74.3  73.8  543.39       105       1
6       6 Nonsmoker   Male   Caucasian   73.0  73.6  692.09        43       1
7       7    Smoker   Male    Hispanic   72.4  70.7  800.48       229       5
8       8 Nonsmoker   Male    Hispanic   73.6  74.0  703.79        40       1
9       9 Nonsmoker Female   Caucasian   73.7  75.9  540.06       101       2
10     10 Nonsmoker Female    Hispanic   74.6  74.8  522.28       440       1
11     11 Nonsmoker Female AfricanAmer   75.8  73.1  377.17       213       1
12     12 Nonsmoker Female   Caucasian   75.3  72.1  525.96       474       2
13     13 Nonsmoker Female   Caucasian   75.0  72.5  548.88       144       1
14     14 Nonsmoker   Male       Asian   72.8  72.7  537.70       179       2
15     15 Nonsmoker   Male       Asian   74.4  75.7  500.20        63       3
16     16 Nonsmoker Female    Hispanic   72.9  73.1  597.73       570       1
17     17 Nonsmoker Female    Hispanic   72.3  74.0  578.95       437       4
18     18 Nonsmoker   Male   Caucasian   74.0  74.6  690.06        62       2
19     19 Nonsmoker   Male   Caucasian   73.1  72.8  748.98       437       2
20     20 Nonsmoker   Male AfricanAmer   74.0  76.1  811.71        60       1
21     21 Nonsmoker   Male       Other   73.6  74.5  660.58       255       1
22     22 Nonsmoker   Male    Hispanic   73.4  75.0  586.29       133       4
23     23 Nonsmoker   Male AfricanAmer   73.9  74.0  387.59        88       1
24     24 Nonsmoker   Male   Caucasian   73.0  73.9  524.54       116       1
25     25 Nonsmoker Female    Hispanic   74.2  75.7  536.87        48       3
26     26 Nonsmoker   Male   Caucasian   73.6  75.4  503.64       365       1
27     27    Smoker   Male AfricanAmer   74.6  68.1  496.09        73       1
28     28 Nonsmoker   Male AfricanAmer   74.5  72.6  701.91       306       5
29     29 Nonsmoker Female   Caucasian   72.6  73.2  595.70       497       1
30     30 Nonsmoker   Male       Asian   72.6  74.1  759.30        32       1
31     31 Nonsmoker Female    Hispanic   72.1  73.7  717.91       497       1
32     32 Nonsmoker   Male       Asian   73.2  73.5  808.63        21       2
33     33    Smoker   Male   Caucasian   73.2  70.0  682.60       291       1
34     34 Nonsmoker   Male       Asian   74.3  75.2  623.09        83       1
35     35    Smoker   Male AfricanAmer   74.0  68.7  550.28        55       2
36     36 Nonsmoker   Male AfricanAmer   75.5  72.9  646.25       100       8
37     37 Nonsmoker Female AfricanAmer   75.4  72.6  635.43       439       4
38     38 Nonsmoker   Male   Caucasian   75.5  72.5  437.19       419       1
39     39 Nonsmoker Female   Caucasian   74.4  73.6  619.29        23       2
40     40 Nonsmoker   Male   Caucasian   73.7  75.0  593.68        71       1
41     41 Nonsmoker   Male AfricanAmer   75.8  73.1  546.26       109       4
42     42 Nonsmoker Female   Caucasian   74.3  72.2  704.83        98       1
43     43 Nonsmoker   Male   Caucasian   74.7  73.1  764.15        78       1
44     44 Nonsmoker Female   Caucasian   74.9  72.0  859.67       257       3
45     45 Nonsmoker Female AfricanAmer   75.3  76.2  724.25       487       1
46     46 Nonsmoker   Male AfricanAmer   75.6  75.0  631.62       213       3
47     47 Nonsmoker Female    Hispanic   72.7  73.4  478.39       383       1
48     48 Nonsmoker Female   Caucasian   75.6  74.9  652.79       116       1
```

49	49	Nonsmoker	Male	Caucasian	73.8	71.9	545.66	1632	2
50	50	Nonsmoker	Male	Caucasian	74.7	75.8	515.95	151	1
51	51	Nonsmoker	Male	AfricanAmer	75.4	74.8	612.27	152	3
52	52	Nonsmoker	Female	Hispanic	74.3	73.8	633.12	390	2
53	53	Nonsmoker	Male	AfricanAmer	75.0	73.2	671.35	64	1
54	54	Nonsmoker	Female	AfricanAmer	75.3	73.8	643.83	85	1
55	55	Nonsmoker	Male	Hispanic	74.8	73.6	794.66	71	2
56	56	Smoker	Female	Asian	73.2	70.6	888.00	37	1
57	57	Nonsmoker	Female	Caucasian	74.0	75.8	602.94	89	2
58	58	Smoker	Male	Caucasian	75.5	74.3	716.78	172	1
59	59	Nonsmoker	Male	Caucasian	75.3	72.8	606.12	3	1
60	60	Nonsmoker	Male	AfricanAmer	73.9	73.7	704.90	247	5
61	61	Nonsmoker	Male	Caucasian	71.7	72.5	620.32	127	2
62	62	Nonsmoker	Male	Caucasian	73.6	74.7	515.92	337	1
63	63	Nonsmoker	Female	AfricanAmer	72.1	73.7	655.72	123	1
64	64	Nonsmoker	Female	Hispanic	72.7	73.1	619.44	205	4
65	65	Nonsmoker	Female	Caucasian	74.5	71.9	640.48	61	1
66	66	Smoker	Male	Caucasian	73.2	72.8	844.32	119	2
67	67	Nonsmoker	Female	Caucasian	73.3	74.9	918.03	165	2
68	68	Nonsmoker	Female	Asian	74.2	75.1	933.49	480	6
69	69	Nonsmoker	Female	Hispanic	74.7	74.2	699.63	39	3
70	70	Nonsmoker	Female	Caucasian	74.4	74.2	593.27	434	4
71	71	Smoker	Male	Caucasian	74.5	69.7	634.24	147	1
72	72	Smoker	Female	Caucasian	73.0	69.3	686.98	270	2
73	73	Nonsmoker	Female	Hispanic	73.5	72.5	618.68	384	1
74	74	Smoker	Female	Hispanic	72.3	70.6	631.20	87	1
75	75	Nonsmoker	Female	Caucasian	75.7	73.8	608.88	291	3
76	76	Smoker	Female	Hispanic	75.6	69.1	686.28	31	2
77	77	Smoker	Female	AfricanAmer	75.4	70.0	715.44	549	1
78	78	Nonsmoker	Male	Hispanic	73.4	74.8	754.66	172	2
79	79	Nonsmoker	Male	AfricanAmer	72.9	74.6	865.89	251	1
80	80	Nonsmoker	Female	Caucasian	72.3	74.0	890.88	335	6
81	81	Smoker	Male	AfricanAmer	74.4	70.7	777.91	319	1
82	82	Smoker	Male	Caucasian	72.8	70.5	680.56	519	1
83	83	Nonsmoker	Male	Caucasian	75.1	73.5	594.61	94	2
84	84	Nonsmoker	Male	AfricanAmer	73.2	75.1	651.73	15	1
85	85	Smoker	Male	Caucasian	74.0	71.3	601.11	397	5
86	86	Nonsmoker	Female	Asian	73.8	72.9	626.71	95	2
87	87	Nonsmoker	Female	Caucasian	73.5	74.8	643.80	551	2
88	88	Smoker	Male	Hispanic	72.2	66.6	724.52	89	1
89	89	Nonsmoker	Female	AfricanAmer	74.4	75.3	745.57	121	2
90	90	Smoker	Male	Caucasian	75.2	72.5	842.05	319	1
91	91	Nonsmoker	Male	AfricanAmer	73.6	74.2	880.47	424	3
92	92	Nonsmoker	Female	Caucasian	73.1	72.6	1016.21	79	2
93	93	Nonsmoker	Male	AfricanAmer	73.9	73.3	726.13	372	5
94	94	Nonsmoker	Male	Caucasian	74.9	74.4	780.21	195	1
95	95	Nonsmoker	Female	Caucasian	72.5	75.0	704.08	324	1
96	96	Nonsmoker	Female	Other	75.0	73.4	785.89	532	3
97	97	Nonsmoker	Male	AfricanAmer	73.8	75.2	662.98	91	2
98	98	Nonsmoker	Male	Caucasian	73.6	75.2	621.30	32	1
99	99	Smoker	Male	Asian	74.8	71.3	521.17	94	2
100	100	Nonsmoker	Female	Caucasian	73.8	74.3	714.58	95	3
101	101	Nonsmoker	Male	Caucasian	75.8	74.6	728.94	99	5
102	102	Smoker	Male	Caucasian	75.5	71.1	812.26	275	1
103	103	Smoker	Male	Caucasian	72.4	71.7	924.78	203	1
104	104	Nonsmoker	Female	AfricanAmer	73.6	74.3	1001.31	131	3

105	105	Nonsmoker	Male	Hispanic	73.3	74.3	724.99	116	2
106	106	Nonsmoker	Male	Hispanic	72.9	73.3	822.35	66	1
107	107	Nonsmoker	Male	Hispanic	75.7	73.1	653.58	574	1
108	108	Nonsmoker	Female	Asian	72.6	73.3	642.28	87	1
109	109	Nonsmoker	Male	AfricanAmer	73.8	73.6	730.12	149	1
110	110	Smoker	Female	AfricanAmer	72.8	70.6	708.30	538	1
111	111	Nonsmoker	Male	Caucasian	73.9	71.9	629.17	419	2
112	112	Nonsmoker	Male	Caucasian	73.2	75.1	790.33	33	1
113	113	Nonsmoker	Male	AfricanAmer	75.5	73.8	788.05	213	1
114	114	Nonsmoker	Female	Caucasian	72.4	74.5	849.25	44	1
115	115	Nonsmoker	Male	AfricanAmer	72.8	74.5	1036.06	814	1
116	116	Nonsmoker	Male	Hispanic	74.8	75.2	1149.92	131	2
117	117	Smoker	Male	Caucasian	75.6	72.4	854.31	100	4
118	118	Nonsmoker	Female	Caucasian	74.1	74.2	768.94	688	4
119	119	Smoker	Male	Caucasian	75.3	69.6	666.74	83	1
120	120	Nonsmoker	Female	Hispanic	75.1	73.2	639.72	185	1
121	121	Smoker	Male	AfricanAmer	74.1	70.3	744.38	60	2
122	122	Nonsmoker	Female	Caucasian	74.6	74.1	584.08	6	1
123	123	Nonsmoker	Male	Caucasian	74.1	72.5	712.00	60	2
124	124	Nonsmoker	Female	AfricanAmer	73.9	72.7	789.76	282	1
125	125	Smoker	Male	Hispanic	73.0	67.3	719.06	31	1
126	126	Nonsmoker	Male	AfricanAmer	75.3	73.8	903.34	82	2
127	127	Nonsmoker	Male	Caucasian	73.5	75.3	1044.98	65	1
128	128	Nonsmoker	Male	Asian	72.3	74.8	1027.36	26	2
129	129	Nonsmoker	Female	AfricanAmer	73.5	73.7	855.36	117	1
130	130	Nonsmoker	Male	Caucasian	72.9	76.2	796.51	205	1
131	131	Smoker	Male	Caucasian	72.6	70.3	771.74	99	3
132	132	Nonsmoker	Male	Caucasian	76.3	74.2	780.27	401	1
133	133	Nonsmoker	Male	AfricanAmer	73.0	75.2	808.65	8	2
134	134	Nonsmoker	Female	Caucasian	74.7	74.7	632.05	469	4
135	135	Smoker	Female	Hispanic	74.5	67.5	681.58	116	4
136	136	Nonsmoker	Male	Caucasian	71.4	74.6	823.38	298	4
137	137	Nonsmoker	Male	Hispanic	74.4	73.9	754.55	115	2
138	138	Nonsmoker	Male	Asian	72.1	73.1	938.47	721	1
139	139	Nonsmoker	Male	Caucasian	73.1	76.4	1072.65	135	1
140	140	Nonsmoker	Male	AfricanAmer	73.7	73.3	1021.69	202	1
141	141	Nonsmoker	Female	Caucasian	73.0	73.3	785.75	642	1
142	142	Nonsmoker	Female	Hispanic	73.8	74.4	882.78	95	1
143	143	Nonsmoker	Female	Caucasian	73.6	72.0	762.43	262	2
144	144	Nonsmoker	Male	Hispanic	73.1	74.2	863.78	564	1
145	145	Nonsmoker	Male	Caucasian	73.4	73.9	745.97	258	3
146	146	Nonsmoker	Female	Hispanic	74.0	72.4	809.26	41	1
147	147	Nonsmoker	Female	AfricanAmer	75.8	72.9	668.26	77	3
148	148	Smoker	Female	Asian	74.2	67.8	780.61	429	2
149	149	Nonsmoker	Female	AfricanAmer	75.4	73.3	749.43	557	1
150	150	Nonsmoker	Male	Caucasian	75.1	72.9	889.55	89	1
151	151	Nonsmoker	Female	Caucasian	74.6	74.9	1025.09	59	1
152	152	Smoker	Male	Caucasian	75.5	69.8	1156.16	370	1
153	153	Nonsmoker	Male	AfricanAmer	74.9	74.3	777.93	202	2
154	154	Nonsmoker	Male	AfricanAmer	73.6	74.3	835.96	111	2
155	155	Nonsmoker	Female	Caucasian	74.5	72.6	668.69	598	3
156	156	Nonsmoker	Female	Caucasian	75.7	74.6	870.52	55	1
157	157	Nonsmoker	Male	AfricanAmer	72.6	73.8	827.18	750	1
158	158	Smoker	Male	Caucasian	74.1	70.8	689.23	83	2
159	159	Nonsmoker	Female	AfricanAmer	73.6	74.2	662.17	257	1
160	160	Smoker	Female	Caucasian	75.0	70.3	820.52	303	1

```
161   161 Nonsmoker Female AfricanAmer   73.1  74.8  780.51        79       2
162   162 Nonsmoker   Male    Hispanic   73.6  74.3  980.09       156       4
163   163 Nonsmoker   Male AfricanAmer   73.6  75.1 1084.21       166       6
164   164    Smoker   Male    Hispanic   73.5  72.1 1073.50         9       1
165   165 Nonsmoker   Male AfricanAmer   73.7  72.5  908.11       409       3
166   166 Nonsmoker   Male    Hispanic   73.1  73.4  793.42       424       2
167   167 Nonsmoker   Male    Hispanic   74.5  74.9  804.78       205       1
168   168 Nonsmoker   Male AfricanAmer   73.7  74.1  790.82        47       2
> library(dplyr)
> str(RcmdrTestDrive)
'data.frame':  168 obs. of  9 variables:
 $ order    : int  1 2 3 4 5 6 7 8 9 10 ...
 $ smoking  : Factor w/ 2 levels "Nonsmoker","Smoker": 1 1 1 1 1 1 2 1 1 1
...
 $ gender   : Factor w/ 2 levels "Female","Male": 1 2 1 1 1 2 2 2 1 1 ...
 $ race     : Factor w/ 5 levels "AfricanAmer",..: 3 1 3 3 4 3 4 4 3 4 ...
 $ before   : num  72.6 75.3 75.5 71.3 74.3 73 72.4 73.6 73.7 74.6 ...
 $ after    : num  75.2 73.2 74.5 74.6 73.8 73.6 70.7 74 75.9 74.8 ...
 $ salary   : num  619 545 550 616 543 ...
 $ reduction: int  9 62 19 30 105 43 229 40 101 440 ...
 $ parking  : int  2 1 4 1 1 1 5 1 2 1 ...
> AvgSalary <- RcmdrTestDrive%>%group_by(gender, smoking)%>%
+   select(smoking, gender, salary)%>%summarise(mean(salary))
> AvgSalary <- as.data.frame(AvgSalary)
> AvgSalary$meansalary <- AvgSalary$`mean(salary)`
> AvgSalary
  gender   smoking mean(salary) meansalary
1 Female Nonsmoker     692.9093   692.9093
2 Female    Smoker     733.2122   733.2122
3   Male Nonsmoker     740.9080   740.9080
4   Male    Smoker     751.4900   751.4900
> stripchart(meansalary ~ gender, vertical=TRUE, method="jitter",
+            ylab="meansalary", data=AvgSalary)
```



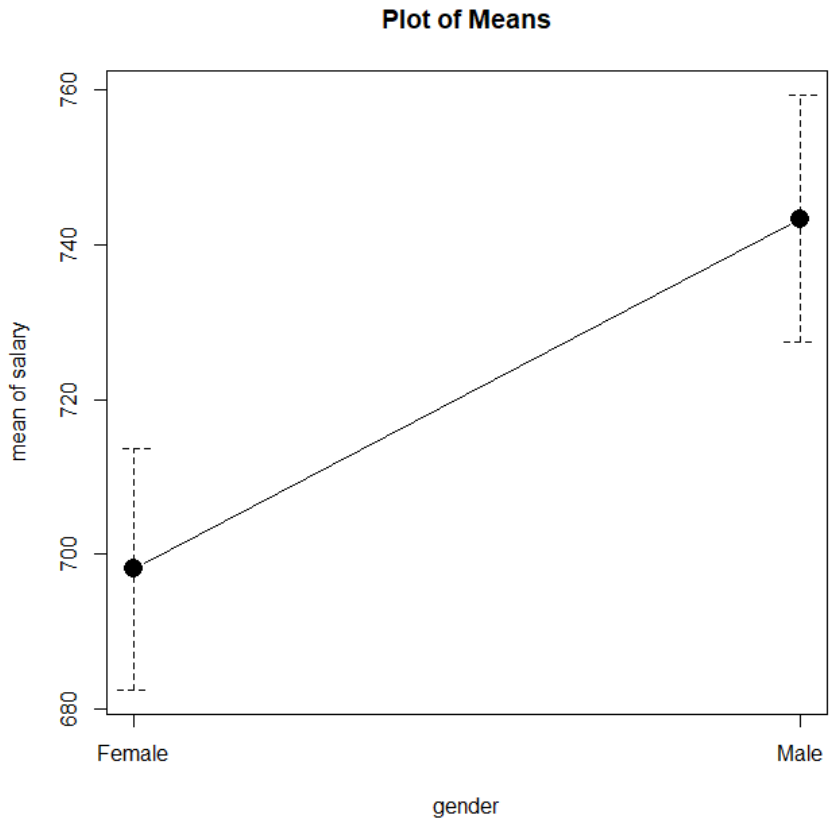
b. Which gender has the highest mean salary?

The R-script for the given problem is as follows:

```
with(RcmdrTestDrive, plotMeans(salary, gender, error.bars="se"))
```

The output of the R-Script (from Console window) is given as follows:

```
> with(RcmdrTestDrive, plotMeans(salary, gender, error.bars="se"))
```



Conclusion/Interpretation:
From the above graph ,it is concluded that male has highest mean salary.

c. Report the highest mean salary.

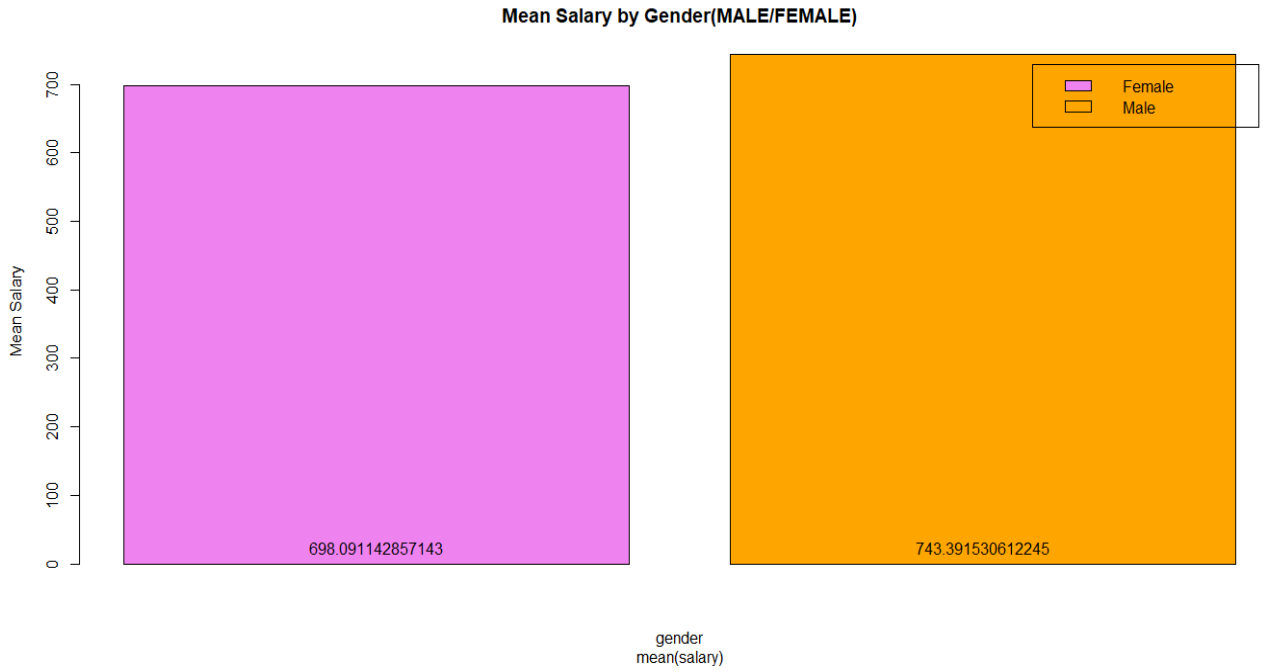
The R-script for the given problem is as follows:

```
meansalary <- as.data.frame(RcmdrTestDrive%>%group_by(gender)%>%
                    select(gender,salary)%>%summarise(mean(salary)))

meansalary$meansalary <- meansalary$`mean(salary)`
meansalary
meansalary[which.max(meansalary$meansalary),]

bp <- barplot(meansalary$meansalary, xlab = names(meansalary),
```

```
        ylab = "Mean Salary",
        main = "Mean Salary by Gender(MALE/FEMALE)",
        col = c("Violet", "Orange"),
        legend = meansalary$gender)
text(bp, 0, meansalary$meansalary, cex = 1, pos = 3)
```

The output of the R-Script (from Console window) is given as follows:

```
> meansalary <- as.data.frame(RcmdrTestDrive%>%group_by(gender)%>%
+
select(gender,salary)%>%summarise(mean(salary)))
>
> meansalary$meansalary <- meansalary$`mean(salary)`
> meansalary
  gender mean(salary) meansalary
1 Female     698.0911   698.0911
2   Male     743.3915   743.3915
> meansalary[which.max(meansalary$meansalary),]    # gives the maximum mean
salary row i.e. Male
  gender mean(salary) meansalary
2   Male     743.3915   743.3915
> bp <- barplot(meansalary$meansalary, xlab = names(meansalary),
+               ylab = "Mean Salary",
+               main = "Mean Salary by Gender(MALE/FEMALE)",
+               col = c("Violet", "Orange"),
+               legend = meansalary$gender)
> text(bp, 0, meansalary$meansalary, cex = 1, pos = 3)
```



Conclusion/Interpretation:

Highest Mean Salary = 743.391

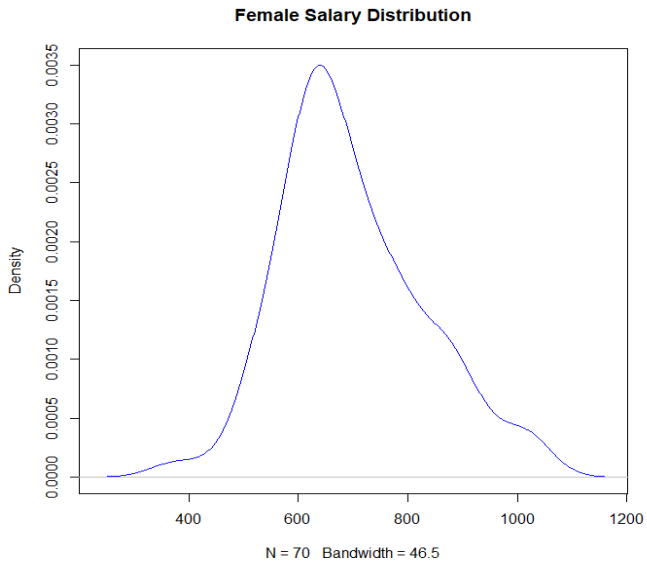
d. Compare the spreads for the genders by calculating the standard deviation of salary by gender.

The R-script for the given problem is as follows:

```
str(RcmdrTestDrive)
MaleSalary <- RcmdrTestDrive%>%select(gender, salary)%>%filter(gender == "Male")
FemaleSalary <- RcmdrTestDrive%>%select(gender, salary)%>%filter(gender == "Female")

par(mfrow = c(1,2))
M <- density(MaleSalary$salary)
plot(M, type="l", main="Male Salary Distribution", col = "Red")

N <- density(FemaleSalary$salary)
plot(N, type = "l", main = "Female Salary Distribution", col = "Blue")
```

The output of the R-Script (from Console /Plot window) is given as follows:

```
> str(RcmdrTestDrive)
'data.frame':  168 obs. of  9 variables:
 $ order    : int  1 2 3 4 5 6 7 8 9 10 ...
 $ smoking  : Factor w/ 2 levels "Nonsmoker","Smoker": 1 1 1 1 1 1 2 1 1 1
...
 $ gender   : Factor w/ 2 levels "Female","Male": 1 2 1 1 1 2 2 2 1 1 ...
 $ race     : Factor w/ 5 levels "AfricanAmer",..: 3 1 3 3 4 3 4 4 3 4 ...
 $ before   : num  72.6 75.3 75.5 71.3 74.3 73 72.4 73.6 73.7 74.6 ...
 $ after    : num  75.2 73.2 74.5 74.6 73.8 73.6 70.7 74 75.9 74.8 ...
 $ salary   : num  619 545 550 616 543 ...
 $ reduction: int  9 62 19 30 105 43 229 40 101 440 ...
 $ parking  : int  2 1 4 1 1 1 5 1 2 1 ...
> MaleSalary <- RcmdrTestDrive%>%select(gender, salary)%>%filter(gender ==
"Male")
> FemaleSalary <- RcmdrTestDrive%>%select(gender, salary)%>%filter(gender ==
"Female")
>
> par(mfrow = c(1,2))
> M <- density(MaleSalary$salary)
> plot(M, type="l", main="Male Salary Distribution", col = "Red")
>
> N <- density(FemaleSalary$salary)
> plot(N, type = "l", main = "Female Salary Distribution", col = "Blue")
```



Conclusion/Interpretation:

Comparison between the spreads for the genders is shown above in the figure plot.