

# hw1-Rohit-Thakur

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*1/11/2020*

PROBLEM 1 ->

```
library(ggplot2)
selectCols <- function(data, ...) {
  args <- list(...)
  df <- data.frame(data[args[[1]])
  for( a in args[-1]) {
    df <- cbind(df, data.frame(data[a]))
  }
  return(df)
}
selectCols(mpg, "model", "hwy")
```

```
##           model hwy
## 1           a4  29
## 2           a4  29
## 3           a4  31
## 4           a4  30
## 5           a4  26
## 6           a4  26
## 7           a4  27
## 8      a4 quattro  26
## 9      a4 quattro  25
## 10     a4 quattro  28
## 11     a4 quattro  27
## 12     a4 quattro  25
## 13     a4 quattro  25
## 14     a4 quattro  25
## 15     a4 quattro  25
## 16     a6 quattro  24
## 17     a6 quattro  25
## 18     a6 quattro  23
## 19 c1500 suburban 2wd  20
## 20 c1500 suburban 2wd  15
## 21 c1500 suburban 2wd  20
## 22 c1500 suburban 2wd  17
## 23 c1500 suburban 2wd  17
## 24      corvette  26
## 25      corvette  23
## 26      corvette  26
## 27      corvette  25
## 28      corvette  24
## 29 k1500 tahoe 4wd  19
## 30 k1500 tahoe 4wd  14
## 31 k1500 tahoe 4wd  15
## 32 k1500 tahoe 4wd  17
## 33      malibu  27
```

## 34	malibu	30
## 35	malibu	26
## 36	malibu	29
## 37	malibu	26
## 38	caravan 2wd	24
## 39	caravan 2wd	24
## 40	caravan 2wd	22
## 41	caravan 2wd	22
## 42	caravan 2wd	24
## 43	caravan 2wd	24
## 44	caravan 2wd	17
## 45	caravan 2wd	22
## 46	caravan 2wd	21
## 47	caravan 2wd	23
## 48	caravan 2wd	23
## 49	dakota pickup 4wd	19
## 50	dakota pickup 4wd	18
## 51	dakota pickup 4wd	17
## 52	dakota pickup 4wd	17
## 53	dakota pickup 4wd	19
## 54	dakota pickup 4wd	19
## 55	dakota pickup 4wd	12
## 56	dakota pickup 4wd	17
## 57	dakota pickup 4wd	15
## 58	durango 4wd	17
## 59	durango 4wd	17
## 60	durango 4wd	12
## 61	durango 4wd	17
## 62	durango 4wd	16
## 63	durango 4wd	18
## 64	durango 4wd	15
## 65	ram 1500 pickup 4wd	16
## 66	ram 1500 pickup 4wd	12
## 67	ram 1500 pickup 4wd	17
## 68	ram 1500 pickup 4wd	17
## 69	ram 1500 pickup 4wd	16
## 70	ram 1500 pickup 4wd	12
## 71	ram 1500 pickup 4wd	15
## 72	ram 1500 pickup 4wd	16
## 73	ram 1500 pickup 4wd	17
## 74	ram 1500 pickup 4wd	15
## 75	expedition 2wd	17
## 76	expedition 2wd	17
## 77	expedition 2wd	18
## 78	explorer 4wd	17
## 79	explorer 4wd	19
## 80	explorer 4wd	17
## 81	explorer 4wd	19
## 82	explorer 4wd	19
## 83	explorer 4wd	17
## 84	f150 pickup 4wd	17
## 85	f150 pickup 4wd	17
## 86	f150 pickup 4wd	16
## 87	f150 pickup 4wd	16

## 88	f150 pickup 4wd	17
## 89	f150 pickup 4wd	15
## 90	f150 pickup 4wd	17
## 91	mustang	26
## 92	mustang	25
## 93	mustang	26
## 94	mustang	24
## 95	mustang	21
## 96	mustang	22
## 97	mustang	23
## 98	mustang	22
## 99	mustang	20
## 100	civic	33
## 101	civic	32
## 102	civic	32
## 103	civic	29
## 104	civic	32
## 105	civic	34
## 106	civic	36
## 107	civic	36
## 108	civic	29
## 109	sonata	26
## 110	sonata	27
## 111	sonata	30
## 112	sonata	31
## 113	sonata	26
## 114	sonata	26
## 115	sonata	28
## 116	tiburon	26
## 117	tiburon	29
## 118	tiburon	28
## 119	tiburon	27
## 120	tiburon	24
## 121	tiburon	24
## 122	tiburon	24
## 123	grand cherokee 4wd	22
## 124	grand cherokee 4wd	19
## 125	grand cherokee 4wd	20
## 126	grand cherokee 4wd	17
## 127	grand cherokee 4wd	12
## 128	grand cherokee 4wd	19
## 129	grand cherokee 4wd	18
## 130	grand cherokee 4wd	14
## 131	range rover	15
## 132	range rover	18
## 133	range rover	18
## 134	range rover	15
## 135	navigator 2wd	17
## 136	navigator 2wd	16
## 137	navigator 2wd	18
## 138	mountaineer 4wd	17
## 139	mountaineer 4wd	19
## 140	mountaineer 4wd	19
## 141	mountaineer 4wd	17

## 142	altima	29
## 143	altima	27
## 144	altima	31
## 145	altima	32
## 146	altima	27
## 147	altima	26
## 148	maxima	26
## 149	maxima	25
## 150	maxima	25
## 151	pathfinder 4wd	17
## 152	pathfinder 4wd	17
## 153	pathfinder 4wd	20
## 154	pathfinder 4wd	18
## 155	grand prix	26
## 156	grand prix	26
## 157	grand prix	27
## 158	grand prix	28
## 159	grand prix	25
## 160	forester awd	25
## 161	forester awd	24
## 162	forester awd	27
## 163	forester awd	25
## 164	forester awd	26
## 165	forester awd	23
## 166	impreza awd	26
## 167	impreza awd	26
## 168	impreza awd	26
## 169	impreza awd	26
## 170	impreza awd	25
## 171	impreza awd	27
## 172	impreza awd	25
## 173	impreza awd	27
## 174	4runner 4wd	20
## 175	4runner 4wd	20
## 176	4runner 4wd	19
## 177	4runner 4wd	17
## 178	4runner 4wd	20
## 179	4runner 4wd	17
## 180	camry	29
## 181	camry	27
## 182	camry	31
## 183	camry	31
## 184	camry	26
## 185	camry	26
## 186	camry	28
## 187	camry solara	27
## 188	camry solara	29
## 189	camry solara	31
## 190	camry solara	31
## 191	camry solara	26
## 192	camry solara	26
## 193	camry solara	27
## 194	corolla	30
## 195	corolla	33

```

## 196          corolla 35
## 197          corolla 37
## 198          corolla 35
## 199 land cruiser wagon 4wd 15
## 200 land cruiser wagon 4wd 18
## 201      toyota tacoma 4wd 20
## 202      toyota tacoma 4wd 20
## 203      toyota tacoma 4wd 22
## 204      toyota tacoma 4wd 17
## 205      toyota tacoma 4wd 19
## 206      toyota tacoma 4wd 18
## 207      toyota tacoma 4wd 20
## 208          gti 29
## 209          gti 26
## 210          gti 29
## 211          gti 29
## 212          gti 24
## 213          jetta 44
## 214          jetta 29
## 215          jetta 26
## 216          jetta 29
## 217          jetta 29
## 218          jetta 29
## 219          jetta 29
## 220          jetta 23
## 221          jetta 24
## 222      new beetle 44
## 223      new beetle 41
## 224      new beetle 29
## 225      new beetle 26
## 226      new beetle 28
## 227      new beetle 29
## 228          passat 29
## 229          passat 29
## 230          passat 28
## 231          passat 29
## 232          passat 26
## 233          passat 26
## 234          passat 26

```

```
selectCols(mpg, 1, 2:3)
```

```

##      manufacturer      model displ
## 1          audi          a4    1.8
## 2          audi          a4    1.8
## 3          audi          a4    2.0
## 4          audi          a4    2.0
## 5          audi          a4    2.8
## 6          audi          a4    2.8
## 7          audi          a4    3.1
## 8          audi      a4 quattro 1.8
## 9          audi      a4 quattro 1.8
## 10         audi      a4 quattro 2.0
## 11         audi      a4 quattro 2.0

```

## 12	audi	a4 quattro	2.8
## 13	audi	a4 quattro	2.8
## 14	audi	a4 quattro	3.1
## 15	audi	a4 quattro	3.1
## 16	audi	a6 quattro	2.8
## 17	audi	a6 quattro	3.1
## 18	audi	a6 quattro	4.2
## 19	chevrolet	c1500 suburban 2wd	5.3
## 20	chevrolet	c1500 suburban 2wd	5.3
## 21	chevrolet	c1500 suburban 2wd	5.3
## 22	chevrolet	c1500 suburban 2wd	5.7
## 23	chevrolet	c1500 suburban 2wd	6.0
## 24	chevrolet	corvette	5.7
## 25	chevrolet	corvette	5.7
## 26	chevrolet	corvette	6.2
## 27	chevrolet	corvette	6.2
## 28	chevrolet	corvette	7.0
## 29	chevrolet	k1500 tahoe 4wd	5.3
## 30	chevrolet	k1500 tahoe 4wd	5.3
## 31	chevrolet	k1500 tahoe 4wd	5.7
## 32	chevrolet	k1500 tahoe 4wd	6.5
## 33	chevrolet	malibu	2.4
## 34	chevrolet	malibu	2.4
## 35	chevrolet	malibu	3.1
## 36	chevrolet	malibu	3.5
## 37	chevrolet	malibu	3.6
## 38	dodge	caravan 2wd	2.4
## 39	dodge	caravan 2wd	3.0
## 40	dodge	caravan 2wd	3.3
## 41	dodge	caravan 2wd	3.3
## 42	dodge	caravan 2wd	3.3
## 43	dodge	caravan 2wd	3.3
## 44	dodge	caravan 2wd	3.3
## 45	dodge	caravan 2wd	3.8
## 46	dodge	caravan 2wd	3.8
## 47	dodge	caravan 2wd	3.8
## 48	dodge	caravan 2wd	4.0
## 49	dodge	dakota pickup 4wd	3.7
## 50	dodge	dakota pickup 4wd	3.7
## 51	dodge	dakota pickup 4wd	3.9
## 52	dodge	dakota pickup 4wd	3.9
## 53	dodge	dakota pickup 4wd	4.7
## 54	dodge	dakota pickup 4wd	4.7
## 55	dodge	dakota pickup 4wd	4.7
## 56	dodge	dakota pickup 4wd	5.2
## 57	dodge	dakota pickup 4wd	5.2
## 58	dodge	durango 4wd	3.9
## 59	dodge	durango 4wd	4.7
## 60	dodge	durango 4wd	4.7
## 61	dodge	durango 4wd	4.7
## 62	dodge	durango 4wd	5.2
## 63	dodge	durango 4wd	5.7
## 64	dodge	durango 4wd	5.9
## 65	dodge	ram 1500 pickup 4wd	4.7

## 66	dodge	ram 1500 pickup 4wd	4.7
## 67	dodge	ram 1500 pickup 4wd	4.7
## 68	dodge	ram 1500 pickup 4wd	4.7
## 69	dodge	ram 1500 pickup 4wd	4.7
## 70	dodge	ram 1500 pickup 4wd	4.7
## 71	dodge	ram 1500 pickup 4wd	5.2
## 72	dodge	ram 1500 pickup 4wd	5.2
## 73	dodge	ram 1500 pickup 4wd	5.7
## 74	dodge	ram 1500 pickup 4wd	5.9
## 75	ford	expedition 2wd	4.6
## 76	ford	expedition 2wd	5.4
## 77	ford	expedition 2wd	5.4
## 78	ford	explorer 4wd	4.0
## 79	ford	explorer 4wd	4.0
## 80	ford	explorer 4wd	4.0
## 81	ford	explorer 4wd	4.0
## 82	ford	explorer 4wd	4.6
## 83	ford	explorer 4wd	5.0
## 84	ford	f150 pickup 4wd	4.2
## 85	ford	f150 pickup 4wd	4.2
## 86	ford	f150 pickup 4wd	4.6
## 87	ford	f150 pickup 4wd	4.6
## 88	ford	f150 pickup 4wd	4.6
## 89	ford	f150 pickup 4wd	5.4
## 90	ford	f150 pickup 4wd	5.4
## 91	ford	mustang	3.8
## 92	ford	mustang	3.8
## 93	ford	mustang	4.0
## 94	ford	mustang	4.0
## 95	ford	mustang	4.6
## 96	ford	mustang	4.6
## 97	ford	mustang	4.6
## 98	ford	mustang	4.6
## 99	ford	mustang	5.4
## 100	honda	civic	1.6
## 101	honda	civic	1.6
## 102	honda	civic	1.6
## 103	honda	civic	1.6
## 104	honda	civic	1.6
## 105	honda	civic	1.8
## 106	honda	civic	1.8
## 107	honda	civic	1.8
## 108	honda	civic	2.0
## 109	hyundai	sonata	2.4
## 110	hyundai	sonata	2.4
## 111	hyundai	sonata	2.4
## 112	hyundai	sonata	2.4
## 113	hyundai	sonata	2.5
## 114	hyundai	sonata	2.5
## 115	hyundai	sonata	3.3
## 116	hyundai	tiburon	2.0
## 117	hyundai	tiburon	2.0
## 118	hyundai	tiburon	2.0
## 119	hyundai	tiburon	2.0

## 120	hyundai	tiburon	2.7
## 121	hyundai	tiburon	2.7
## 122	hyundai	tiburon	2.7
## 123	jeep	grand cherokee 4wd	3.0
## 124	jeep	grand cherokee 4wd	3.7
## 125	jeep	grand cherokee 4wd	4.0
## 126	jeep	grand cherokee 4wd	4.7
## 127	jeep	grand cherokee 4wd	4.7
## 128	jeep	grand cherokee 4wd	4.7
## 129	jeep	grand cherokee 4wd	5.7
## 130	jeep	grand cherokee 4wd	6.1
## 131	land rover	range rover	4.0
## 132	land rover	range rover	4.2
## 133	land rover	range rover	4.4
## 134	land rover	range rover	4.6
## 135	lincoln	navigator 2wd	5.4
## 136	lincoln	navigator 2wd	5.4
## 137	lincoln	navigator 2wd	5.4
## 138	mercury	mountaineer 4wd	4.0
## 139	mercury	mountaineer 4wd	4.0
## 140	mercury	mountaineer 4wd	4.6
## 141	mercury	mountaineer 4wd	5.0
## 142	nissan	altima	2.4
## 143	nissan	altima	2.4
## 144	nissan	altima	2.5
## 145	nissan	altima	2.5
## 146	nissan	altima	3.5
## 147	nissan	altima	3.5
## 148	nissan	maxima	3.0
## 149	nissan	maxima	3.0
## 150	nissan	maxima	3.5
## 151	nissan	pathfinder 4wd	3.3
## 152	nissan	pathfinder 4wd	3.3
## 153	nissan	pathfinder 4wd	4.0
## 154	nissan	pathfinder 4wd	5.6
## 155	pontiac	grand prix	3.1
## 156	pontiac	grand prix	3.8
## 157	pontiac	grand prix	3.8
## 158	pontiac	grand prix	3.8
## 159	pontiac	grand prix	5.3
## 160	subaru	forester awd	2.5
## 161	subaru	forester awd	2.5
## 162	subaru	forester awd	2.5
## 163	subaru	forester awd	2.5
## 164	subaru	forester awd	2.5
## 165	subaru	forester awd	2.5
## 166	subaru	impreza awd	2.2
## 167	subaru	impreza awd	2.2
## 168	subaru	impreza awd	2.5
## 169	subaru	impreza awd	2.5
## 170	subaru	impreza awd	2.5
## 171	subaru	impreza awd	2.5
## 172	subaru	impreza awd	2.5
## 173	subaru	impreza awd	2.5



## 174	toyota	4runner 4wd	2.7
## 175	toyota	4runner 4wd	2.7
## 176	toyota	4runner 4wd	3.4
## 177	toyota	4runner 4wd	3.4
## 178	toyota	4runner 4wd	4.0
## 179	toyota	4runner 4wd	4.7
## 180	toyota	camry	2.2
## 181	toyota	camry	2.2
## 182	toyota	camry	2.4
## 183	toyota	camry	2.4
## 184	toyota	camry	3.0
## 185	toyota	camry	3.0
## 186	toyota	camry	3.5
## 187	toyota	camry solara	2.2
## 188	toyota	camry solara	2.2
## 189	toyota	camry solara	2.4
## 190	toyota	camry solara	2.4
## 191	toyota	camry solara	3.0
## 192	toyota	camry solara	3.0
## 193	toyota	camry solara	3.3
## 194	toyota	corolla	1.8
## 195	toyota	corolla	1.8
## 196	toyota	corolla	1.8
## 197	toyota	corolla	1.8
## 198	toyota	corolla	1.8
## 199	toyota land	cruiser wagon 4wd	4.7
## 200	toyota land	cruiser wagon 4wd	5.7
## 201	toyota	toyota tacoma 4wd	2.7
## 202	toyota	toyota tacoma 4wd	2.7
## 203	toyota	toyota tacoma 4wd	2.7
## 204	toyota	toyota tacoma 4wd	3.4
## 205	toyota	toyota tacoma 4wd	3.4
## 206	toyota	toyota tacoma 4wd	4.0
## 207	toyota	toyota tacoma 4wd	4.0
## 208	volkswagen	gti	2.0
## 209	volkswagen	gti	2.0
## 210	volkswagen	gti	2.0
## 211	volkswagen	gti	2.0
## 212	volkswagen	gti	2.8
## 213	volkswagen	jetta	1.9
## 214	volkswagen	jetta	2.0
## 215	volkswagen	jetta	2.0
## 216	volkswagen	jetta	2.0
## 217	volkswagen	jetta	2.0
## 218	volkswagen	jetta	2.5
## 219	volkswagen	jetta	2.5
## 220	volkswagen	jetta	2.8
## 221	volkswagen	jetta	2.8
## 222	volkswagen	new beetle	1.9
## 223	volkswagen	new beetle	1.9
## 224	volkswagen	new beetle	2.0
## 225	volkswagen	new beetle	2.0
## 226	volkswagen	new beetle	2.5
## 227	volkswagen	new beetle	2.5

```
## 228    volkswagen                passat    1.8
## 229    volkswagen                passat    1.8
## 230    volkswagen                passat    2.0
## 231    volkswagen                passat    2.0
## 232    volkswagen                passat    2.8
## 233    volkswagen                passat    2.8
## 234    volkswagen                passat    3.6
```

```
selectCols(mpg,2,"cty","hwy")
```

```
##           model cty hwy
## 1             a4  18  29
## 2             a4  21  29
## 3             a4  20  31
## 4             a4  21  30
## 5             a4  16  26
## 6             a4  18  26
## 7             a4  18  27
## 8            a4 quattro  18  26
## 9            a4 quattro  16  25
## 10           a4 quattro  20  28
## 11           a4 quattro  19  27
## 12           a4 quattro  15  25
## 13           a4 quattro  17  25
## 14           a4 quattro  17  25
## 15           a4 quattro  15  25
## 16           a6 quattro  15  24
## 17           a6 quattro  17  25
## 18           a6 quattro  16  23
## 19    c1500 suburban 2wd  14  20
## 20    c1500 suburban 2wd  11  15
## 21    c1500 suburban 2wd  14  20
## 22    c1500 suburban 2wd  13  17
## 23    c1500 suburban 2wd  12  17
## 24           corvette  16  26
## 25           corvette  15  23
## 26           corvette  16  26
## 27           corvette  15  25
## 28           corvette  15  24
## 29    k1500 tahoe 4wd  14  19
## 30    k1500 tahoe 4wd  11  14
## 31    k1500 tahoe 4wd  11  15
## 32    k1500 tahoe 4wd  14  17
## 33           malibu  19  27
## 34           malibu  22  30
## 35           malibu  18  26
## 36           malibu  18  29
## 37           malibu  17  26
## 38    caravan 2wd  18  24
## 39    caravan 2wd  17  24
## 40    caravan 2wd  16  22
## 41    caravan 2wd  16  22
## 42    caravan 2wd  17  24
## 43    caravan 2wd  17  24
```

## 44	caravan 2wd	11	17
## 45	caravan 2wd	15	22
## 46	caravan 2wd	15	21
## 47	caravan 2wd	16	23
## 48	caravan 2wd	16	23
## 49	dakota pickup 4wd	15	19
## 50	dakota pickup 4wd	14	18
## 51	dakota pickup 4wd	13	17
## 52	dakota pickup 4wd	14	17
## 53	dakota pickup 4wd	14	19
## 54	dakota pickup 4wd	14	19
## 55	dakota pickup 4wd	9	12
## 56	dakota pickup 4wd	11	17
## 57	dakota pickup 4wd	11	15
## 58	durango 4wd	13	17
## 59	durango 4wd	13	17
## 60	durango 4wd	9	12
## 61	durango 4wd	13	17
## 62	durango 4wd	11	16
## 63	durango 4wd	13	18
## 64	durango 4wd	11	15
## 65	ram 1500 pickup 4wd	12	16
## 66	ram 1500 pickup 4wd	9	12
## 67	ram 1500 pickup 4wd	13	17
## 68	ram 1500 pickup 4wd	13	17
## 69	ram 1500 pickup 4wd	12	16
## 70	ram 1500 pickup 4wd	9	12
## 71	ram 1500 pickup 4wd	11	15
## 72	ram 1500 pickup 4wd	11	16
## 73	ram 1500 pickup 4wd	13	17
## 74	ram 1500 pickup 4wd	11	15
## 75	expedition 2wd	11	17
## 76	expedition 2wd	11	17
## 77	expedition 2wd	12	18
## 78	explorer 4wd	14	17
## 79	explorer 4wd	15	19
## 80	explorer 4wd	14	17
## 81	explorer 4wd	13	19
## 82	explorer 4wd	13	19
## 83	explorer 4wd	13	17
## 84	f150 pickup 4wd	14	17
## 85	f150 pickup 4wd	14	17
## 86	f150 pickup 4wd	13	16
## 87	f150 pickup 4wd	13	16
## 88	f150 pickup 4wd	13	17
## 89	f150 pickup 4wd	11	15
## 90	f150 pickup 4wd	13	17
## 91	mustang	18	26
## 92	mustang	18	25
## 93	mustang	17	26
## 94	mustang	16	24
## 95	mustang	15	21
## 96	mustang	15	22
## 97	mustang	15	23

## 98	mustang	15	22
## 99	mustang	14	20
## 100	civic	28	33
## 101	civic	24	32
## 102	civic	25	32
## 103	civic	23	29
## 104	civic	24	32
## 105	civic	26	34
## 106	civic	25	36
## 107	civic	24	36
## 108	civic	21	29
## 109	sonata	18	26
## 110	sonata	18	27
## 111	sonata	21	30
## 112	sonata	21	31
## 113	sonata	18	26
## 114	sonata	18	26
## 115	sonata	19	28
## 116	tiburon	19	26
## 117	tiburon	19	29
## 118	tiburon	20	28
## 119	tiburon	20	27
## 120	tiburon	17	24
## 121	tiburon	16	24
## 122	tiburon	17	24
## 123	grand cherokee 4wd	17	22
## 124	grand cherokee 4wd	15	19
## 125	grand cherokee 4wd	15	20
## 126	grand cherokee 4wd	14	17
## 127	grand cherokee 4wd	9	12
## 128	grand cherokee 4wd	14	19
## 129	grand cherokee 4wd	13	18
## 130	grand cherokee 4wd	11	14
## 131	range rover	11	15
## 132	range rover	12	18
## 133	range rover	12	18
## 134	range rover	11	15
## 135	navigator 2wd	11	17
## 136	navigator 2wd	11	16
## 137	navigator 2wd	12	18
## 138	mountaineer 4wd	14	17
## 139	mountaineer 4wd	13	19
## 140	mountaineer 4wd	13	19
## 141	mountaineer 4wd	13	17
## 142	altima	21	29
## 143	altima	19	27
## 144	altima	23	31
## 145	altima	23	32
## 146	altima	19	27
## 147	altima	19	26
## 148	maxima	18	26
## 149	maxima	19	25
## 150	maxima	19	25
## 151	pathfinder 4wd	14	17

## 152	pathfinder 4wd	15	17
## 153	pathfinder 4wd	14	20
## 154	pathfinder 4wd	12	18
## 155	grand prix	18	26
## 156	grand prix	16	26
## 157	grand prix	17	27
## 158	grand prix	18	28
## 159	grand prix	16	25
## 160	forester awd	18	25
## 161	forester awd	18	24
## 162	forester awd	20	27
## 163	forester awd	19	25
## 164	forester awd	20	26
## 165	forester awd	18	23
## 166	impreza awd	21	26
## 167	impreza awd	19	26
## 168	impreza awd	19	26
## 169	impreza awd	19	26
## 170	impreza awd	20	25
## 171	impreza awd	20	27
## 172	impreza awd	19	25
## 173	impreza awd	20	27
## 174	4runner 4wd	15	20
## 175	4runner 4wd	16	20
## 176	4runner 4wd	15	19
## 177	4runner 4wd	15	17
## 178	4runner 4wd	16	20
## 179	4runner 4wd	14	17
## 180	camry	21	29
## 181	camry	21	27
## 182	camry	21	31
## 183	camry	21	31
## 184	camry	18	26
## 185	camry	18	26
## 186	camry	19	28
## 187	camry solara	21	27
## 188	camry solara	21	29
## 189	camry solara	21	31
## 190	camry solara	22	31
## 191	camry solara	18	26
## 192	camry solara	18	26
## 193	camry solara	18	27
## 194	corolla	24	30
## 195	corolla	24	33
## 196	corolla	26	35
## 197	corolla	28	37
## 198	corolla	26	35
## 199	land cruiser wagon 4wd	11	15
## 200	land cruiser wagon 4wd	13	18
## 201	toyota tacoma 4wd	15	20
## 202	toyota tacoma 4wd	16	20
## 203	toyota tacoma 4wd	17	22
## 204	toyota tacoma 4wd	15	17
## 205	toyota tacoma 4wd	15	19

```
## 206      toyota tacoma 4wd 15 18
## 207      toyota tacoma 4wd 16 20
## 208              gti 21 29
## 209              gti 19 26
## 210              gti 21 29
## 211              gti 22 29
## 212              gti 17 24
## 213              jetta 33 44
## 214              jetta 21 29
## 215              jetta 19 26
## 216              jetta 22 29
## 217              jetta 21 29
## 218              jetta 21 29
## 219              jetta 21 29
## 220              jetta 16 23
## 221              jetta 17 24
## 222      new beetle 35 44
## 223      new beetle 29 41
## 224      new beetle 21 29
## 225      new beetle 19 26
## 226      new beetle 20 28
## 227      new beetle 20 29
## 228      passat 21 29
## 229      passat 18 29
## 230      passat 19 28
## 231      passat 21 29
## 232      passat 16 26
## 233      passat 18 26
## 234      passat 17 26
```

PROBLEM 2 ->

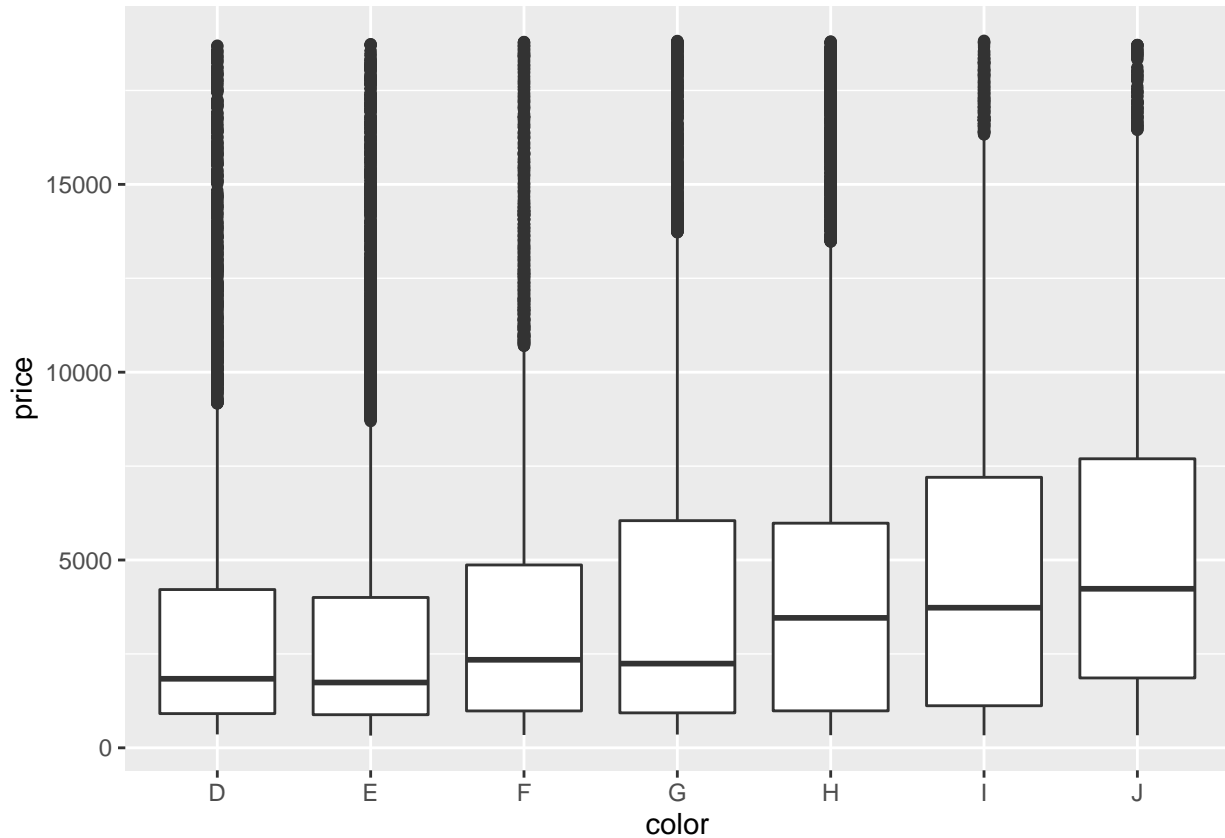
```
plotcols<-function(data){
  for(a in 1 : dim(data)[2]){
    print(typeof(data[[a]]))
    if(class(data[[a]]) == "character"){
      g <- ggplot(data=data,mapping= aes_string(x=colnames(data)[a])) +
        geom_bar()
      print(g)
    }
    else if((class(data[[a]]) == "numeric") | (class(data[[a]])=="integer")){
      g <- ggplot(data=data,mapping= aes_string(x=colnames(data)[a])) +
        geom_histogram()
      print(g)
    }
  }
}
```

PROBLEM 3 ->

For the boxplots shown below for price vs color of diamond, From D to J color is transitioning from best to worst. But unusual observation here is that max price of diamond increases as color goes from D to J. Color

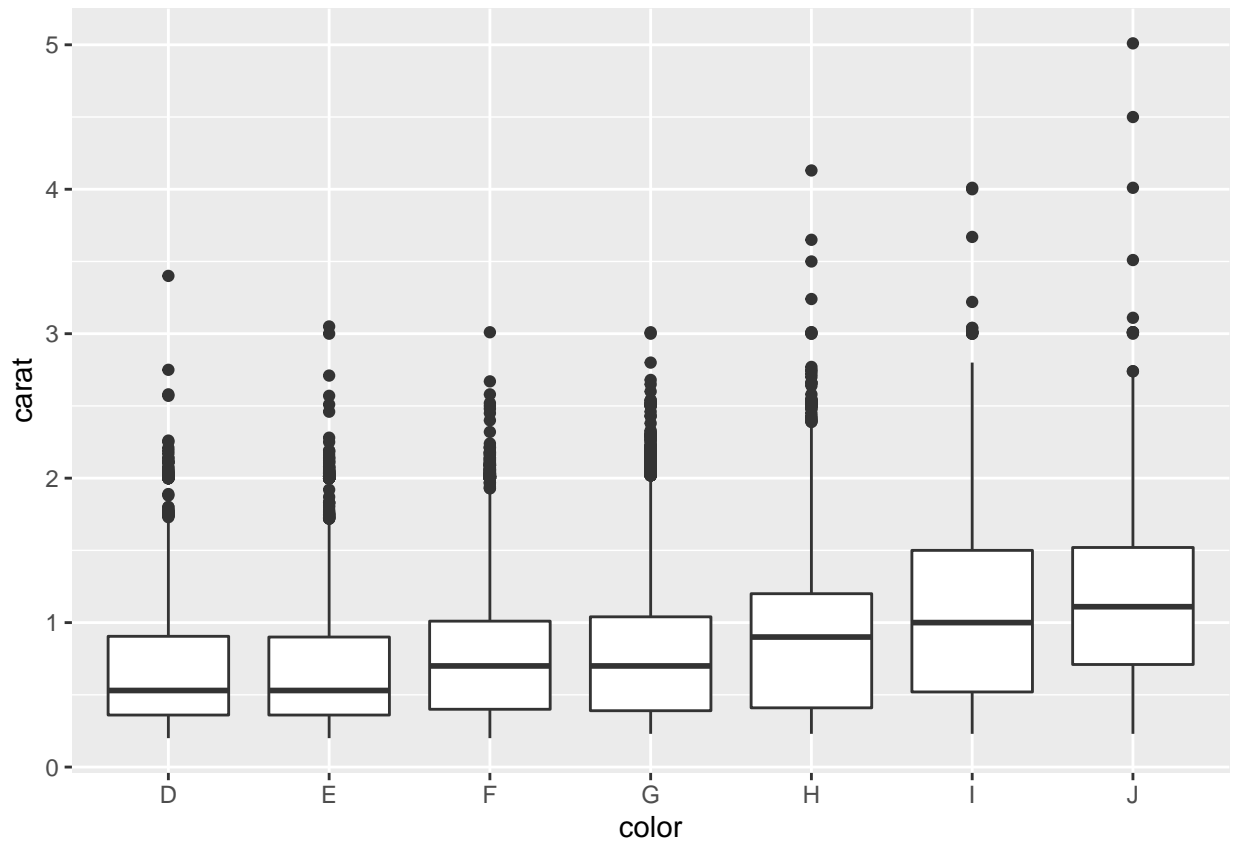
is inversely proportional to price here. This does not make any sense as diamond with best color should be more expensive. Another observation that can be made is there is a huge number of outliers whose numbers decreases as color goes to J.

```
g<-ggplot(data=diamonds,mapping=aes(x=color, y=price)) +  
  geom_boxplot()  
print(g)
```



PROBLEM 4 -> For color vs carat boxplot, we can see that as the color of diamond shifts from D to J, carat (weight) increases. Because of this fact we can make sense of previous observation for problem 3. As color of diamond degrades, it gets more heavier. Thus weight of diamond has more impact on price than color of diamond.

```
g<-ggplot(data=diamonds,mapping=aes(x=color, y=carat)) +  
  geom_boxplot()  
print(g)
```



#### PROBLEM 5 ->

Weight and price of a diamond has linear relationship among them. As weight of diamond increases it's price increases. Overlayed smooth lines indicate almost linear relationship. Also, Color of diamond has less impact on it's price. Price is more dependent on weight rather than color. Also as the color degrades from D to J, correlation between carat and price also increases.

```
g<-ggplot(data=diamonds,mapping=aes(x=carat, y=price)) +
  geom_point() + facet_wrap(~color) + geom_smooth()
print(g)
```

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```



