

# individual assignment8

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8.(d)

```
library(ISLR)
attach(Carseats)
library(randomForest)

## randomForest 4.6-14

## Type rfNews() to see new features/changes/bug fixes.

set.seed(1)
train=sample(1:nrow(Carseats),nrow(Carseats)/2)
test.x=Carseats[-train,]

set.seed(1)
bag.car=randomForest(Sales~.,data=Carseats,subset=train,mtry=10,importance=TRUE)
yhat.bag=predict(bag.car,newdata=test.x)
mean((yhat.bag-test.x$Sales)^2)
```

```
## [1] 2.605253
```

```
imp=importance(bag.car)
imp[which.max(imp)]
```

```
## [1] 502.9034
```

```
imp
```

```
##           %IncMSE IncNodePurity
## CompPrice  24.8888481    170.182937
## Income      4.7121131     91.264880
## Advertising 12.7692401     97.164338
## Population  -1.8074075     58.244596
## Price       56.3326252    502.903407
## Shelveloc  48.8886689    380.032715
## Age        17.7275460    157.846774
## Education   0.5962186     44.598731
## Urban       0.1728373      9.822082
## US          4.2172102     18.073863
```

In this chunk, I use the bagging approach. According to the results, we can see that the test MSE is 2.6. And the most important variable is Price, which will decrease MSE the most. Besides, the Shelveloc, CompPrice and Age are also important.

8.(e)

```
set.seed(1)
rf.car=randomForest(Sales~.,data=Carseats,subset=train,mtry=4,ntree=25,importance = TRUE)
yhat.rf=predict(rf.car,newdata=test.x)
mean((yhat.rf-test.x$Sales)^2)
```

```
## [1] 3.06397
```

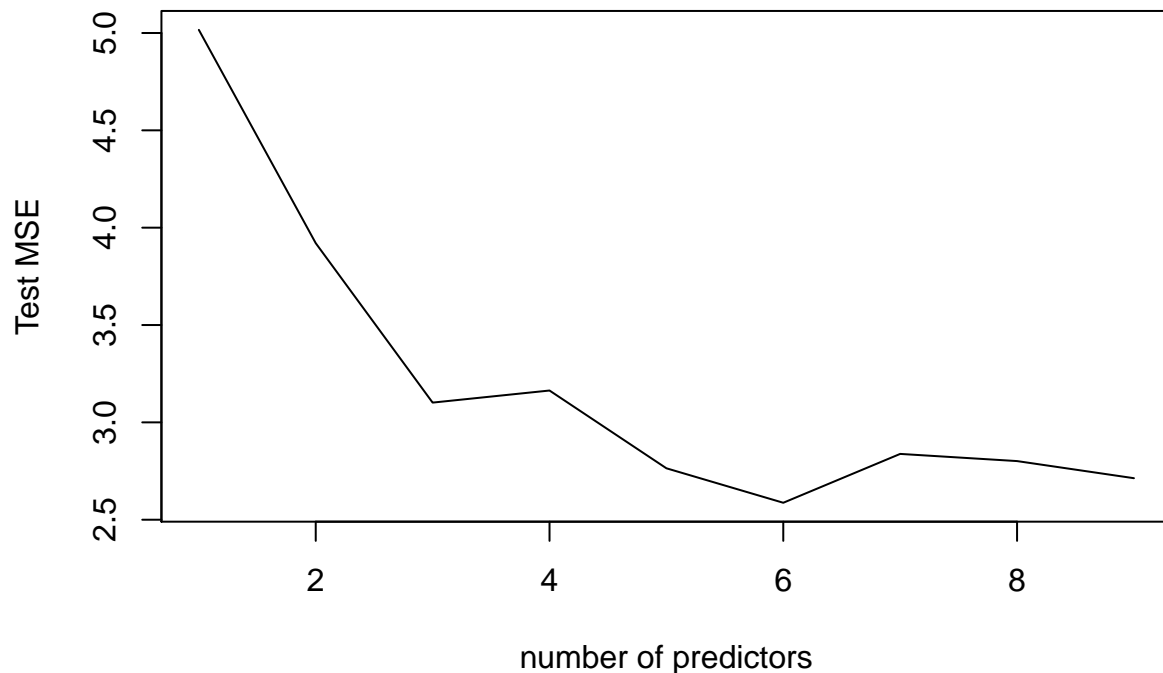
```
importance(rf.car)
```

```
##           %IncMSE IncNodePurity
## CompPrice  4.0702634    167.52864
## Income    1.2788401    109.55315
## Advertising 2.2496267    114.94478
## Population -1.6063385     89.32123
## Price     14.0424305    400.97710
## ShelfLoc   9.7278722    316.10450
## Age        2.5206784    167.53377
## Education  -0.2637835     63.85777
## Urban      0.3521242     15.69881
## US         1.7071804     28.64748
```

```
set.seed(5)
mse=matrix(0,1,9,dimnames=list(NULL,paste(1:9)))
for (i in 1:9){
  rf.car=randomForest(Sales~.,data=Carseats,subset=train,mtry=i,ntree=25,importance = TRUE)
  yhat.rf=predict(rf.car,newdata=test.x)
  mse[1,i]=mean((yhat.rf-test.x$Sales)^2)
}
mse
```

```
##           1           2           3           4           5           6           7
## [1,] 5.016081 3.920537 3.101568 3.163517 2.764163 2.587095 2.83803
##           8           9
## [1,] 2.801142 2.713239
```

```
plot(x=1:9,y=mse,xlab="number of predictors",ylab="Test MSE",type="l")
```



In this chunk, I use random Forest. When I choose mtry to be 4 randomly, the MSE is 3.06, which is bigger than bagging method. And then I use a for loop to see how will the MSE change while the mtry increases from 1 to 9. We can see that, on this condition, the smallest MSE will be obtained when mtry is 6. The effect of m, which represents the number of variables, is shown by this plot. When m increases from 1 to 2,

there is a big drop of MSE. After that, the MSE starts to fluctuate.

10.(a)

```
attach(Hitters)
naSalary=is.na(Salary)
Hitters=Hitters[!naSalary,]
Hitters[, "Salary"]=log(Hitters$Salary)
Hitters
```

##	AtBat	Hits	HmRun	Runs	RBI	Walks	Years	CAtBat	CHits
## -Alan Ashby	315	81	7	24	38	39	14	3449	835
## -Alvin Davis	479	130	18	66	72	76	3	1624	457
## -Andre Dawson	496	141	20	65	78	37	11	5628	1575
## -Andres Galarraga	321	87	10	39	42	30	2	396	101
## -Alfredo Griffin	594	169	4	74	51	35	11	4408	1133
## -Al Newman	185	37	1	23	8	21	2	214	42
## -Argenis Salazar	298	73	0	24	24	7	3	509	108
## -Andres Thomas	323	81	6	26	32	8	2	341	86
## -Andre Thornton	401	92	17	49	66	65	13	5206	1332
## -Alan Trammell	574	159	21	107	75	59	10	4631	1300
## -Alex Trevino	202	53	4	31	26	27	9	1876	467
## -Andy VanSlyke	418	113	13	48	61	47	4	1512	392
## -Alan Wiggins	239	60	0	30	11	22	6	1941	510
## -Bill Almon	196	43	7	29	27	30	13	3231	825
## -Buddy Bell	568	158	20	89	75	73	15	8068	2273
## -Buddy Biancalana	190	46	2	24	8	15	5	479	102
## -Bruce Bochy	127	32	8	16	22	14	8	727	180
## -Barry Bonds	413	92	16	72	48	65	1	413	92
## -Bobby Bonilla	426	109	3	55	43	62	1	426	109
## -Bob Brenly	472	116	16	60	62	74	6	1924	489
## -Bill Buckner	629	168	18	73	102	40	18	8424	2464
## -Brett Butler	587	163	4	92	51	70	6	2695	747
## -Bob Dernier	324	73	4	32	18	22	7	1931	491
## -Bo Diaz	474	129	10	50	56	40	10	2331	604
## -Bill Doran	550	152	6	92	37	81	5	2308	633
## -Brian Downing	513	137	20	90	95	90	14	5201	1382
## -Billy Hatcher	419	108	6	55	36	22	3	591	149
## -Brook Jacoby	583	168	17	83	80	56	5	1646	452
## -Bob Kearney	204	49	6	23	25	12	7	1309	308
## -Bill Madlock	379	106	10	38	60	30	14	6207	1906
## -Bob Melvin	268	60	5	24	25	15	2	350	78
## -BillyJo Robidoux	181	41	1	15	21	33	2	232	50
## -Bill Schroeder	217	46	7	32	19	9	4	694	160
## -Chris Bando	254	68	2	28	26	22	6	999	236
## -Chris Brown	416	132	7	57	49	33	3	932	273
## -Carmen Castillo	205	57	8	34	32	9	5	756	192
## -Chili Davis	526	146	13	71	70	84	6	2648	715
## -Carlton Fisk	457	101	14	42	63	22	17	6521	1767
## -Curt Ford	214	53	2	30	29	23	2	226	59
## -Carney Lansford	591	168	19	80	72	39	9	4478	1307
## -Chet Lemon	403	101	12	45	53	39	12	5150	1429
## -Candy Maldonado	405	102	18	49	85	20	6	950	231
## -Carmelo Martinez	244	58	9	28	25	35	4	1335	333
## -Craig Reynolds	313	78	6	32	41	12	12	3742	968

## -Cal Ripken	627	177	25	98	81	70	6	3210	927
## -Cory Snyder	416	113	24	58	69	16	1	416	113
## -Chris Speier	155	44	6	21	23	15	16	6631	1634
## -Curt Wilkerson	236	56	0	27	15	11	4	1115	270
## -Dave Anderson	216	53	1	31	15	22	4	926	210
## -Don Baylor	585	139	31	93	94	62	17	7546	1982
## -Daryl Boston	199	53	5	29	22	21	3	514	120
## -Darnell Coles	521	142	20	67	86	45	4	815	205
## -Dave Concepcion	311	81	3	42	30	26	17	8247	2198
## -Doug DeCinces	512	131	26	69	96	52	14	5347	1397
## -Darrell Evans	507	122	29	78	85	91	18	7761	1947
## -Dwight Evans	529	137	26	86	97	97	15	6661	1785
## -Damaso Garcia	424	119	6	57	46	13	9	3651	1046
## -Dan Gladden	351	97	4	55	29	39	4	1258	353
## -Dave Henderson	388	103	15	59	47	39	6	2174	555
## -Donnie Hill	339	96	4	37	29	23	4	1064	290
## -Davey Lopes	255	70	7	49	35	43	15	6311	1661
## -Don Mattingly	677	238	31	117	113	53	5	2223	737
## -Dale Murphy	614	163	29	89	83	75	11	5017	1388
## -Dwayne Murphy	329	83	9	50	39	56	9	3828	948
## -Dave Parker	637	174	31	89	116	56	14	6727	2024
## -Dan Pasqua	280	82	16	44	45	47	2	428	113
## -Darrell Porter	155	41	12	21	29	22	16	5409	1338
## -Dick Schofield	458	114	13	67	57	48	4	1350	298
## -Don Slaught	314	83	13	39	46	16	5	1457	405
## -Darryl Strawberry	475	123	27	76	93	72	4	1810	471
## -Dale Sveum	317	78	7	35	35	32	1	317	78
## -Danny Tartabull	511	138	25	76	96	61	3	592	164
## -Denny Walling	382	119	13	54	58	36	12	2133	594
## -Dave Winfield	565	148	24	90	104	77	14	7287	2083
## -Eric Davis	415	115	27	97	71	68	3	711	184
## -Eddie Milner	424	110	15	70	47	36	7	2130	544
## -Eddie Murray	495	151	17	61	84	78	10	5624	1679
## -Ed Romero	233	49	2	41	23	18	8	1350	336
## -Frank White	566	154	22	76	84	43	14	6100	1583
## -George Bell	641	198	31	101	108	41	5	2129	610
## -Glenn Braggs	215	51	4	19	18	11	1	215	51
## -George Brett	441	128	16	70	73	80	14	6675	2095
## -Greg Brock	325	76	16	33	52	37	5	1506	351
## -Gary Carter	490	125	24	81	105	62	13	6063	1646
## -Glenn Davis	574	152	31	91	101	64	3	985	260
## -Gary Gaetti	596	171	34	91	108	52	6	2862	728
## -Greg Gagne	472	118	12	63	54	30	4	793	187
## -George Hendrick	283	77	14	45	47	26	16	6840	1910
## -Glenn Hubbard	408	94	4	42	36	66	9	3573	866
## -Garth Iorg	327	85	3	30	44	20	8	2140	568
## -Gary Matthews	370	96	21	49	46	60	15	6986	1972
## -Graig Nettles	354	77	16	36	55	41	20	8716	2172
## -Gary Pettis	539	139	5	93	58	69	5	1469	369
## -Gary Redus	340	84	11	62	33	47	5	1516	376
## -Garry Templeton	510	126	2	42	44	35	11	5562	1578
## -Greg Walker	282	78	13	37	51	29	5	1649	453
## -Gary Ward	380	120	5	54	51	31	8	3118	900
## -Glenn Wilson	584	158	15	70	84	42	5	2358	636

## -Harold Baines	570	169	21	72	88	38	7	3754	1077
## -Hubie Brooks	306	104	14	50	58	25	7	2954	822
## -Howard Johnson	220	54	10	30	39	31	5	1185	299
## -Hal McRae	278	70	7	22	37	18	18	7186	2081
## -Harold Reynolds	445	99	1	46	24	29	4	618	129
## -Harry Spilman	143	39	5	18	30	15	9	639	151
## -Herm Winningham	185	40	4	23	11	18	3	524	125
## -Jesse Barfield	589	170	40	107	108	69	6	2325	634
## -Juan Beniquez	343	103	6	48	36	40	15	4338	1193
## -John Cangelosi	438	103	2	65	32	71	2	440	103
## -Jose Canseco	600	144	33	85	117	65	2	696	173
## -Joe Carter	663	200	29	108	121	32	4	1447	404
## -Jack Clark	232	55	9	34	23	45	12	4405	1213
## -Jose Cruz	479	133	10	48	72	55	17	7472	2147
## -Jody Davis	528	132	21	61	74	41	6	2641	671
## -Jim Dwyer	160	39	8	18	31	22	14	2128	543
## -Julio Franco	599	183	10	80	74	32	5	2482	715
## -Jim Gantner	497	136	7	58	38	26	11	3871	1066
## -Johnny Grubb	210	70	13	32	51	28	15	4040	1130
## -Jack Howell	151	41	4	26	21	19	2	288	68
## -John Kruk	278	86	4	33	38	45	1	278	86
## -Jeffrey Leonard	341	95	6	48	42	20	10	2964	808
## -Jim Morrison	537	147	23	58	88	47	10	2744	730
## -John Moses	399	102	3	56	34	34	5	670	167
## -Jerry Mumphrey	309	94	5	37	32	26	13	4618	1330
## -Jim Presley	616	163	27	83	107	32	3	1437	377
## -Johnny Ray	579	174	7	67	78	58	6	3053	880
## -Jeff Reed	165	39	2	13	9	16	3	196	44
## -Jim Rice	618	200	20	98	110	62	13	7127	2163
## -Jerry Royster	257	66	5	31	26	32	14	3910	979
## -John Russell	315	76	13	35	60	25	3	630	151
## -Juan Samuel	591	157	16	90	78	26	4	2020	541
## -John Shelby	404	92	11	54	49	18	6	1354	325
## -Joel Skinner	315	73	5	23	37	16	4	450	108
## -Jim Sundberg	429	91	12	41	42	57	13	5590	1397
## -Jose Uribe	453	101	3	46	43	61	3	948	218
## -Joel Youngblood	184	47	5	20	28	18	11	3327	890
## -Kevin Bass	591	184	20	83	79	38	5	1689	462
## -Kal Daniels	181	58	6	34	23	22	1	181	58
## -Kirk Gibson	441	118	28	84	86	68	8	2723	750
## -Ken Griffey	490	150	21	69	58	35	14	6126	1839
## -Keith Hernandez	551	171	13	94	83	94	13	6090	1840
## -Kent Hrbek	550	147	29	85	91	71	6	2816	815
## -Ken Landreaux	283	74	4	34	29	22	10	3919	1062
## -Kevin McReynolds	560	161	26	89	96	66	4	1789	470
## -Kevin Mitchell	328	91	12	51	43	33	2	342	94
## -Keith Moreland	586	159	12	72	79	53	9	3082	880
## -Ken Oberkfell	503	136	5	62	48	83	10	3423	970
## -Ken Phelps	344	85	24	69	64	88	7	911	214
## -Kirby Puckett	680	223	31	119	96	34	3	1928	587
## -Kurt Stillwell	279	64	0	31	26	30	1	279	64
## -Leon Durham	484	127	20	66	65	67	7	3006	844
## -Len Dykstra	431	127	8	77	45	58	2	667	187
## -Larry Herndon	283	70	8	33	37	27	12	4479	1222

## -Lee Lacy	491	141	11	77	47	37	15	4291	1240
## -Len Matuszek	199	52	9	26	28	21	6	805	191
## -Lloyd Moseby	589	149	21	89	86	64	7	3558	928
## -Lance Parrish	327	84	22	53	62	38	10	4273	1123
## -Larry Parrish	464	128	28	67	94	52	13	5829	1552
## -Larry Sheets	338	92	18	42	60	21	3	682	185
## -Lou Whitaker	584	157	20	95	73	63	10	4704	1320
## -Mike Aldrete	216	54	2	27	25	33	1	216	54
## -Marty Barrett	625	179	4	94	60	65	5	1696	476
## -Mike Davis	489	131	19	77	55	34	7	2051	549
## -Mike Diaz	209	56	12	22	36	19	2	216	58
## -Mariano Duncan	407	93	8	47	30	30	2	969	230
## -Mike Easler	490	148	14	64	78	49	13	3400	1000
## -Mel Hall	442	131	18	68	77	33	6	1416	398
## -Mike Heath	288	65	8	30	36	27	9	2815	698
## -Mike Kingery	209	54	3	25	14	12	1	209	54
## -Mike LaValliere	303	71	3	18	30	36	3	344	76
## -Mike Marshall	330	77	19	47	53	27	6	1928	516
## -Mike Pagliarulo	504	120	28	71	71	54	3	1085	259
## -Mark Salas	258	60	8	28	33	18	3	638	170
## -Mike Schmidt	20	1	0	0	0	0	2	41	9
## -Mike Scioscia	374	94	5	36	26	62	7	1968	519
## -Mickey Tettleton	211	43	10	26	35	39	3	498	116
## -Milt Thompson	299	75	6	38	23	26	3	580	160
## -Mitch Webster	576	167	8	89	49	57	4	822	232
## -Mookie Wilson	381	110	9	61	45	32	7	3015	834
## -Marvell Wynne	288	76	7	34	37	15	4	1644	408
## -Mike Young	369	93	9	43	42	49	5	1258	323
## -Ozzie Guillen	547	137	2	58	47	12	2	1038	271
## -Oddibe McDowell	572	152	18	105	49	65	2	978	249
## -Ozzie Smith	514	144	0	67	54	79	9	4739	1169
## -Ozzie Virgil	359	80	15	45	48	63	7	1493	359
## -Phil Bradley	526	163	12	88	50	77	4	1556	470
## -Phil Garner	313	83	9	43	41	30	14	5885	1543
## -Pete Incaviglia	540	135	30	82	88	55	1	540	135
## -Paul Molitor	437	123	9	62	55	40	9	4139	1203
## -Pete Rose	237	52	0	15	25	30	24	14053	4256
## -Pat Sheridan	236	56	6	41	19	21	5	1257	329
## -Pat Tabler	473	154	6	61	48	29	6	1966	566
## -Rafael Belliard	309	72	0	33	31	26	5	354	82
## -Rick Burleson	271	77	5	35	29	33	12	4933	1358
## -Randy Bush	357	96	7	50	45	39	5	1394	344
## -Rick Cerone	216	56	4	22	18	15	12	2796	665
## -Ron Cey	256	70	13	42	36	44	16	7058	1845
## -Rob Deer	466	108	33	75	86	72	3	652	142
## -Rick Dempsey	327	68	13	42	29	45	18	3949	939
## -Ron Hassey	341	110	9	45	49	46	9	2331	658
## -Rickey Henderson	608	160	28	130	74	89	8	4071	1182
## -Reggie Jackson	419	101	18	65	58	92	20	9528	2510
## -Ron Kittle	376	82	21	42	60	35	5	1770	408
## -Ray Knight	486	145	11	51	76	40	11	3967	1102
## -Rick Leach	246	76	5	35	39	13	6	912	234
## -Rick Manning	205	52	8	31	27	17	12	5134	1323
## -Rance Mulliniks	348	90	11	50	45	43	10	2288	614

## -Ron Oester	523	135	8	52	44	52	9	3368	895
## -Rey Quinones	312	68	2	32	22	24	1	312	68
## -Rafael Ramirez	496	119	8	57	33	21	7	3358	882
## -Ronn Reynolds	126	27	3	8	10	5	4	239	49
## -Ron Roenicke	275	68	5	42	42	61	6	961	238
## -Ryne Sandberg	627	178	14	68	76	46	6	3146	902
## -Rafael Santana	394	86	1	38	28	36	4	1089	267
## -Rick Schu	208	57	8	32	25	18	3	653	170
## -Ruben Sierra	382	101	16	50	55	22	1	382	101
## -Roy Smalley	459	113	20	59	57	68	12	5348	1369
## -Robby Thompson	549	149	7	73	47	42	1	549	149
## -Rob Wilfong	288	63	3	25	33	16	10	2682	667
## -Robin Yount	522	163	9	82	46	62	13	7037	2019
## -Steve Balboni	512	117	29	54	88	43	6	1750	412
## -Scott Bradley	220	66	5	20	28	13	3	290	80
## -Sid Bream	522	140	16	73	77	60	4	730	185
## -Steve Buechele	461	112	18	54	54	35	2	680	160
## -Shawon Dunston	581	145	17	66	68	21	2	831	210
## -Scott Fletcher	530	159	3	82	50	47	6	1619	426
## -Steve Garvey	557	142	21	58	81	23	18	8759	2583
## -Steve Jeltz	439	96	0	44	36	65	4	711	148
## -Steve Lombardozzi	453	103	8	53	33	52	2	507	123
## -Spike Owen	528	122	1	67	45	51	4	1716	403
## -Steve Sax	633	210	6	91	56	59	6	3070	872
## -Tony Bernazard	562	169	17	88	73	53	8	3181	841
## -Tom Brookens	281	76	3	42	25	20	8	2658	657
## -Tom Brunansky	593	152	23	69	75	53	6	2765	686
## -Tony Fernandez	687	213	10	91	65	27	4	1518	448
## -Tim Flannery	368	103	3	48	28	54	8	1897	493
## -Tom Foley	263	70	1	26	23	30	4	888	220
## -Tony Gwynn	642	211	14	107	59	52	5	2364	770
## -Terry Harper	265	68	8	26	30	29	7	1337	339
## -Tommy Herr	559	141	2	48	61	73	8	3162	874
## -Tim Hulett	520	120	17	53	44	21	4	927	227
## -Terry Kennedy	19	4	1	2	3	1	1	19	4
## -Tito Landrum	205	43	2	24	17	20	7	854	219
## -Tim Laudner	193	47	10	21	29	24	6	1136	256
## -Tom Paciorek	213	61	4	17	22	3	17	4061	1145
## -Tony Pena	510	147	10	56	52	53	7	2872	821
## -Terry Pendleton	578	138	1	56	59	34	3	1399	357
## -Tony Phillips	441	113	5	76	52	76	5	1546	397
## -Terry Puhl	172	42	3	17	14	15	10	4086	1150
## -Ted Simmons	127	32	4	14	25	12	19	8396	2402
## -Tim Teufel	279	69	4	35	31	32	4	1359	355
## -Tim Wallach	480	112	18	50	71	44	7	3031	771
## -Vince Coleman	600	139	0	94	29	60	2	1236	309
## -Von Hayes	610	186	19	107	98	74	6	2728	753
## -Vance Law	360	81	5	37	44	37	7	2268	566
## -Wally Backman	387	124	1	67	27	36	7	1775	506
## -Wade Boggs	580	207	8	107	71	105	5	2778	978
## -Will Clark	408	117	11	66	41	34	1	408	117
## -Wally Joyner	593	172	22	82	100	57	1	593	172
## -Willie McGee	497	127	7	65	48	37	5	2703	806
## -Willie Randolph	492	136	5	76	50	94	12	5511	1511

## -Wayne Tolleson	475	126	3	61	43	52	6	1700	433
## -Willie Upshaw	573	144	9	85	60	78	8	3198	857
## -Willie Wilson	631	170	9	77	44	31	11	4908	1457
##	CHmRun	CRuns	CRBI	CWalks	League	Division	PutOuts		
## -Alan Ashby	69	321	414	375	N	W	632		
## -Alvin Davis	63	224	266	263	A	W	880		
## -Andre Dawson	225	828	838	354	N	E	200		
## -Andres Galarrraga	12	48	46	33	N	E	805		
## -Alfredo Griffin	19	501	336	194	A	W	282		
## -Al Newman	1	30	9	24	N	E	76		
## -Argenis Salazar	0	41	37	12	A	W	121		
## -Andres Thomas	6	32	34	8	N	W	143		
## -Andre Thornton	253	784	890	866	A	E	0		
## -Alan Trammell	90	702	504	488	A	E	238		
## -Alex Trevino	15	192	186	161	N	W	304		
## -Andy VanSlyke	41	205	204	203	N	E	211		
## -Alan Wiggins	4	309	103	207	A	E	121		
## -Bill Almon	36	376	290	238	N	E	80		
## -Buddy Bell	177	1045	993	732	N	W	105		
## -Buddy Biancalana	5	65	23	39	A	W	102		
## -Bruce Bochy	24	67	82	56	N	W	202		
## -Barry Bonds	16	72	48	65	N	E	280		
## -Bobby Bonilla	3	55	43	62	A	W	361		
## -Bob Brenly	67	242	251	240	N	W	518		
## -Bill Buckner	164	1008	1072	402	A	E	1067		
## -Brett Butler	17	442	198	317	A	E	434		
## -Bob Dernier	13	291	108	180	N	E	222		
## -Bo Diaz	61	246	327	166	N	W	732		
## -Bill Doran	32	349	182	308	N	W	262		
## -Brian Downing	166	763	734	784	A	W	267		
## -Billy Hatcher	8	80	46	31	N	W	226		
## -Brook Jacoby	44	219	208	136	A	E	109		
## -Bob Kearney	27	126	132	66	A	W	419		
## -Bill Madlock	146	859	803	571	N	W	72		
## -Bob Melvin	5	34	29	18	N	W	442		
## -BillyJo Robidoux	4	20	29	45	A	E	326		
## -Bill Schroeder	32	86	76	32	A	E	307		
## -Chris Bando	21	108	117	118	A	E	359		
## -Chris Brown	24	113	121	80	N	W	73		
## -Carmen Castillo	32	117	107	51	A	E	58		
## -Chili Davis	77	352	342	289	N	W	303		
## -Carlton Fisk	281	1003	977	619	A	W	389		
## -Curt Ford	2	32	32	27	N	E	109		
## -Carney Lansford	113	634	563	319	A	W	67		
## -Chet Lemon	166	747	666	526	A	E	316		
## -Candy Maldonado	29	99	138	64	N	W	161		
## -Carmelo Martinez	49	164	179	194	N	W	142		
## -Craig Reynolds	35	409	321	170	N	W	106		
## -Cal Ripken	133	529	472	313	A	E	240		
## -Cory Snyder	24	58	69	16	A	E	203		
## -Chris Speier	98	698	661	777	N	E	53		
## -Curt Wilkerson	1	116	64	57	A	W	125		
## -Dave Anderson	9	118	69	114	N	W	73		
## -Don Baylor	315	1141	1179	727	A	E	0		



## -Daryl Boston	8	57	40	39	A	W	152
## -Darnell Coles	22	99	103	78	A	E	107
## -Dave Concepcion	100	950	909	690	N	W	153
## -Doug DeCinces	221	712	815	548	A	W	119
## -Darrell Evans	347	1175	1152	1380	A	E	808
## -Dwight Evans	291	1082	949	989	A	E	280
## -Damaso Garcia	32	461	301	112	A	E	224
## -Dan Gladden	16	196	110	117	N	W	226
## -Dave Henderson	80	285	274	186	A	W	182
## -Donnie Hill	11	123	108	55	A	W	104
## -Davey Lopes	154	1019	608	820	N	E	51
## -Don Mattingly	93	349	401	171	A	E	1377
## -Dale Murphy	266	813	822	617	N	W	303
## -Dwayne Murphy	145	575	528	635	A	W	276
## -Dave Parker	247	978	1093	495	N	W	278
## -Dan Pasqua	25	61	70	63	A	E	148
## -Darrell Porter	181	746	805	875	A	W	165
## -Dick Schofield	28	160	123	122	A	W	246
## -Don Slaught	28	156	159	76	A	W	533
## -Darryl Strawberry	108	292	343	267	N	E	226
## -Dale Sveum	7	35	35	32	A	E	45
## -Danny Tartabull	28	87	110	71	A	W	157
## -Denny Walling	41	287	294	227	N	W	59
## -Dave Winfield	305	1135	1234	791	A	E	292
## -Eric Davis	45	156	119	99	N	W	274
## -Eddie Milner	38	335	174	258	N	W	292
## -Eddie Murray	275	884	1015	709	A	E	1045
## -Ed Romero	7	166	122	106	A	E	102
## -Frank White	131	743	693	300	A	W	316
## -George Bell	92	297	319	117	A	E	269
## -Glenn Braggs	4	19	18	11	A	E	116
## -George Brett	209	1072	1050	695	A	W	97
## -Greg Brock	71	195	219	214	N	W	726
## -Gary Carter	271	847	999	680	N	E	869
## -Glenn Davis	53	148	173	95	N	W	1253
## -Gary Gaetti	107	361	401	224	A	W	118
## -Greg Gagne	14	102	80	50	A	W	228
## -George Hendrick	259	915	1067	546	A	W	144
## -Glenn Hubbard	59	429	365	410	N	W	282
## -Garth Iorg	16	216	208	93	A	E	91
## -Gary Matthews	231	1070	955	921	N	E	137
## -Graig Nettles	384	1172	1267	1057	N	W	83
## -Gary Pettis	12	247	126	198	A	W	462
## -Gary Redus	42	284	141	219	N	E	185
## -Garry Templeton	44	703	519	256	N	W	207
## -Greg Walker	73	211	280	138	A	W	670
## -Gary Ward	92	444	419	240	A	W	237
## -Glenn Wilson	58	265	316	134	N	E	331
## -Harold Baines	140	492	589	263	A	W	295
## -Hubie Brooks	55	313	377	187	N	E	116
## -Howard Johnson	40	145	154	128	N	E	50
## -Hal McRae	190	935	1088	643	A	W	0
## -Harold Reynolds	1	72	31	48	A	W	278
## -Harry Spilman	16	80	97	61	N	W	138

## -Herm Winningham	7	58	37	47	N	E	97
## -Jesse Barfield	128	371	376	238	A	E	368
## -Juan Beniquez	70	581	421	325	A	E	211
## -John Cangelosi	2	67	32	71	A	W	276
## -Jose Canseco	38	101	130	69	A	W	319
## -Joe Carter	57	210	222	68	A	E	241
## -Jack Clark	194	702	705	625	N	E	623
## -Jose Cruz	153	980	1032	854	N	W	237
## -Jody Davis	97	273	383	226	N	E	885
## -Jim Dwyer	56	304	268	298	A	E	33
## -Julio Franco	27	330	326	158	A	E	231
## -Jim Gantner	40	450	367	241	A	E	304
## -Johnny Grubb	97	544	462	551	A	E	0
## -Jack Howell	9	45	39	35	A	W	28
## -John Kruk	4	33	38	45	N	W	102
## -Jeffrey Leonard	81	379	428	221	N	W	158
## -Jim Morrison	97	302	351	174	N	E	92
## -John Moses	4	89	48	54	A	W	211
## -Jerry Mumphrey	57	616	522	436	N	E	161
## -Jim Presley	65	181	227	82	A	W	110
## -Johnny Ray	32	366	337	218	N	E	280
## -Jeff Reed	2	18	10	18	A	W	332
## -Jim Rice	351	1104	1289	564	A	E	330
## -Jerry Royster	33	518	324	382	N	W	87
## -John Russell	24	68	94	55	N	E	498
## -Juan Samuel	52	310	226	91	N	E	290
## -John Shelby	30	188	135	63	A	E	222
## -Joel Skinner	6	38	46	28	A	W	227
## -Jim Sundberg	83	578	579	644	A	W	686
## -Jose Uribe	6	96	72	91	N	W	249
## -Joel Youngblood	74	419	382	304	N	W	49
## -Kevin Bass	40	219	195	82	N	W	303
## -Kal Daniels	6	34	23	22	N	W	88
## -Kirk Gibson	126	433	420	309	A	E	190
## -Ken Griffey	121	983	707	600	A	E	96
## -Keith Hernandez	128	969	900	917	N	E	1199
## -Kent Hrbek	117	405	474	319	A	W	1218
## -Ken Landreaux	85	505	456	283	N	W	145
## -Kevin McReynolds	65	233	260	155	N	W	332
## -Kevin Mitchell	12	51	44	33	N	E	145
## -Keith Moreland	83	363	477	295	N	E	181
## -Ken Oberkfell	20	408	303	414	N	W	65
## -Ken Phelps	64	150	156	187	A	W	0
## -Kirby Puckett	35	262	201	91	A	W	429
## -Kurt Stillwell	0	31	26	30	N	W	107
## -Leon Durham	116	436	458	377	N	E	1231
## -Len Dykstra	9	117	64	88	N	E	283
## -Larry Herndon	94	557	483	307	A	E	156
## -Lee Lacy	84	615	430	340	A	E	239
## -Len Matuszek	30	113	119	87	N	W	235
## -Lloyd Moseby	102	513	471	351	A	E	371
## -Lance Parrish	212	577	700	334	A	E	483
## -Larry Parrish	210	740	840	452	A	W	0
## -Larry Sheets	36	88	112	50	A	E	0

## -Lou Whitaker	93	724	522	576	A	E	276
## -Mike Aldrete	2	27	25	33	N	W	317
## -Marty Barrett	12	216	163	166	A	E	303
## -Mike Davis	62	300	263	153	A	W	310
## -Mike Diaz	12	24	37	19	N	E	201
## -Mariano Duncan	14	121	69	68	N	W	172
## -Mike Easler	113	445	491	301	A	E	0
## -Mel Hall	47	210	203	136	A	E	233
## -Mike Heath	55	315	325	189	N	E	259
## -Mike Kingery	3	25	14	12	A	W	102
## -Mike LaValliere	3	20	36	45	N	E	468
## -Mike Marshall	90	247	288	161	N	W	149
## -Mike Pagliarulo	54	150	167	114	A	E	103
## -Mark Salas	17	80	75	36	A	W	358
## -Mike Schmidt	2	6	7	4	N	E	78
## -Mike Scioscia	26	181	199	288	N	W	756
## -Mickey Tettleton	14	59	55	78	A	W	463
## -Milt Thompson	8	71	33	44	N	E	212
## -Mitch Webster	19	132	83	79	N	E	325
## -Mookie Wilson	40	451	249	168	N	E	228
## -Marvell Wynne	16	198	120	113	N	W	203
## -Mike Young	54	181	177	157	A	E	149
## -Ozzie Guillen	3	129	80	24	A	W	261
## -Oddibe McDowell	36	168	91	101	A	W	325
## -Ozzie Smith	13	583	374	528	N	E	229
## -Ozzie Virgil	61	176	202	175	N	W	682
## -Phil Bradley	38	245	167	174	A	W	250
## -Phil Garner	104	751	714	535	N	W	58
## -Pete Incaviglia	30	82	88	55	A	W	157
## -Paul Molitor	79	676	390	364	A	E	82
## -Pete Rose	160	2165	1314	1566	N	W	523
## -Pat Sheridan	24	166	125	105	A	E	172
## -Pat Tabler	29	250	252	178	A	E	846
## -Rafael Belliard	0	41	32	26	N	E	117
## -Rick Burleson	48	630	435	403	A	W	62
## -Randy Bush	43	178	192	136	A	W	167
## -Rick Cerone	43	266	304	198	A	E	391
## -Ron Cey	312	965	1128	990	N	E	41
## -Rob Deer	44	102	109	102	A	E	286
## -Rick Dempsey	78	438	380	466	A	E	659
## -Ron Hassey	50	249	322	274	A	E	251
## -Rickey Henderson	103	862	417	708	A	E	426
## -Reggie Jackson	548	1509	1659	1342	A	W	0
## -Ron Kittle	115	238	299	157	A	W	0
## -Ray Knight	67	410	497	284	N	E	88
## -Rick Leach	12	102	96	80	A	E	44
## -Rick Manning	56	643	445	459	A	E	155
## -Rance Mulliniks	43	295	273	269	A	E	60
## -Ron Oester	39	377	284	296	N	W	367
## -Rey Quinones	2	32	22	24	A	E	86
## -Rafael Ramirez	36	365	280	165	N	W	155
## -Ronn Reynolds	3	16	13	14	N	E	190
## -Ron Roenicke	16	128	104	172	N	E	181
## -Ryne Sandberg	74	494	345	242	N	E	309

## -Rafael Santana	3	94	71	76	N	E	203
## -Rick Schu	17	98	54	62	N	E	42
## -Ruben Sierra	16	50	55	22	A	W	200
## -Roy Smalley	155	713	660	735	A	W	0
## -Robby Thompson	7	73	47	42	N	W	255
## -Rob Wilfong	38	315	259	204	A	W	135
## -Robin Yount	153	1043	827	535	A	E	352
## -Steve Balboni	100	204	276	155	A	W	1236
## -Scott Bradley	5	27	31	15	A	W	281
## -Sid Bream	22	93	106	86	N	E	1320
## -Steve Buechele	24	76	75	49	A	W	111
## -Shawon Dunston	21	106	86	40	N	E	320
## -Scott Fletcher	11	218	149	163	A	W	196
## -Steve Garvey	271	1138	1299	478	N	W	1160
## -Steve Jeltz	1	68	56	99	N	E	229
## -Steve Lombardozzi	8	63	39	58	A	W	289
## -Spike Owen	12	211	146	155	A	W	209
## -Steve Sax	19	420	230	274	N	W	367
## -Tony Bernazard	61	450	342	373	A	E	351
## -Tom Brookens	48	324	300	179	A	E	106
## -Tom Brunansky	133	369	384	321	A	W	315
## -Tony Fernandez	15	196	137	89	A	E	294
## -Tim Flannery	9	207	162	198	N	W	209
## -Tom Foley	9	83	82	86	N	E	81
## -Tony Gwynn	27	352	230	193	N	W	337
## -Terry Harper	32	135	163	128	N	W	92
## -Tommy Herr	16	421	349	359	N	E	352
## -Tim Hulett	22	106	80	52	A	W	70
## -Terry Kennedy	1	2	3	1	N	W	692
## -Tito Landrum	12	105	99	71	N	E	131
## -Tim Laudner	42	129	139	106	A	W	299
## -Tom Paciorek	83	488	491	244	A	W	178
## -Tony Pena	63	307	340	174	N	E	810
## -Terry Pendleton	7	149	161	87	N	E	133
## -Tony Phillips	17	226	149	191	A	W	160
## -Terry Puhl	57	579	363	406	N	W	65
## -Ted Simmons	242	1048	1348	819	N	W	167
## -Tim Teufel	31	180	148	158	N	E	133
## -Tim Wallach	110	338	406	239	N	E	94
## -Vince Coleman	1	201	69	110	N	E	300
## -Von Hayes	69	399	366	286	N	E	1182
## -Vance Law	41	279	257	246	N	E	170
## -Wally Backman	6	272	125	194	N	E	186
## -Wade Boggs	32	474	322	417	A	E	121
## -Will Clark	11	66	41	34	N	W	942
## -Wally Joyner	22	82	100	57	A	W	1222
## -Willie McGee	32	379	311	138	N	E	325
## -Willie Randolph	39	897	451	875	A	E	313
## -Wayne Tolleson	7	217	93	146	A	W	37
## -Willie Upshaw	97	470	420	332	A	E	1314
## -Willie Wilson	30	775	357	249	A	W	408
##	Assists	Errors	Salary	NewLeague			
## -Alan Ashby	43	10	6.163315	N			
## -Alvin Davis	82	14	6.173786	A			

## -Andre Dawson	11	3	6.214608	N
## -Andres Galarraga	40	4	4.516339	N
## -Alfredo Griffin	421	25	6.620073	A
## -Al Newman	127	7	4.248495	A
## -Argenis Salazar	283	9	4.605170	A
## -Andres Thomas	290	19	4.317488	N
## -Andre Thornton	0	0	7.003065	A
## -Alan Trammell	445	22	6.248319	A
## -Alex Trevino	45	11	6.239301	N
## -Andy VanSlyke	11	7	6.309918	N
## -Alan Wiggins	151	6	6.551080	A
## -Bill Almon	45	8	5.480639	N
## -Buddy Bell	290	10	6.652863	N
## -Buddy Biancalana	177	16	5.164786	A
## -Bruce Bochy	22	2	4.905275	N
## -Barry Bonds	9	5	4.605170	N
## -Bobby Bonilla	22	2	4.744932	N
## -Bob Brenly	55	3	6.396930	N
## -Bill Buckner	157	14	6.655012	A
## -Brett Butler	9	3	6.639876	A
## -Bob Dernier	3	3	6.562914	N
## -Bo Diaz	83	13	6.620073	N
## -Bill Doran	329	16	6.437752	N
## -Brian Downing	5	3	6.802395	A
## -Billy Hatcher	7	4	4.700480	N
## -Brook Jacoby	292	25	6.417549	A
## -Bob Kearney	46	5	5.703782	A
## -Bill Madlock	170	24	6.745236	N
## -Bob Melvin	59	6	4.499810	N
## -BillyJo Robidoux	29	5	4.212128	A
## -Bill Schroeder	25	1	5.192957	A
## -Chris Bando	30	4	5.720312	A
## -Chris Brown	177	18	5.370638	N
## -Carmen Castillo	4	4	5.511411	A
## -Chili Davis	9	9	6.703188	N
## -Carlton Fisk	39	4	6.774224	A
## -Curt Ford	7	3	4.248495	N
## -Carney Lansford	147	4	7.090077	A
## -Chet Lemon	6	5	6.514713	A
## -Candy Maldonado	10	3	6.028279	N
## -Carmelo Martinez	14	2	5.828946	N
## -Craig Reynolds	206	7	6.032287	N
## -Cal Ripken	482	13	7.207860	A
## -Cory Snyder	70	10	4.499810	A
## -Chris Speier	88	3	5.616771	N
## -Curt Wilkerson	199	13	5.438079	A
## -Dave Anderson	152	11	5.416100	N
## -Don Baylor	0	0	6.856462	A
## -Daryl Boston	3	5	4.317488	A
## -Darnell Coles	242	23	4.653960	A
## -Dave Concepcion	223	10	5.768321	N
## -Doug DeCinces	216	12	6.745236	A
## -Darrell Evans	108	2	6.282267	A
## -Dwight Evans	10	5	6.838762	A

## -Damaso Garcia	286	8 6.745236	N
## -Dan Gladden	7	3 5.347108	A
## -Dave Henderson	9	4 5.783825	A
## -Donnie Hill	213	9 5.616771	A
## -Davey Lopes	54	8 6.109248	N
## -Don Mattingly	100	6 7.588324	A
## -Dale Murphy	6	6 7.549609	N
## -Dwayne Murphy	6	2 6.396930	A
## -Dave Parker	9	9 6.948578	N
## -Dan Pasqua	4	2 4.700480	A
## -Darrell Porter	9	1 5.560682	A
## -Dick Schofield	389	18 6.163315	A
## -Don Slaught	40	4 6.067268	A
## -Darryl Strawberry	10	6 7.106606	N
## -Dale Sveum	122	26 4.248495	A
## -Danny Tartabull	7	8 4.976734	A
## -Denny Walling	156	9 6.388561	N
## -Dave Winfield	9	5 7.529116	A
## -Eric Davis	2	7 5.703782	N
## -Eddie Milner	6	3 6.194405	N
## -Eddie Murray	88	13 7.807917	A
## -Ed Romero	132	10 5.926926	A
## -Frank White	439	10 6.620073	A
## -George Bell	17	10 7.069023	A
## -Glenn Braggs	5	12 4.248495	A
## -George Brett	218	16 7.313220	A
## -Greg Brock	87	3 5.953243	A
## -Gary Carter	62	8 7.562978	N
## -Glenn Davis	111	11 5.370638	N
## -Gary Gaetti	334	21 6.802395	A
## -Greg Gagne	377	26 5.043425	A
## -George Hendrick	6	5 6.551080	A
## -Glenn Hubbard	487	19 6.282267	N
## -Garth Iorg	185	12 5.893024	A
## -Gary Matthews	5	9 6.597600	N
## -Graig Nettles	174	16 5.298317	N
## -Gary Pettis	9	7 5.991465	A
## -Gary Redus	8	4 5.991465	A
## -Garry Templeton	358	20 6.603266	N
## -Greg Walker	57	5 6.214608	A
## -Gary Ward	8	1 6.396930	A
## -Glenn Wilson	20	4 6.496021	N
## -Harold Baines	15	5 6.856462	A
## -Hubie Brooks	222	15 6.620073	N
## -Howard Johnson	136	20 5.695414	N
## -Hal McRae	0	0 5.783825	A
## -Harold Reynolds	415	16 4.471639	A
## -Harry Spilman	15	1 5.164786	N
## -Herm Winningham	2	2 4.499810	N
## -Jesse Barfield	20	3 7.120848	A
## -Juan Beniquez	56	13 6.063785	A
## -John Cangelosi	7	9 4.605170	N
## -Jose Canseco	4	14 5.105945	A
## -Joe Carter	8	6 5.521461	A

## -Jack Clark	35	3 7.170120	N
## -Jose Cruz	5	4 6.650710	N
## -Jody Davis	105	8 6.916054	N
## -Jim Dwyer	3	0 5.616771	A
## -Julio Franco	374	18 6.652863	A
## -Jim Gantner	347	10 6.745236	A
## -Johnny Grubb	0	0 5.899897	A
## -Jack Howell	56	2 4.553877	A
## -John Kruk	4	2 4.700480	N
## -Jeffrey Leonard	4	5 4.605170	N
## -Jim Morrison	257	20 5.625821	N
## -John Moses	9	3 4.382027	A
## -Jerry Mumphrey	3	3 6.396930	N
## -Jim Presley	308	15 5.298317	A
## -Johnny Ray	479	5 6.487684	N
## -Jeff Reed	19	2 4.317488	N
## -Jim Rice	16	8 7.788419	A
## -Jerry Royster	166	14 5.521461	A
## -John Russell	39	13 5.043425	N
## -Juan Samuel	440	25 6.461468	N
## -John Shelby	5	5 5.703782	A
## -Joel Skinner	15	3 4.700480	A
## -Jim Sundberg	46	4 6.715383	N
## -Jose Uribe	444	16 5.273000	N
## -Joel Youngblood	2	0 6.109248	N
## -Kevin Bass	12	5 6.445720	N
## -Kal Daniels	0	3 4.460144	N
## -Kirk Gibson	2	2 7.170120	A
## -Ken Griffey	5	3 6.907755	N
## -Keith Hernandez	149	5 7.495542	N
## -Kent Hrbek	104	10 7.177782	A
## -Ken Landreaux	5	7 6.603266	N
## -Kevin McReynolds	9	8 6.437752	N
## -Kevin Mitchell	59	8 4.828314	N
## -Keith Moreland	13	4 6.950176	N
## -Ken Oberkfell	258	8 6.586172	N
## -Ken Phelps	0	0 5.703782	A
## -Kirby Puckett	8	6 5.899897	A
## -Kurt Stillwell	205	16 4.317488	N
## -Leon Durham	80	7 7.076090	N
## -Len Dykstra	8	3 5.310740	N
## -Larry Herndon	2	2 5.416100	A
## -Lee Lacy	8	2 6.263398	A
## -Len Matuszek	22	5 5.579730	N
## -Lloyd Moseby	6	6 6.668863	A
## -Lance Parrish	48	6 6.684612	N
## -Larry Parrish	0	0 6.375876	A
## -Larry Sheets	0	0 4.976734	A
## -Lou Whitaker	421	11 6.040255	A
## -Mike Aldrete	36	1 4.317488	N
## -Marty Barrett	450	14 6.354370	A
## -Mike Davis	9	9 6.659294	A
## -Mike Diaz	6	3 4.499810	N
## -Mariano Duncan	317	25 5.010635	N

## -Mike Easler	0	0 6.551080	N
## -Mel Hall	7	7 6.309918	A
## -Mike Heath	30	10 6.476972	A
## -Mike Kingery	6	3 4.219508	A
## -Mike LaValliere	47	6 4.605170	N
## -Mike Marshall	8	6 6.507278	N
## -Mike Pagliarulo	283	19 5.164786	A
## -Mark Salas	32	8 4.919981	A
## -Mike Schmidt	220	6 7.662624	N
## -Mike Scioscia	64	15 6.774224	N
## -Mickey Tettleton	32	8 4.787492	A
## -Milt Thompson	1	2 4.941642	N
## -Mitch Webster	12	8 5.347108	N
## -Mookie Wilson	7	5 6.684612	N
## -Marvell Wynne	3	3 5.480639	N
## -Mike Young	1	6 5.857933	A
## -Ozzie Guillen	459	22 5.164786	A
## -Oddibe McDowell	13	3 5.298317	A
## -Ozzie Smith	453	15 7.570443	N
## -Ozzie Virgil	93	13 6.551080	N
## -Phil Bradley	11	1 6.620073	A
## -Phil Garner	141	23 6.109248	N
## -Pete Incaviglia	6	14 5.147494	A
## -Paul Molitor	170	15 7.138867	A
## -Pete Rose	43	6 6.620073	N
## -Pat Sheridan	1	4 5.247024	A
## -Pat Tabler	84	9 6.363028	A
## -Rafael Belliard	269	12 4.867534	N
## -Rick Burleson	90	3 6.109248	A
## -Randy Bush	2	4 5.703782	A
## -Rick Cerone	44	4 5.521461	A
## -Ron Cey	118	8 6.956545	A
## -Rob Deer	8	8 5.370638	A
## -Rick Dempsey	53	7 5.991465	A
## -Ron Hassey	9	4 6.327937	A
## -Rickey Henderson	4	6 7.420579	A
## -Reggie Jackson	0	0 6.189290	A
## -Ron Kittle	0	0 6.052089	A
## -Ray Knight	204	16 6.214608	A
## -Rick Leach	0	1 5.521461	A
## -Rick Manning	3	2 5.991465	A
## -Rance Mulliniks	176	6 6.109248	A
## -Ron Oester	475	19 6.620073	N
## -Rey Quinones	150	15 4.248495	A
## -Rafael Ramirez	371	29 6.774224	N
## -Ronn Reynolds	2	9 5.247024	N
## -Ron Roenicke	3	2 5.252273	N
## -Ryne Sandberg	492	5 6.606650	N
## -Rafael Santana	369	16 5.521461	N
## -Rick Schu	94	13 4.941642	N
## -Ruben Sierra	7	6 4.579852	A
## -Roy Smalley	0	0 6.606650	A
## -Robby Thompson	450	17 4.941642	N
## -Rob Wilfong	257	7 5.833837	A



## -Robin Yount	9	1	6.907755	A
## -Steve Balboni	98	18	4.605170	A
## -Scott Bradley	21	3	4.499810	A
## -Sid Bream	166	17	5.298317	N
## -Steve Buechele	226	11	4.905275	A
## -Shawon Dunston	465	32	5.043425	N
## -Scott Fletcher	354	15	6.163315	A
## -Steve Garvey	53	7	7.279319	N
## -Steve Jeltz	406	22	5.010635	N
## -Steve Lombardozzi	407	6	4.653960	A
## -Spike Owen	372	17	5.857933	A
## -Steve Sax	432	16	4.499810	N
## -Tony Bernazard	442	17	6.272877	A
## -Tom Brookens	144	7	5.833837	A
## -Tom Brunansky	10	6	6.845880	A
## -Tony Fernandez	445	13	5.857933	A
## -Tim Flannery	246	3	5.788941	N
## -Tom Foley	147	4	5.521461	N
## -Tony Gwynn	19	4	6.606650	N
## -Terry Harper	5	3	6.052089	A
## -Tommy Herr	414	9	6.829794	N
## -Tim Hulett	144	11	5.220356	A
## -Terry Kennedy	70	8	6.824374	A
## -Tito Landrum	6	1	5.658321	N
## -Tim Laudner	13	5	5.501258	A
## -Tom Paciorek	45	4	5.459586	A
## -Tony Pena	99	18	7.047517	N
## -Terry Pendleton	371	20	5.075174	N
## -Tony Phillips	290	11	6.052089	A
## -Terry Puhl	0	0	6.802395	N
## -Ted Simmons	18	6	6.214608	N
## -Tim Teufel	173	9	5.625821	N
## -Tim Wallach	270	16	6.620073	N
## -Vince Coleman	12	9	5.075174	N
## -Von Hayes	96	13	7.170120	N
## -Vance Law	284	3	6.263398	N
## -Wally Backman	290	17	6.309918	N
## -Wade Boggs	267	19	7.377759	A
## -Will Clark	72	11	4.787492	N
## -Wally Joyner	139	15	5.105945	A
## -Willie McGee	9	3	6.551080	N
## -Willie Randolph	381	20	6.774224	A
## -Wayne Tolleson	113	7	5.953243	A
## -Willie Upshaw	131	12	6.866933	A
## -Willie Wilson	4	3	6.907755	A

In this chunk, I remove the na values from Salary and log-transform the Salary column.

10.(b)

```
set.seed(1)
train_1=sample(1:nrow(Hitters),200)
train.x1=Hitters[train_1,]
test.x1=Hitters[-train_1,]
```

I create the training and test data set.

10.(c)

```
library(gbm)

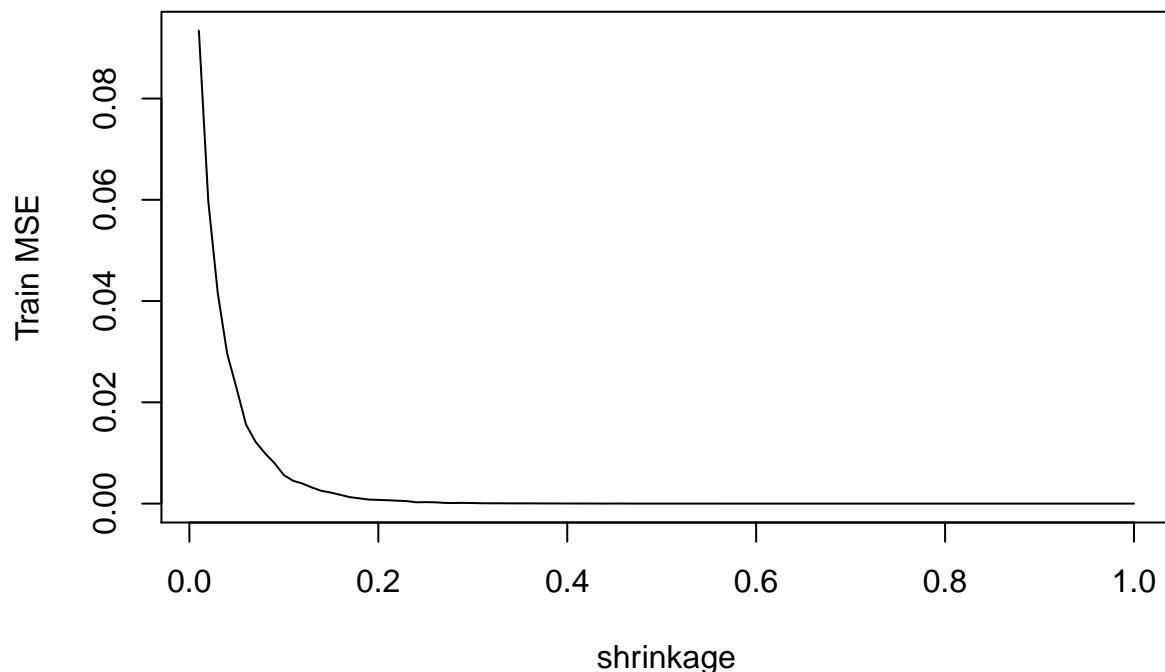
## Loaded gbm 2.1.5

set.seed(1)

boostmse=c()
for (a in 1:100){
  boost.hitt=gbm(Salary~.,train.x1,distribution="gaussian",n.trees=1000,
                 interaction.depth=2,shrinkage=a*0.01,verbose=F)
  yhat.boost=predict(boost.hitt,newdata=train.x1,n.trees=1000)
  boostmse=c(boostmse,mean((yhat.boost-train.x1$Salary)^2))
}
boostmse

##      [1] 9.339991e-02 5.968471e-02 4.161603e-02 2.960607e-02 2.271321e-02
##      [6] 1.557795e-02 1.221503e-02 9.938642e-03 8.015007e-03 5.624858e-03
##     [11] 4.497503e-03 3.933912e-03 3.160615e-03 2.503685e-03 2.166049e-03
##     [16] 1.711937e-03 1.265567e-03 1.034202e-03 7.959915e-04 7.278516e-04
##     [21] 6.610501e-04 5.744435e-04 4.943781e-04 2.573799e-04 2.893490e-04
##     [26] 2.537229e-04 1.383477e-04 1.141488e-04 1.390320e-04 1.110400e-04
##     [31] 6.642908e-05 5.374046e-05 5.359057e-05 4.384866e-05 3.955620e-05
##     [36] 4.566245e-05 2.822533e-05 3.073930e-05 2.606360e-05 2.053013e-05
##     [41] 1.567999e-05 1.474238e-05 7.808850e-06 3.393918e-06 6.529225e-06
##     [46] 6.505698e-06 6.065055e-06 5.371020e-06 1.924142e-06 3.379940e-06
##     [51] 1.610399e-06 1.609180e-06 2.449801e-06 1.923495e-06 9.175584e-07
##     [56] 1.256492e-06 8.316911e-07 7.682323e-07 4.113792e-07 6.828592e-07
##     [61] 2.823886e-07 5.892264e-07 2.081557e-07 5.058133e-07 1.934498e-07
##     [66] 3.515516e-07 5.950026e-07 1.375137e-07 1.829137e-07 2.125139e-07
##     [71] 7.551659e-08 7.858592e-08 9.408189e-08 1.428793e-07 5.826190e-08
##     [76] 1.218534e-07 6.989628e-08 7.441420e-08 3.780871e-08 6.174020e-08
##     [81] 1.094867e-07 4.987464e-08 7.912534e-08 2.456767e-08 5.936227e-08
##     [86] 1.141667e-07 2.838980e-08 8.594751e-08 4.182362e-08 8.265818e-08
##     [91] 8.999492e-08 6.503606e-08 8.065940e-08 7.323612e-09 1.261406e-08
##     [96] 7.895214e-08 7.023641e-08 6.045772e-08 4.880352e-08 4.342187e-08

s=seq(0.01,1,0.01)
plot(x=s,y=boostmse,xlab="shrinkage",ylab="Train MSE",type="l")
```



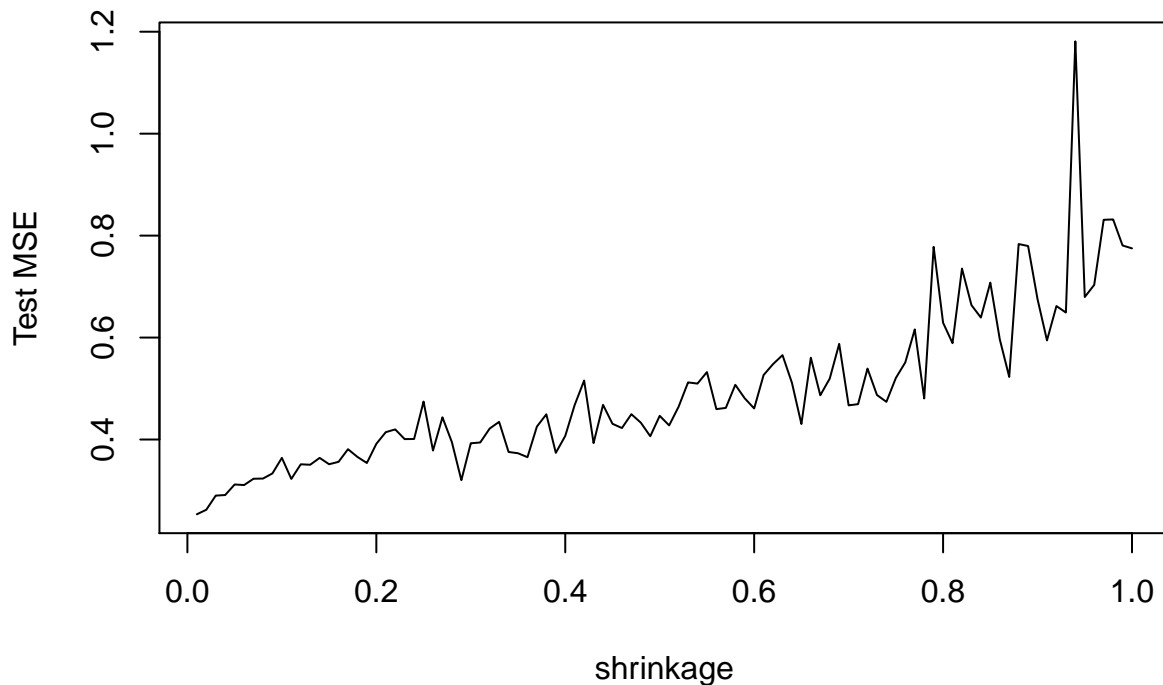
In this chunk, I use a for loop to show how will the Train MSE change while the shrinkage increases. According to the plot, we can see that when the shrinkage increases, the training MSE decrease.

10.(d)

```
set.seed(4)
boost.testmse=c( )
for (i in 1:100){
  boost.hitt1=gbm(Salary~.,train.x1,distribution="gaussian",n.trees=1000,
                  interaction.depth=2,shrinkage=i*0.01,verbose=F)
  yhat.boost1=predict(boost.hitt1,newdata=test.x1,n.trees=1000)
  boost.testmse=c(boost.testmse,mean((yhat.boost1-test.x1$Salary)^2))
}
boost.testmse
```

```
## [1] 0.2533938 0.2622133 0.2900141 0.2911052 0.3117941 0.3107303 0.3230629
## [8] 0.3234272 0.3334607 0.3640120 0.3227676 0.3513913 0.3505458 0.3639519
## [15] 0.3515212 0.3562057 0.3810123 0.3658910 0.3539658 0.3915425 0.4144522
## [22] 0.4198651 0.4008634 0.4010301 0.4744671 0.3783960 0.4435605 0.3948195
## [29] 0.3202334 0.3926134 0.3941807 0.4215243 0.4346675 0.3755717 0.3730571
## [36] 0.3653961 0.4254321 0.4494888 0.3738689 0.4070827 0.4678325 0.5157103
## [43] 0.3930671 0.4680363 0.4308786 0.4224814 0.4496389 0.4331003 0.4064546
## [50] 0.4465196 0.4276603 0.4642822 0.5120789 0.5096880 0.5323293 0.4596592
## [57] 0.4620078 0.5072850 0.4808281 0.4609590 0.5265582 0.5479558 0.5655394
## [64] 0.5110470 0.4304540 0.5604404 0.4868157 0.5196132 0.5875968 0.4670419
## [71] 0.4693853 0.5391632 0.4873162 0.4739379 0.5207393 0.5513010 0.6159502
## [78] 0.4805900 0.7779705 0.6290777 0.5890097 0.7352841 0.6637351 0.6392199
## [85] 0.7078410 0.5968279 0.5228161 0.7834777 0.7795899 0.6753091 0.5944672
## [92] 0.6618337 0.6490585 1.1810717 0.6795165 0.7033784 0.8310240 0.8317331
## [99] 0.7806452 0.7749871
```

```
s=seq(0.01,1,0.01)
plot(x=s,y=boost.testmse,xlab="shrinkage",ylab="Test MSE",type="l")
```



In this chunk, I use a plot to show visually how the test MSE changes. We can see that, although there are fluctuations, the general trend is that when shrinkage increases, the Test MSE increases.

10.(e)

```
#linear regression
lm.fit=lm(Salary~.,data=train.x1)
lm.pred=predict(lm.fit,newdata=test.x1)
mean((lm.pred-test.x1$Salary)^2)

## [1] 0.4848397

#LASSO
library(glmnet)

## Loading required package: Matrix
## Loading required package: foreach
## Loaded glmnet 2.0-18

x = model.matrix(Salary~.,Hitters)[,-1]
y=Hitters$Salary
grid=10^seq(10,-2,length=100)

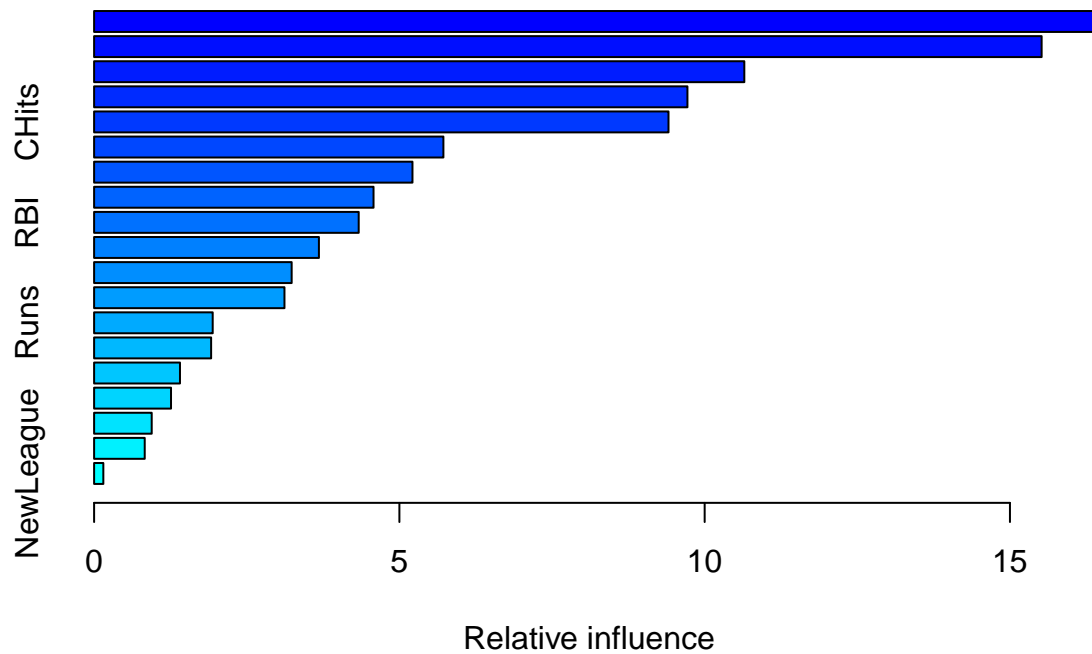
lasso.mod = glmnet(x[train_1,],y[train_1],alpha = 1,lambda = grid)
set.seed(1)
cv.lasso=cv.glmnet(x[train_1,],y[train_1],alpha = 1)
bestlam=cv.lasso$lambda.min
lasso.pred=predict(lasso.mod,s=bestlam,newx=x[-train_1,])
mean((lasso.pred-test.x1$Salary)^2)

## [1] 0.4696875
```

In this chunk, I use linear and LASSO regression. And the Test MSE of these two methods are 0.48 and 0.46 respectively. The MSE are bigger than boosting method, if the shrinkage is small.

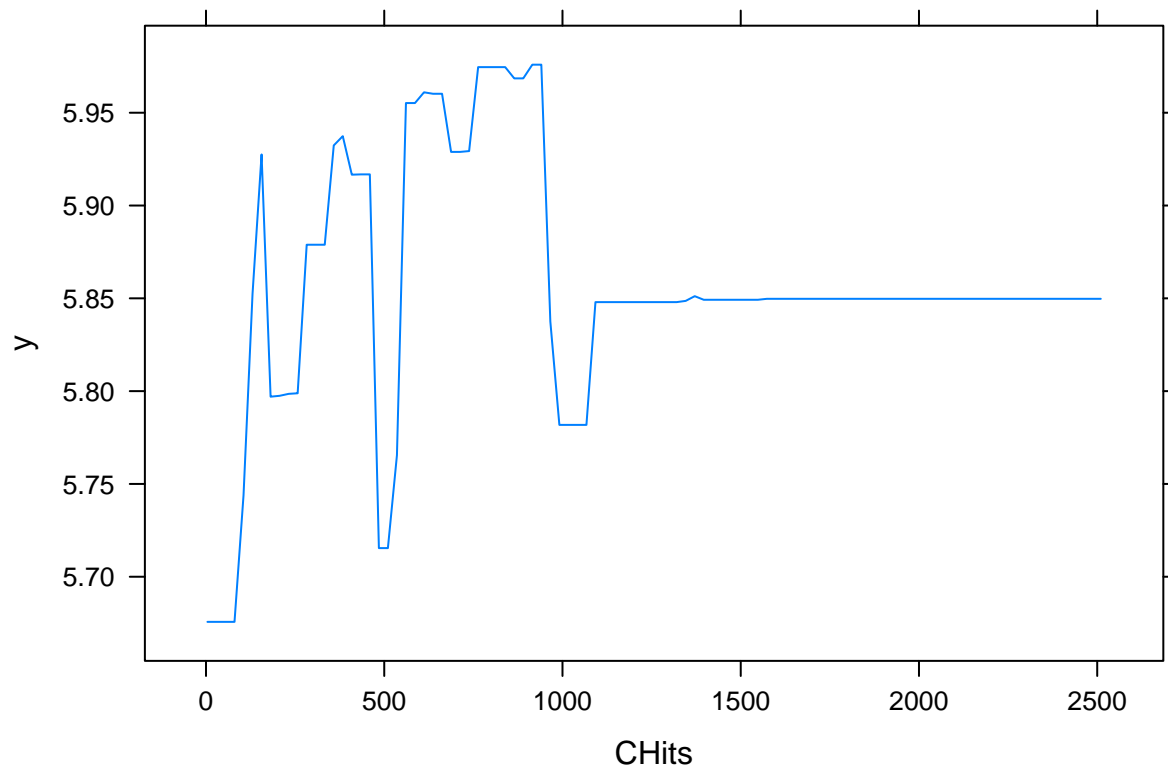
10.(f)

```
boost.hitt1=gbm(Salary~.,train.x1,distribution="gaussian",n.trees=1000,  
                interaction.depth=2,shrinkage=0.01,verbose=F)  
summary(boost.hitt1)
```



```
##          var    rel.inf  
## CAtBat    CAtBat 16.3776595  
## CRuns     CRuns 15.5188890  
## CRBI      CRBI 10.6494179  
## CWalks    CWalks 9.7179133  
## CHits     CHits 9.4076788  
## PutOuts   PutOuts 5.7208589  
## Walks     Walks 5.2140845  
## Years     Years 4.5764863  
## RBI       RBI 4.3334572  
## Hits      Hits 3.6820489  
## AtBat     AtBat 3.2353995  
## CHmRun    CHmRun 3.1176115  
## Runs      Runs 1.9424084  
## HmRun     HmRun 1.9165987  
## Errors    Errors 1.4062493  
## Assists   Assists 1.2597410  
## League    League 0.9434615  
## Division  Division 0.8291265  
## NewLeague NewLeague 0.1509093
```

```
plot(boost.hitt,i="CHits")
```



According to the picture, we can find the most important predictor is CHits. And the influence of this variable is shown in the plot.

10.(g)

```
library(randomForest)
set.seed(1)
bag.hitt=randomForest(Salary~.,data=train.x1,ntree=1000,mtry=19,importance=TRUE)
yhat.hitt=predict(bag.hitt,test.x1)
mean((yhat.hitt-test.x1$Salary)^2)
```

```
## [1] 0.2390823
```

According to the results, the test MSE of bagging method is about 0.239.