

```

> x<-read.table("/Users/Simon/Downloads/seeds_original.csv", header = T, sep=",")
> seeds_original<-data.frame(x)
> head(seeds_original)
  Area Perimeter Compactness LengthKernel WidthKernel AsymmetryCoefficient
1 15.26      14.84      0.8710         5.763         3.312              2.221
2 14.88      14.57      0.8811         5.554         3.333              1.018
3 14.29      14.09      0.9050         5.291         3.337              2.699
4 13.84      13.94      0.8955         5.324         3.379              2.259
5 16.14      14.99      0.9034         5.658         3.562              1.355
6 14.38      14.21      0.8951         5.386         3.312              2.462
  LengthKernelGroove Class
1          5.220 Kama
2          4.956 Kama
3          4.825 Kama
4          4.805 Kama
5          5.175 Kama
6          4.956 Kama
> head(seeds_original)
  Area Perimeter Compactness LengthKernel WidthKernel AsymmetryCoefficient LengthKernelGroove Cl
ass
1 15.26      14.84      0.8710         5.763         3.312              2.221          5.220 K
ama
2 14.88      14.57      0.8811         5.554         3.333              1.018          4.956 K
ama
3 14.29      14.09      0.9050         5.291         3.337              2.699          4.825 K
ama
4 13.84      13.94      0.8955         5.324         3.379              2.259          4.805 K
ama
5 16.14      14.99      0.9034         5.658         3.562              1.355          5.175 K
ama
6 14.38      14.21      0.8951         5.386         3.312              2.462          4.956 K
ama
> dim(seeds_original)
[1] 210   8
> seeds_o_sample<-seeds_original[sample(1:nrow(seeds_original), size = 210), ]
> seeds_o_sample
  Area Perimeter Compactness LengthKernel WidthKernel AsymmetryCoefficient LengthKernelGroove
Class
32 15.49      14.94      0.8724         5.757         3.371              3.4120          5.228
Kama
158 12.13      13.73      0.8081         5.394         2.745              4.8250          5.220
Canadian
72 16.84      15.67      0.8623         5.998         3.484              4.6750          5.877
Rosa
172 11.55      13.10      0.8455         5.167         2.845              6.7150          4.956
Canadian
151 11.83      13.23      0.8496         5.263         2.840              5.1950          5.307
Canadian
201 12.38      13.44      0.8609         5.219         2.989              5.4720          5.045
Canadian
192 11.27      12.86      0.8563         5.091         2.804              3.9850          5.001
Canadian
96 16.87      15.65      0.8648         6.139         3.463              3.6960          5.967
Rosa
174 11.40      13.08      0.8375         5.136         2.763              5.5880          5.089
Canadian
81 16.53      15.34      0.8823         5.875         3.467              5.5320          5.880
Rosa
197 12.79      13.53      0.8786         5.224         3.054              5.4830          4.958
Canadian
85 19.51      16.71      0.8780         6.366         3.801              2.9620          6.185
Rosa
42 13.50      13.85      0.8852         5.351         3.158              2.2490          5.176
Kama
209 11.84      13.21      0.8521         5.175         2.836              3.5980          5.044
Canadian
148 12.49      13.46      0.8658         5.267         2.967              4.4210          5.002
Canadian
94 18.59      16.05      0.9066         6.037         3.860              6.0010          5.877
Rosa

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122	18.14	16.12	0.8772	6.059	3.563	3.6190	6.011
	Rosa						
11	15.26	14.85	0.8696	5.714	3.242	4.5430	5.314
	Kama						
208	13.20	13.66	0.8883	5.236	3.232	8.3150	5.056
	Canadian						
88	18.98	16.66	0.8590	6.549	3.670	3.6910	6.498
	Rosa						
1	15.26	14.84	0.8710	5.763	3.312	2.2210	5.220
	Kama						
166	12.10	13.15	0.8793	5.105	2.941	2.2010	5.056
	Canadian						
157	11.34	12.87	0.8596	5.053	2.849	3.3470	5.003
	Canadian						
167	12.44	13.59	0.8462	5.319	2.897	4.9240	5.270
	Canadian						
169	11.35	13.12	0.8291	5.176	2.668	4.3370	5.132
	Canadian						
198	13.37	13.78	0.8849	5.320	3.128	4.6700	5.091
	Canadian						
10	16.44	15.25	0.8880	5.884	3.505	1.9690	5.533
	Kama						
82	18.72	16.19	0.8977	6.006	3.857	5.3240	5.879
	Rosa						
54	14.33	14.28	0.8831	5.504	3.199	3.3280	5.224
	Kama						
185	12.89	13.77	0.8541	5.495	3.026	6.1850	5.316
	Canadian						
104	19.18	16.63	0.8717	6.369	3.681	3.3570	6.229
	Rosa						
4	13.84	13.94	0.8955	5.324	3.379	2.2590	4.805
	Kama						
2	14.88	14.57	0.8811	5.554	3.333	1.0180	4.956
	Kama						
179	11.48	13.05	0.8473	5.180	2.758	5.8760	5.002
	Canadian						
46	13.80	14.04	0.8794	5.376	3.155	1.5600	4.961
	Kama						
138	15.57	15.15	0.8527	5.920	3.231	2.6400	5.879
	Rosa						
165	11.14	12.79	0.8558	5.011	2.794	6.3880	5.049
	Canadian						
107	18.85	16.17	0.9056	6.152	3.806	2.8430	6.200
	Rosa						
125	15.99	14.89	0.9064	5.363	3.582	3.3360	5.144
	Rosa						
64	13.22	13.84	0.8680	5.395	3.070	4.1570	5.088
	Kama						
84	19.57	16.74	0.8779	6.384	3.772	1.4720	6.273
	Rosa						
117	18.96	16.20	0.9077	6.051	3.897	4.3340	5.750
	Rosa						
147	11.43	13.13	0.8335	5.176	2.719	2.2210	5.132
	Canadian						
160	11.49	13.22	0.8263	5.304	2.695	5.3880	5.310
	Canadian						
69	14.37	14.39	0.8726	5.569	3.153	1.4640	5.300
	Kama						
78	20.71	17.23	0.8763	6.579	3.814	4.4510	6.451
	Rosa						
62	11.23	12.63	0.8840	4.902	2.879	2.2690	4.703
	Kama						
110	18.55	16.22	0.8865	6.153	3.674	1.7380	5.894
	Rosa						
176	10.80	12.57	0.8590	4.981	2.821	4.7730	5.063
	Canadian						
77	17.32	15.91	0.8599	6.064	3.403	3.8240	5.922
	Rosa						
186	11.56	13.31	0.8198	5.363	2.683	4.0620	5.182
	Canadian						

23	15.88	14.90	0.8988	5.618	3.507	0.7651	5.091
	Kama						
48	14.99	14.56	0.8883	5.570	3.377	2.9580	5.175
	Kama						
27	13.02	13.76	0.8641	5.395	3.026	3.3730	4.825
	Kama						
116	19.06	16.45	0.8854	6.416	3.719	2.2480	6.163
	Rosa						
161	12.54	13.67	0.8425	5.451	2.879	3.0820	5.491
	Canadian						
207	11.23	12.88	0.8511	5.140	2.795	4.3250	5.003
	Canadian						
121	20.24	16.91	0.8897	6.315	3.962	5.9010	6.188
	Rosa						
129	20.16	17.03	0.8735	6.513	3.773	1.9100	6.185
	Rosa						
3	14.29	14.09	0.9050	5.291	3.337	2.6990	4.825
	Kama						
150	10.79	12.93	0.8107	5.317	2.648	5.4620	5.194
	Canadian						
120	20.03	16.90	0.8811	6.493	3.857	3.0630	6.320
	Rosa						
17	13.99	13.83	0.9183	5.119	3.383	5.2340	4.781
	Kama						
119	18.89	16.23	0.9008	6.227	3.769	3.6390	5.966
	Rosa						
126	18.75	16.18	0.8999	6.111	3.869	4.1880	5.992
	Rosa						
29	14.11	14.18	0.8820	5.541	3.221	2.7540	5.038
	Kama						
162	12.02	13.33	0.8503	5.350	2.810	4.2710	5.308
	Canadian						
136	15.38	14.66	0.8990	5.477	3.465	3.6000	5.439
	Rosa						
113	19.13	16.31	0.9035	6.183	3.902	2.1090	5.924
	Rosa						
76	16.77	15.62	0.8638	5.927	3.438	4.9200	5.795
	Rosa						
210	12.30	13.34	0.8684	5.243	2.974	5.6370	5.063
	Canadian						
128	17.98	15.85	0.8993	5.979	3.687	2.2570	5.919
	Rosa						
173	11.27	12.97	0.8419	5.088	2.763	4.3090	5.000
	Canadian						
99	18.17	16.26	0.8637	6.271	3.512	2.8530	6.273
	Rosa						
184	11.65	13.07	0.8575	5.108	2.850	5.2090	5.135
	Canadian						
93	18.81	16.29	0.8906	6.272	3.693	3.2370	6.053
	Rosa						
35	15.05	14.68	0.8779	5.712	3.328	2.1290	5.360
	Kama						
57	14.46	14.35	0.8818	5.388	3.377	2.8020	5.044
	Kama						
199	12.62	13.67	0.8481	5.410	2.911	3.3060	5.231
	Canadian						
135	15.56	14.89	0.8823	5.776	3.408	4.9720	5.847
	Rosa						
178	10.74	12.73	0.8329	5.145	2.642	4.7020	4.963
	Canadian						
53	14.49	14.61	0.8538	5.715	3.113	4.1160	5.396
	Kama						
89	21.18	17.21	0.8989	6.573	4.033	5.7800	6.231
	Rosa						
20	12.72	13.57	0.8686	5.226	3.049	4.1020	4.914
	Kama						
5	16.14	14.99	0.9034	5.658	3.562	1.3550	5.175
	Kama						
140	16.23	15.18	0.8850	5.872	3.472	3.7690	5.922
	Rosa						

6	14.38	14.21	0.8951	5.386	3.312	2.4620	4.956
	Kama						
164	12.55	13.57	0.8558	5.333	2.968	4.4190	5.176
	Canadian						
155	11.36	13.05	0.8382	5.175	2.755	4.0480	5.263
	Canadian						
181	11.41	12.95	0.8560	5.090	2.775	4.9570	4.825
	Canadian						
60	12.11	13.47	0.8392	5.159	3.032	1.5020	4.519
	Kama						
101	16.41	15.25	0.8866	5.718	3.525	4.2170	5.618
	Rosa						
21	14.16	14.40	0.8584	5.658	3.129	3.0720	5.176
	Kama						
196	12.80	13.47	0.8860	5.160	3.126	4.8730	4.914
	Canadian						
153	12.26	13.60	0.8333	5.408	2.833	4.7560	5.360
	Canadian						
59	15.38	14.77	0.8857	5.662	3.419	1.9990	5.222
	Kama						
127	18.65	16.41	0.8698	6.285	3.594	4.3910	6.102
	Rosa						
28	12.74	13.67	0.8564	5.395	2.956	2.5040	4.869
	Kama						
90	20.88	17.05	0.9031	6.450	4.032	5.0160	6.321
	Rosa						
143	13.34	13.95	0.8620	5.389	3.074	5.9950	5.307
	Canadian						
68	14.01	14.29	0.8625	5.609	3.158	2.2170	5.132
	Kama						
26	16.19	15.16	0.8849	5.833	3.421	0.9030	5.307
	Kama						
109	19.94	16.92	0.8752	6.675	3.763	3.2520	6.550
	Rosa						
193	11.87	13.02	0.8795	5.132	2.953	3.5970	5.132
	Canadian						
204	12.70	13.41	0.8874	5.183	3.091	8.4560	5.000
	Canadian						
19	14.70	14.21	0.9153	5.205	3.466	1.7670	4.649
	Kama						
13	13.89	14.02	0.8880	5.439	3.199	3.9860	4.738
	Kama						
12	14.03	14.16	0.8796	5.438	3.201	1.7170	5.001
	Kama						
124	18.43	15.97	0.9077	5.980	3.771	2.9840	5.905
	Rosa						
43	13.16	13.55	0.9009	5.138	3.201	2.4610	4.783
	Kama						
45	15.11	14.54	0.8986	5.579	3.462	3.1280	5.180
	Kama						
102	17.99	15.86	0.8992	5.890	3.694	2.0680	5.837
	Rosa						
100	18.72	16.34	0.8810	6.219	3.684	2.1880	6.097
	Rosa						
188	10.91	12.80	0.8372	5.088	2.675	4.1790	4.956
	Canadian						
41	13.54	13.85	0.8871	5.348	3.156	2.5870	5.178
	Kama						
111	18.45	16.12	0.8921	6.107	3.769	2.2350	5.794
	Rosa						
75	16.82	15.51	0.8786	6.017	3.486	4.0040	5.841
	Rosa						
205	12.37	13.47	0.8567	5.204	2.960	3.9190	5.001
	Canadian						
146	11.21	13.13	0.8167	5.279	2.687	6.1690	5.275
	Canadian						
36	16.12	15.00	0.9000	5.709	3.485	2.2700	5.443
	Kama						
30	13.45	14.02	0.8604	5.516	3.065	3.5310	5.097
	Kama						

175	10.83	12.96	0.8099	5.278	2.641	5.1820	5.185
Canadian							
154	11.18	13.04	0.8266	5.220	2.693	3.3320	5.001
Canadian							
51	14.43	14.40	0.8751	5.585	3.272	3.9750	5.144
Kama							
7	14.69	14.49	0.8799	5.563	3.259	3.5860	5.219
Kama							
87	18.88	16.26	0.8969	6.084	3.764	1.6490	6.109
Rosa							
139	15.60	15.11	0.8580	5.832	3.286	2.7250	5.752
Rosa							
15	13.74	14.05	0.8744	5.482	3.114	2.9320	4.825
Kama							
31	13.16	13.82	0.8662	5.454	2.975	0.8551	5.056
Kama							
39	14.80	14.52	0.8823	5.656	3.288	3.1120	5.309
Kama							
189	11.23	12.82	0.8594	5.089	2.821	7.5240	4.957
Canadian							
16	14.59	14.28	0.8993	5.351	3.333	4.1850	4.781
Kama							
145	11.82	13.40	0.8274	5.314	2.777	4.4710	5.178
Canadian							
130	17.55	15.66	0.8991	5.791	3.690	5.3660	5.661
Rosa							
47	15.36	14.76	0.8861	5.701	3.393	1.3670	5.132
Kama							
149	12.70	13.71	0.8491	5.386	2.911	3.2600	5.316
Canadian							
50	14.86	14.67	0.8676	5.678	3.258	2.1290	5.351
Kama							
63	12.36	13.19	0.8923	5.076	3.042	3.2200	4.605
Kama							
79	18.94	16.49	0.8750	6.445	3.639	5.0640	6.362
Rosa							
182	12.46	13.41	0.8706	5.236	3.017	4.9870	5.147
Canadian							
141	13.07	13.92	0.8480	5.472	2.994	5.3040	5.395
Canadian							
134	16.16	15.33	0.8644	5.845	3.395	4.2660	5.795
Rosa							
118	19.15	16.45	0.8890	6.245	3.815	3.0840	6.185
Rosa							
194	10.82	12.83	0.8256	5.180	2.630	4.8530	5.089
Canadian							
86	18.27	16.09	0.8870	6.173	3.651	2.4430	6.197
Rosa							
80	17.12	15.55	0.8892	5.850	3.566	2.8580	5.746
Rosa							
144	12.22	13.32	0.8652	5.224	2.967	5.4690	5.221
Canadian							
97	19.31	16.59	0.8815	6.341	3.810	3.4770	6.238
Rosa							
103	19.46	16.50	0.8985	6.113	3.892	4.3080	6.009
Rosa							
114	19.14	16.61	0.8722	6.259	3.737	6.6820	6.053
Rosa							
112	19.38	16.72	0.8716	6.303	3.791	3.6780	5.965
Rosa							
44	15.50	14.86	0.8820	5.877	3.396	4.7110	5.528
Kama							
37	16.20	15.27	0.8734	5.826	3.464	2.8230	5.527
Kama							
8	14.11	14.10	0.8911	5.420	3.302	2.7000	5.000
Kama							
183	12.19	13.36	0.8579	5.240	2.909	4.8570	5.158
Canadian							
132	18.94	16.32	0.8942	6.144	3.825	2.9080	5.949
Rosa							

58	14.92	14.43	0.9006	5.384	3.412	1.1420	5.088
	Kama						
142	13.32	13.94	0.8613	5.541	3.073	7.0350	5.440
	Canadian						
115	20.97	17.25	0.8859	6.563	3.991	4.6770	6.316
	Rosa						
74	19.11	16.26	0.9081	6.154	3.930	2.9360	6.079
	Rosa						
66	12.88	13.50	0.8879	5.139	3.119	2.3520	4.607
	Kama						
49	14.79	14.52	0.8819	5.545	3.291	2.7040	5.111
	Kama						
24	12.08	13.23	0.8664	5.099	2.936	1.4150	4.961
	Kama						
71	17.63	15.98	0.8673	6.191	3.561	4.0760	6.060
	Rosa						
156	11.19	13.05	0.8253	5.250	2.675	5.8130	5.219
	Canadian						
25	15.01	14.76	0.8657	5.789	3.245	1.7910	5.001
	Kama						
67	14.34	14.37	0.8726	5.630	3.190	1.3130	5.150
	Kama						
152	12.01	13.52	0.8249	5.405	2.776	6.9920	5.270
	Canadian						
200	12.76	13.38	0.8964	5.073	3.155	2.8280	4.830
	Canadian						
52	15.78	14.91	0.8923	5.674	3.434	5.5930	5.136
	Kama						
108	17.63	15.86	0.8800	6.033	3.573	3.7470	5.929
	Rosa						
83	20.20	16.89	0.8894	6.285	3.864	5.1730	6.187
	Rosa						
91	20.10	16.99	0.8746	6.581	3.785	1.9550	6.449
	Rosa						
206	12.19	13.20	0.8783	5.137	2.981	3.6310	4.870
	Canadian						
171	11.02	13.00	0.8189	5.325	2.701	6.7350	5.163
	Canadian						
98	18.98	16.57	0.8687	6.449	3.552	2.1440	6.453
	Rosa						
106	18.83	16.29	0.8917	6.037	3.786	2.5530	5.879
	Rosa						
65	12.78	13.57	0.8716	5.262	3.026	1.1760	4.782
	Kama						
195	12.11	13.27	0.8639	5.236	2.975	4.1320	5.012
	Canadian						
202	12.67	13.32	0.8977	4.984	3.135	2.3000	4.745
	Canadian						
70	12.73	13.75	0.8458	5.412	2.882	3.5330	5.067
	Kama						
61	11.42	12.86	0.8683	5.008	2.850	2.7000	4.607
	Kama						
191	10.93	12.80	0.8390	5.046	2.717	5.3980	5.045
	Canadian						
123	16.17	15.38	0.8588	5.762	3.387	4.2860	5.703
	Rosa						
9	16.63	15.46	0.8747	6.053	3.465	2.0400	5.877
	Kama						
18	15.69	14.75	0.9058	5.527	3.514	1.5990	5.046
	Kama						
137	17.36	15.76	0.8785	6.145	3.574	3.5260	5.971
	Rosa						
56	15.03	14.77	0.8658	5.702	3.212	1.9330	5.439
	Kama						
163	12.05	13.41	0.8416	5.267	2.847	4.9880	5.046
	Canadian						
203	11.18	12.72	0.8680	5.009	2.810	4.0510	4.828
	Canadian						
133	15.38	14.90	0.8706	5.884	3.268	4.4620	5.795
	Rosa						

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92  18.76    16.20    0.8984    6.172    3.796    3.1200    6.053
    Rosa
38  17.08    15.38    0.9079    5.832    3.683    2.9560    5.484
    Kama
187 11.81    13.45    0.8198    5.413    2.716    4.8980    5.352
Canadian
55  14.52    14.60    0.8557    5.741    3.113    1.4810    5.487
    Kama
105 18.95    16.42    0.8829    6.248    3.755    3.3680    6.148
    Rosa
34  13.94    14.17    0.8728    5.585    3.150    2.1240    5.012
    Kama
180 12.21    13.47    0.8453    5.357    2.893    1.6610    5.178
Canadian
95  18.36    16.52    0.8452    6.666    3.485    4.9330    6.448
    Rosa
73  17.26    15.73    0.8763    5.978    3.594    4.5390    5.791
    Rosa
170 11.24    13.00    0.8359    5.090    2.715    3.5210    5.088
Canadian
22  14.11    14.26    0.8722    5.520    3.168    2.6880    5.219
    Kama
40  14.28    14.17    0.8944    5.397    3.298    6.6850    5.001
    Kama
33  14.09    14.41    0.8529    5.717    3.186    3.9200    5.299
    Kama
168 12.15    13.45    0.8443    5.417    2.837    3.6380    5.338
Canadian
14  13.78    14.06    0.8759    5.479    3.156    3.1360    4.872
    Kama
159 11.75    13.52    0.8082    5.444    2.678    4.3780    5.310
Canadian
190 10.59    12.41    0.8648    4.899    2.787    4.9750    4.794
Canadian
131 18.30    15.89    0.9108    5.979    3.755    2.8370    5.962
    Rosa
177 11.26    13.01    0.8355    5.186    2.710    5.3350    5.092
Canadian
> total_missing_values <- sum(is.na(seeds_o_sample))
> cat("Total number of missing values:", total_missing_values, "\n"
+ )
Total number of missing values: 0
> missing_objects <- sum(rowSums(is.na(seeds_o_sample)) > 0)
> cat("Number of objects (rows) with missing values:", missing_objects, "\n")
Number of objects (rows) with missing values: 0
> five_number_summary <- apply(seeds_o_sample[, sapply(seeds_o_sample, is.numeric)], 2, fivenum)
> print(five_number_summary)
      Area Perimeter Compactness LengthKernel WidthKernel AsymmetryCoefficient LengthKernelGroove
e
[1,] 10.590    12.41    0.80810    4.8990    2.630    0.7651    4.51
9
[2,] 12.260    13.45    0.85670    5.2620    2.941    2.5530    5.04
5
[3,] 14.355    14.32    0.87345    5.5235    3.237    3.5990    5.22
3
[4,] 17.320    15.73    0.88790    5.9800    3.562    4.7730    5.87
7
[5,] 21.180    17.25    0.91830    6.6750    4.033    8.4560    6.55
0
> summary(seeds_o_sample[,1])
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
10.59  12.27  14.36  14.85  17.30  21.18
> summary(seeds_o_sample[,2])
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
12.41  13.45  14.32  14.56  15.71  17.25
> summary(seeds_o_sample[,3])
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.8081 0.8569 0.8734 0.8710 0.8878 0.9183
> summary(seeds_o_sample[,4])
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.

```

```

4.899 5.262 5.524 5.629 5.980 6.675
> summary(seeds_o_sample[,5])
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
2.630  2.944  3.237  3.259  3.562  4.033
> summary(seeds_o_sample[,6])
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.7651 2.5615  3.5990  3.7002  4.7687  8.4560
> summary(seeds_o_sample[,7])
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
4.519  5.045  5.223  5.408  5.877  6.550
> summary(seeds_o_sample[,8])
  Length      Class      Mode
210 character character
> numeric_cols <- names(seeds_o_sample)[sapply(seeds_o_sample, is.numeric)]
> summary_data <- aggregate(seeds_o_sample[numeric_cols], by = list(Class = seeds_o_sample$Class),
, FUN = fivenum)
> print(summary_data)
  Class Area.1 Area.2 Area.3 Area.4 Area.5 Perimeter.1 Perimeter.2 Perimeter.3 Perimeter.4 Per
imeter.5 Compactness.1 Compactness.2 Compactness.3
1 Canadian 10.590 11.260 11.835 12.440 13.370      12.41      13.00      13.25      13.47
  13.95      0.80810      0.83350      0.84935
2 Kama 11.230 13.740 14.355 15.050 17.080      12.63      13.94      14.32      14.75
  15.46      0.83920      0.86860      0.88050
3 Rosa 15.380 17.320 18.720 19.140 21.180      14.66      15.73      16.21      16.57
  17.25      0.84520      0.87220      0.88260
  Compactness.4 Compactness.5 LengthKernel.1 LengthKernel.2 LengthKernel.3 LengthKernel.4 LengthK
ernel.5 WidthKernel.1 WidthKernel.2 WidthKernel.3
1      0.86200      0.89770      4.8990      5.1360      5.2240      5.3250
  5.5410      2.6300      2.7190      2.8345
2      0.89110      0.91830      4.9020      5.3840      5.5340      5.6780
  6.0530      2.8500      3.1290      3.2435
3      0.89840      0.91080      5.3630      5.9790      6.1485      6.3150
  6.6750      3.2310      3.5520      3.6935
  WidthKernel.4 WidthKernel.5 AsymmetryCoefficient.1 AsymmetryCoefficient.2 AsymmetryCoefficient.
3 AsymmetryCoefficient.4 AsymmetryCoefficient.5
1      2.9670      3.2320      1.6610      4.0480      4.839
0      5.4690      8.4560
2      3.3790      3.6830      0.7651      1.7910      2.545
5      3.3280      6.6850
3      3.8060      4.0330      1.4720      2.8430      3.609
5      4.4510      6.6820
  LengthKernelGroove.1 LengthKernelGroove.2 LengthKernelGroove.3 LengthKernelGroove.4 LengthKerne
lGroove.5
1      4.7450      5.0020      5.0915      5.2310
  5.4910
2      4.5190      4.9140      5.0940      5.2240
  5.8770
3      5.1440      5.8770      5.9815      6.1880
  6.5500
> by(seeds_o_sample[numeric_cols], seeds_o_sample$Class, function(x) apply(x, 2, fivenum))
seeds_o_sample$Class: Canadian
  Area Perimeter Compactness LengthKernel WidthKernel AsymmetryCoefficient LengthKernelGroov
e
[1,] 10.590      12.41      0.80810      4.899      2.6300      1.661      4.745
0
[2,] 11.260      13.00      0.83350      5.136      2.7190      4.048      5.002
0
[3,] 11.835      13.25      0.84935      5.224      2.8345      4.839      5.091
5
[4,] 12.440      13.47      0.86200      5.325      2.9670      5.469      5.231
0
[5,] 13.370      13.95      0.89770      5.541      3.2320      8.456      5.491
0
-----
seeds_o_sample$Class: Kama
  Area Perimeter Compactness LengthKernel WidthKernel AsymmetryCoefficient LengthKernelGroov
e
[1,] 11.230      12.63      0.8392      4.902      2.8500      0.7651      4.51
9

```



```
[2,] 13.740      13.94      0.8686      5.384      3.1290      1.7910      4.91
4
[3,] 14.355      14.32      0.8805      5.534      3.2435      2.5455      5.09
4
[4,] 15.050      14.75      0.8911      5.678      3.3790      3.3280      5.22
4
[5,] 17.080      15.46      0.9183      6.053      3.6830      6.6850      5.87
7
```

```
-----
seeds_o_sample$Class: Rosa
```

	Area	Perimeter	Compactness	LengthKernel	WidthKernel	AsymmetryCoefficient	LengthKernelGroove
[1,]	15.38	14.66	0.8452	5.3630	3.2310	1.4720	5.1440
[2,]	17.32	15.73	0.8722	5.9790	3.5520	2.8430	5.8770
[3,]	18.72	16.21	0.8826	6.1485	3.6935	3.6095	5.9815
[4,]	19.14	16.57	0.8984	6.3150	3.8060	4.4510	6.1880
[5,]	21.18	17.25	0.9108	6.6750	4.0330	6.6820	6.5500

```
> table <- table(seeds_o_sample[,8])
```

```
> print(table)
```

Canadian	Kama	Rosa
70	70	70

```
> barplot(table)
```

```
> par(mfrow=c(4,4))
```

```
> hist(seeds_o_sample[,3], main = "Histogram of input_data[,3]", xlab = "input_data[,3]", col = "
+ skyblue", border = "black")
```

```
Error in rect(x$breaks[-nB], 0, x$breaks[-1L], y, col = col, border = border, :
  invalid color name '
skyblue'
```

```
skyblue'
```

```
> par(mfrow=c(7,7))
```

```
> hist(seeds_o_sample[,1], main = "Histogram of input_data[,1]", xlab = "input_data[,1]", col = "
+ skyblue", border = "black")
```

```
Error in plot.new() : figure margins too large
```

```
> par(mfrow=c(6,6))
```

```
> hist(seeds_o_sample[,1], main = "Histogram of input_data[,1]", xlab = "input_data[,1]", col = "
+ skyblue", border = "black")
```

```
Error in plot.new() : figure margins too large
```

```
> par(mfrow=c(4,4))
```

```
> hist(seeds_o_sample[,1], main = "Histogram of input_data[,1]", xlab = "input_data[,1]", col = "
+ skyblue", border = "black")
```

```
Error in rect(x$breaks[-nB], 0, x$breaks[-1L], y, col = col, border = border, :
  invalid color name '
skyblue'
```

```
skyblue'
```

```
> par(mfrow=c(4,4))
```

```
> hist(seeds_o_sample[,1], main = "Histogram of input_data[,1]", xlab = "input_data[,1]", col = "
skyblue", border = "black")
```

```
> hist(scale(seeds_o_sample[,1]), main = "Histogram of scale(input_data[,1]", xlab = "scale(input
_data[,1])", col = "skyblue", border = "black")
```

```
> hist(log(1 + seeds_o_sample[,1]), main = "Histogram of log(1 + input_data[,1]", xlab = "log(1 +
input_data[,1])", col = "skyblue", border = "black")
```

```
> hist(sqrt(seeds_o_sample[,1]), main = "Histogram of sqrt(input_data[,1]", xlab = "sqrt(input_da
ta[,1])", col = "skyblue", border = "black")
```

```
> hist(seeds_o_sample[,2], main = "Histogram of input_data[,2]", xlab = "input_data[,2]", col = "
skyblue", border = "black")
```

```
> hist(scale(seeds_o_sample[,2]), main = "Histogram of scale(input_data[,2]", xlab = "scale(input
_data[,2])", col = "skyblue", border = "black")
```

```
> hist(log(1 + seeds_o_sample[,2]), main = "Histogram of log(1 + input_data[,2]", xlab = "log(1 +
input_data[,2])", col = "skyblue", border = "black")
```

```
> hist(sqrt(seeds_o_sample[,2]), main = "Histogram of sqrt(input_data[,2]", xlab = "sqrt(input_da
ta[,2])", col = "skyblue", border = "black")
```

```
> hist(seeds_o_sample[,3], main = "Histogram of input_data[,3]", xlab = "input_data[,3]", col = "
skyblue", border = "black")
```

```
> hist(scale(seeds_o_sample[,3]), main = "Histogram of scale(input_data[,3]", xlab = "scale(input
_data[,3])", col = "skyblue", border = "black")
```

```
> hist(log(1 + seeds_o_sample[,3]), main = "Histogram of log(1 + input_data[,3]", xlab = "log(1 +
input_data[,3])", col = "skyblue", border = "black")
```

```
> hist(sqrt(seeds_o_sample[,3]), main = "Histogram of sqrt(input_data[,3]", xlab = "sqrt(input_da
ta[,3])", col = "skyblue", border = "black")
```

```
> hist(seeds_o_sample[,4], main = "Histogram of input_data[,4]", xlab = "input_data[,4]", col = "
skyblue", border = "black")
```

```

> hist(scale(seeds_o_sample[,4]), main = "Histogram of scale(input_data[,4])", xlab = "scale(input_data[,4])", col = "skyblue", border = "black")
> hist(log(1 + seeds_o_sample[,4]), main = "Histogram of log(1 + input_data[,4])", xlab = "log(1 + input_data[,4])", col = "skyblue", border = "black")
> hist(sqrt(seeds_o_sample[,4]), main = "Histogram of sqrt(input_data[,4])", xlab = "sqrt(input_data[,4])", col = "skyblue", border = "black")
> par(mfrow=c(3,4))
> hist(seeds_o_sample[,5], main = "Histogram of input_data[,5]", xlab = "input_data[,5]", col = "skyblue", border = "black")
> hist(scale(seeds_o_sample[,5]), main = "Histogram of scale(input_data[,5])", xlab = "scale(input_data[,5])", col = "skyblue", border = "black")
> hist(log(1 + seeds_o_sample[,5]), main = "Histogram of log(1 + input_data[,5])", xlab = "log(1 + input_data[,5])", col = "skyblue", border = "black")
> hist(sqrt(seeds_o_sample[,5]), main = "Histogram of sqrt(input_data[,5])", xlab = "sqrt(input_data[,5])", col = "skyblue", border = "black")
> hist(seeds_o_sample[,6], main = "Histogram of input_data[,6]", xlab = "input_data[,6]", col = "skyblue", border = "black")
> hist(scale(seeds_o_sample[,6]), main = "Histogram of scale(input_data[,6])", xlab = "scale(input_data[,6])", col = "skyblue", border = "black")
> hist(log(1 + seeds_o_sample[,6]), main = "Histogram of log(1 + input_data[,6])", xlab = "log(1 + input_data[,6])", col = "skyblue", border = "black")
> hist(sqrt(seeds_o_sample[,6]), main = "Histogram of sqrt(input_data[,6])", xlab = "sqrt(input_data[,6])", col = "skyblue", border = "black")
> hist(seeds_o_sample[,7], main = "Histogram of input_data[,7]", xlab = "input_data[,7]", col = "skyblue", border = "black")
> hist(scale(seeds_o_sample[,7]), main = "Histogram of scale(input_data[,7])", xlab = "scale(input_data[,7])", col = "skyblue", border = "black")
> hist(log(1 + seeds_o_sample[,7]), main = "Histogram of log(1 + input_data[,7])", xlab = "log(1 + input_data[,7])", col = "skyblue", border = "black")
> hist(sqrt(seeds_o_sample[,7]), main = "Histogram of sqrt(input_data[,7])", xlab = "sqrt(input_data[,7])", col = "skyblue", border = "black")
> seed_types <- unique(seeds_o_sample$Class)
> par(mfrow = c(1, 3))
> for (seed in seed_types) {
+   subset_data <- seeds_o_sample[seeds_o_sample$Class == seed, ]
+   hist(subset_data$Area,
+       main = paste("Histogram of Area -", seed),
+       xlab = "Area",
+       col = "lightblue",
+       border = "black",
+       breaks = 10)
+ }
>

```