In [2]:
```
## Question 3
library(ggplot2)
data = read.csv("Wholesale customers data.csv")
summary(data)

## Data preprocessing
top.n.custs <- function (data,cols,n=5)
{
    idx.to.remove <-integer(0)
    for (c in cols)
    {
        col.order <-order(data[,c],decreasing=T) #
        idx <-head(col.order, n) #
        idx.to.remove <-union(idx.to.remove,idx)
    }
    return(idx.to.remove)
}
top.custs <-top.n.custs(data,cols=3:8,n=5)
length(top.custs)
data[top.custs,]
data.rm.top<-data[-c(top.custs),]


## finding approporiate k
rng<-2:20
tries <-100
avg.totw.ss <-integer(length(rng))
for(v in rng)
{
    v.totw.ss <-integer(tries)
    for(i in 1:tries)
    {
        k.temp <-kmeans(data.rm.top,centers=v)
        v.totw.ss[i] <-k.temp$tot.withinss
    }
    avg.totw.ss[v-1] <-mean(v.totw.ss)
}

df = data.frame(x = rng,y = avg.totw.ss)
ggplot(df,aes(x = x,y = y)) + geom_line() + xlab("Value of k") + ylab(
"Average Total Within Sum of Squares") + ggtitle("Total Within SS by V
arious K")

# By observing the above plot, we choose the optimal value of k = 5
set.seed(76964057)
km = kmeans(data.rm.top[-c(1,2)],centers = 5)

km$centers
```

```
clusters = as.factor(km$cluster)

# Plots
ggplot(data.rm.top,aes(x= Fresh,y = Grocery,color = clusters)) +
geom_point() + ggtitle("Grocery vs Fresh")

ggplot(data.rm.top,aes(x= Fresh,y = Detergents_Paper,color = clusters)
) + geom_point() + ggtitle("Detergents_Paper vs Fresh")
```

```
    Channel          Region          Fresh             Milk      
 Min.   :1.000   Min.   :1.000   Min.   :     3   Min.   :   55  
 1st Qu.:1.000   1st Qu.:2.000   1st Qu.:  3128   1st Qu.: 1533  
 Median :1.000   Median :3.000   Median :  8504   Median : 3627  
 Mean   :1.323   Mean   :2.543   Mean   : 12000   Mean   : 5796  
 3rd Qu.:2.000   3rd Qu.:3.000   3rd Qu.: 16934   3rd Qu.: 7190  
 Max.   :2.000   Max.   :3.000   Max.   :112151   Max.   :73498  
    Grocery          Frozen        Detergents_Paper    Delicassen     
 Min.   :    3   Min.   :   25.0   Min.   :    3.0   Min.   :    3.0  
 1st Qu.: 2153   1st Qu.:  742.2   1st Qu.:  256.8   1st Qu.:  408.2  
 Median : 4756   Median : 1526.0   Median :  816.5   Median :  965.5  
 Mean   : 7951   Mean   : 3071.9   Mean   : 2881.5   Mean   : 1524.9  
 3rd Qu.:10656   3rd Qu.: 3554.2   3rd Qu.: 3922.0   3rd Qu.: 1820.2  
 Max.   :92780   Max.   :60869.0   Max.   :40827.0   Max.   :47943.0  
```

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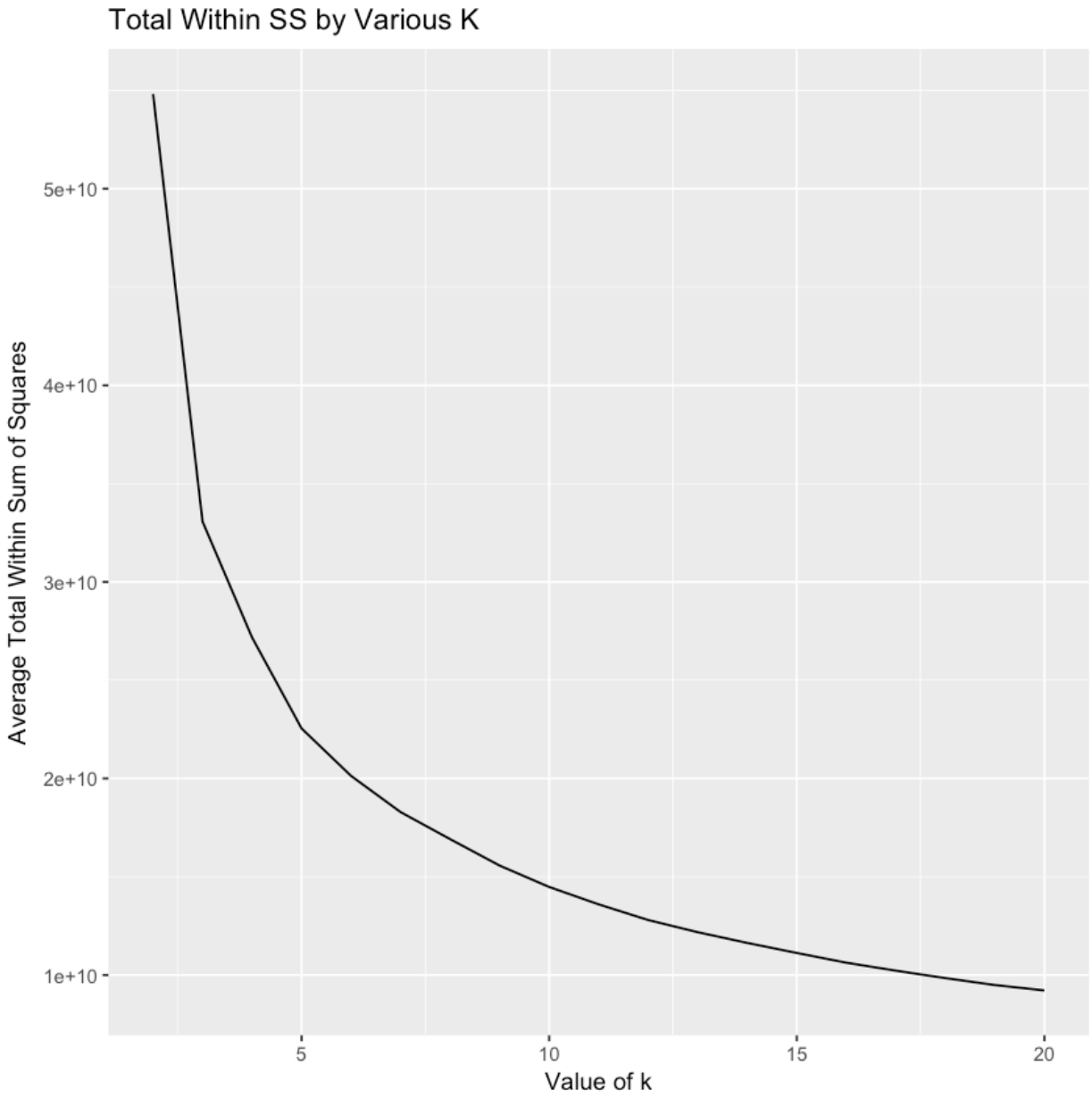
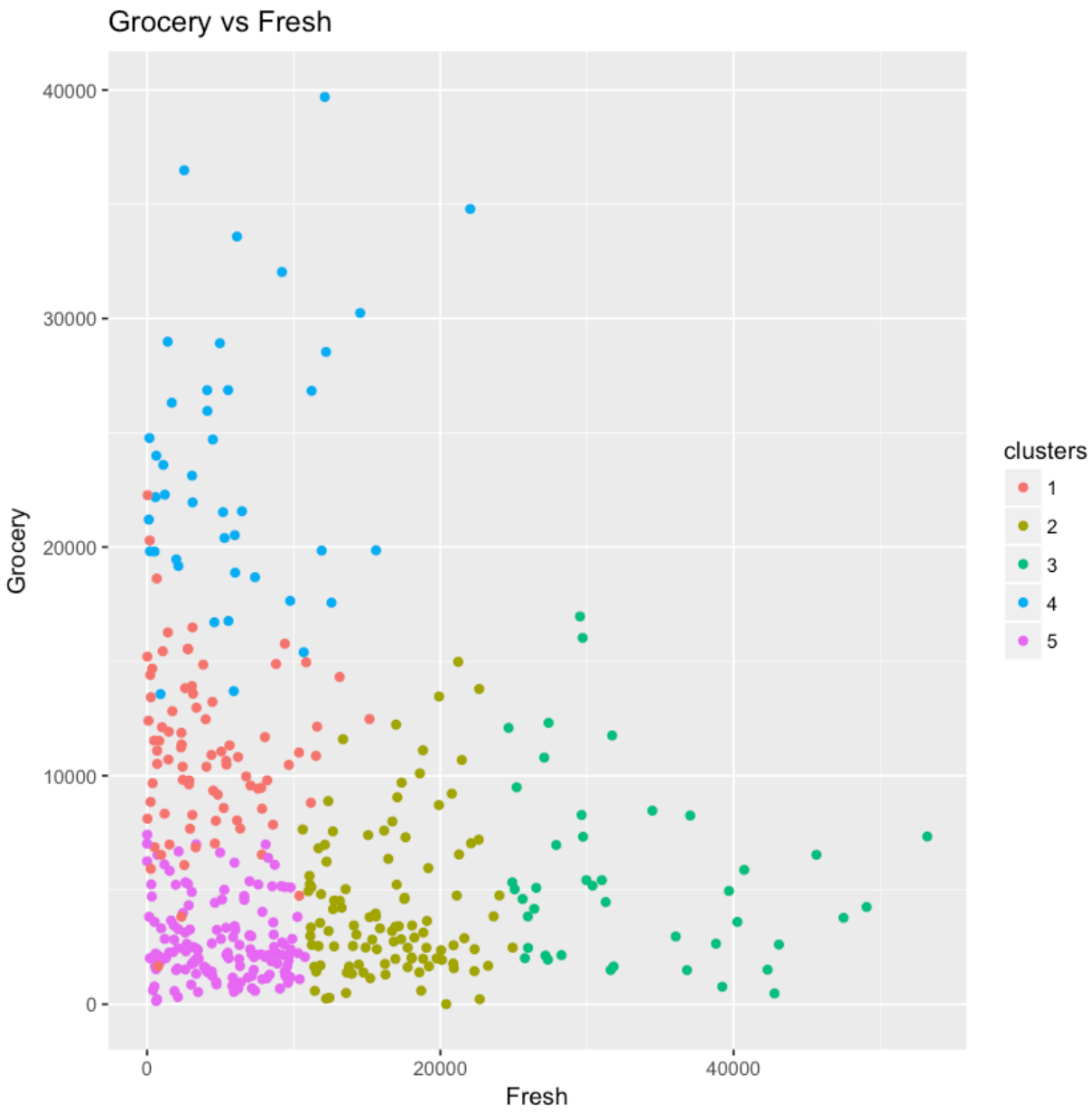
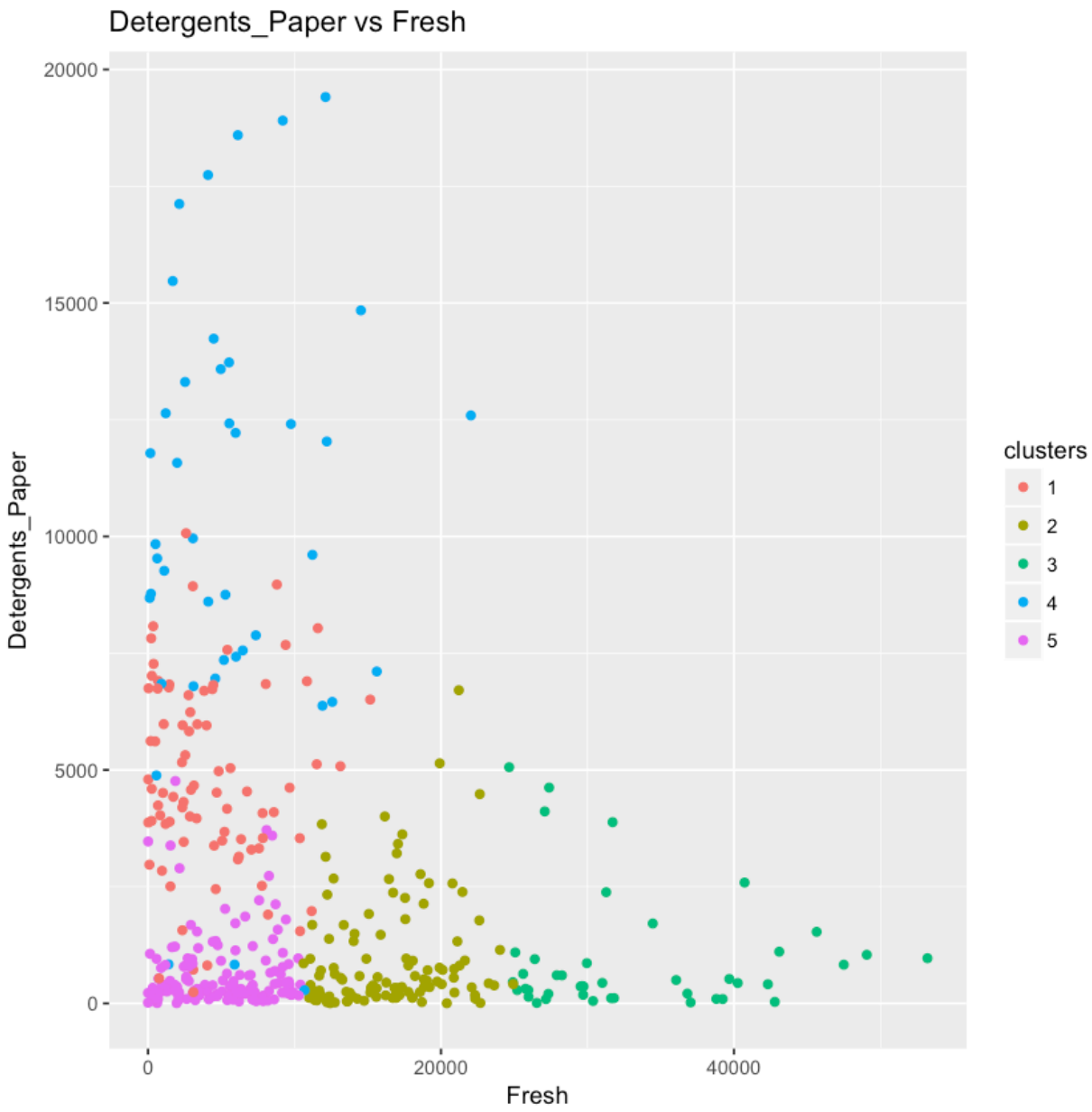
	Channel	Region	Fresh	Milk	Grocery	Frozen	Detergents_Paper	Delicassen
182	1	3	112151	29627	18148	16745	4948	8550
126	1	3	76237	3473	7102	16538	778	918
285	1	3	68951	4411	12609	8692	751	2406
40	1	3	56159	555	902	10002	212	2916
259	1	1	56083	4563	2124	6422	730	3321
87	2	3	22925	73498	32114	987	20070	903
48	2	3	44466	54259	55571	7782	24171	6465
86	2	3	16117	46197	92780	1026	40827	2944
184	1	3	36847	43950	20170	36534	239	47943
62	2	3	35942	38369	59598	3254	26701	2017
334	2	2	8565	4980	67298	131	38102	1215
66	2	3	85	20959	45828	36	24231	1423
326	1	2	32717	16784	13626	60869	1272	5609
94	1	3	11314	3090	2062	35009	71	2698
197	1	1	30624	7209	4897	18711	763	2876
104	1	3	56082	3504	8906	18028	1480	2498
24	2	3	26373	36423	22019	5154	4337	16523
72	1	3	18291	1266	21042	5373	4173	14472
88	1	3	43265	5025	8117	6312	1579	14351

	Fresh	Milk	Grocery	Frozen	Detergents_Paper	Delicassen
1	4189.747	7645.639	11015.277	1335.145	4750.4819	1387.1205
2	16470.870	3026.491	4264.741	3217.306	996.5556	1319.7593
3	33120.163	4896.977	5579.860	3823.372	945.4651	1620.1860
4	5830.214	15295.048	23449.167	1936.452	10361.6429	1912.7381
5	5043.434	2329.683	2786.138	2689.814	652.8276	849.8414


Total Within SS by Various K
Average Total Within Sum of Squares
5e+10
4e+10
3e+10
2e+10
1e+10
5
10
15
20
Value of k


Grocery vs Fresh
40000
30000
20000
10000
0
Grocery
0
20000
40000
Fresh
clusters
1
2
3
4
5


Detergents_Paper vs Fresh
Detergents_Paper
20000
15000
10000
5000
0
0
20000
40000
Fresh
clusters
1
2
3
4
5