

154Lab6

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```
library(ISLR)
library(pls)

##
## Attaching package: 'pls'
## The following object is masked from 'package:stats':
##
##      loadings
str(Hitters, vec.len = 1)

## 'data.frame':   322 obs. of  20 variables:
## $ AtBat      : int  293 315 ...
## $ Hits       : int  66 81 ...
## $ HmRun      : int   1 7 ...
## $ Runs       : int  30 24 ...
## $ RBI        : int  29 38 ...
## $ Walks      : int  14 39 ...
## $ Years      : int   1 14 ...
## $ CAtBat     : int  293 3449 ...
## $ CHits      : int  66 835 ...
## $ CHmRun     : int   1 69 ...
## $ CRuns      : int  30 321 ...
## $ CRBI       : int  29 414 ...
## $ CWalks     : int  14 375 ...
## $ League     : Factor w/ 2 levels "A","N": 1 2 ...
## $ Division   : Factor w/ 2 levels "E","W": 1 2 ...
## $ PutOuts    : int  446 632 ...
## $ Assists    : int   33 43 ...
## $ Errors     : int   20 10 ...
## $ Salary     : num  NA 475 ...
## $ NewLeague  : Factor w/ 2 levels "A","N": 1 2 ...

# principal component regression
pcr_fit <- pcr(Salary ~ ., data = Hitters, scale = TRUE, validation = "none")
names(pcr_fit)

## [1] "coefficients" "scores"      "loadings"    "Yloadings"
## [5] "projection"   "Xmeans"      "Ymeans"      "fitted.values"
## [9] "residuals"    "Xvar"        "Xtotvar"     "fit.time"
## [13] "na.action"    "ncomp"       "method"      "scale"
## [17] "call"         "terms"       "model"
```

1) Start with PCA

```
hitters <- na.omit(Hitters)
X <- model.matrix(Salary ~., hitters)
X <- X[,-1]
X <- scale(X)
y <- hitters[, "Salary"]
svd <- svd(X)

Z <- X %%% svd$v # Q

head(pcr_fit$scores[,1])

##      -Alan Ashby      -Alvin Davis      -Andre Dawson -Andres Galarraga
##      -0.009630358      0.410650757      3.460224766      -2.553449083
## -Alfredo Griffin      -Al Newman
##      1.025746581      -3.973081710

head(Z[,1])

##      -Alan Ashby      -Alvin Davis      -Andre Dawson -Andres Galarraga
##      -0.009630358      0.410650757      3.460224766      -2.553449083
## -Alfredo Griffin      -Al Newman
##      1.025746581      -3.973081710
```

2) PC Regression on the first component

```
z1 <- Z[,1, drop = F]
b1 <- solve(t(z1) %%% z1) %%% t(z1) %%% y
b1 <- as.numeric(b1)
b1

## [1] 106.5714

yhat <- as.numeric(b1)* z1

yhat + mean(y) # due to the intercept

##      [,1]
## -Alan Ashby      534.899561
## -Alvin Davis      579.689505
## -Andre Dawson      904.686853
## -Andres Galarraga      263.801258
## -Alfredo Griffin      645.241123
## -Al Newman      112.509033
## -Argenis Salazar      168.771416
## -Andres Thomas      170.828426
## -Andre Thornton      950.732270
## -Alan Trammell      873.626137
## -Alex Trevino      305.360701
## -Andy VanSlyke      436.661287
## -Alan Wiggins      293.902861
## -Bill Almon      424.637802
```

## -Buddy Bell	1137.546564
## -Buddy Biancalana	155.425391
## -Bruce Bochy	188.802022
## -Barry Bonds	349.673079
## -Bobby Bonilla	306.937740
## -Bob Brenly	544.890543
## -Bill Buckner	1171.050729
## -Brett Butler	619.469738
## -Bob Dernier	317.371887
## -Bo Diaz	527.037942
## -Bill Doran	553.510495
## -Brian Downing	1027.435942
## -Billy Hatcher	267.743963
## -Brook Jacoby	573.640397
## -Bob Kearney	260.145419
## -Bill Madlock	828.154618
## -Bob Melvin	160.341023
## -BillyJo Robidoux	157.164040
## -Bill Schroeder	215.073201
## -Chris Bando	270.906350
## -Chris Brown	336.897882
## -Carmen Castillo	245.695109
## -Chili Davis	635.082343
## -Carlton Fisk	990.813880
## -Curt Ford	152.057824
## -Carney Lansford	800.296972
## -Chet Lemon	798.428045
## -Candy Maldonado	385.565595
## -Carmelo Martinez	294.671148
## -Craig Reynolds	455.357652
## -Cal Ripken	816.013349
## -Cory Snyder	354.887937
## -Chris Speier	677.086225
## -Curt Wilkerson	191.328206
## -Dave Anderson	187.545893
## -Don Baylor	1269.790965
## -Daryl Boston	185.472994
## -Darnell Coles	467.833685
## -Dave Concepcion	847.852967
## -Doug DeCinces	977.592331
## -Darrell Evans	1383.033711
## -Dwight Evans	1243.479719
## -Damaso Garcia	515.950461
## -Dan Gladden	329.398060
## -Dave Henderson	496.785308
## -Donnie Hill	278.446398
## -Davey Lopes	816.675610
## -Don Mattingly	836.295962
## -Dale Murphy	1042.609499
## -Dwayne Murphy	679.449308
## -Dave Parker	1171.990484
## -Dan Pasqua	310.853337
## -Darrell Porter	755.609960
## -Dick Schofield	432.895758

## -Don Slaught	353.217450
## -Darryl Strawberry	634.480399
## -Dale Sveum	225.196755
## -Danny Tartabull	497.690849
## -Denny Walling	507.636677
## -Dave Winfield	1276.471160
## -Eric Davis	483.696763
## -Eddie Milner	485.119308
## -Eddie Murray	1081.793186
## -Ed Romero	277.389488
## -Frank White	919.390095
## -George Bell	718.485223
## -Glenn Braggs	132.715774
## -George Brett	1085.029508
## -Greg Brock	419.812412
## -Gary Carter	1094.470984
## -Glenn Davis	598.272618
## -Gary Gaetti	758.507588
## -Greg Gagne	367.313319
## -George Hendrick	926.981248
## -Glenn Hubbard	554.446465
## -Garth Iorg	364.614060
## -Gary Matthews	1027.084279
## -Graig Nettles	1169.671530
## -Gary Pettis	513.097457
## -Gary Redus	409.573131
## -Garry Templeton	655.720706
## -Greg Walker	418.405706
## -Gary Ward	563.470479
## -Glenn Wilson	575.422502
## -Harold Baines	772.513890
## -Hubie Brooks	490.500283
## -Howard Johnson	288.461324
## -Hal McRae	880.665049
## -Harold Reynolds	265.629922
## -Harry Spilman	199.316823
## -Herm Winningham	140.760652
## -Jesse Barfield	813.355050
## -Juan Beniquez	641.277799
## -John Cangelosi	313.836487
## -Jose Canseco	572.503580
## -Joe Carter	657.355214
## -Jack Clark	702.421322
## -Jose Cruz	1037.401914
## -Jody Davis	616.777499
## -Jim Dwyer	406.473355
## -Julio Franco	585.287321
## -Jim Gantner	597.244982
## -Johnny Grubb	641.384815
## -Jack Howell	147.620802
## -John Kruk	209.574995
## -Jeffrey Leonard	492.600456
## -Jim Morrison	644.975740
## -John Moses	303.309699

## -Jerry Mumphrey	604.847517
## -Jim Presley	578.200893
## -Johnny Ray	611.989854
## -Jeff Reed	110.651650
## -Jim Rice	1284.370296
## -Jerry Royster	506.180144
## -John Russell	292.027107
## -Juan Samuel	538.824553
## -John Shelby	379.157241
## -Joel Skinner	219.278494
## -Jim Sundberg	762.587665
## -Jose Uribe	320.876006
## -Joel Youngblood	427.261739
## -Kevin Bass	543.844975
## -Kal Daniels	143.163243
## -Kirk Gibson	736.670206
## -Ken Griffey	932.393834
## -Keith Hernandez	1113.791814
## -Kent Hrbek	793.778528
## -Ken Landreaux	501.784163
## -Kevin McReynolds	618.473864
## -Kevin Mitchell	264.453697
## -Keith Moreland	681.565140
## -Ken Oberkfell	615.477250
## -Ken Phelps	508.502972
## -Kirby Puckett	670.663483
## -Kurt Stillwell	152.872622
## -Leon Durham	712.747579
## -Len Dykstra	365.045533
## -Larry Herndon	594.276399
## -Lee Lacy	740.600581
## -Len Matuszek	237.563705
## -Lloyd Moseby	785.841661
## -Lance Parrish	751.767833
## -Larry Parrish	967.433703
## -Larry Sheets	335.512186
## -Lou Whitaker	885.532137
## -Mike Aldrete	150.347333
## -Marty Barrett	545.723588
## -Mike Davis	547.640871
## -Mike Diaz	178.972401
## -Mariano Duncan	273.575977
## -Mike Easler	722.977781
## -Mel Hall	505.516661
## -Mike Heath	431.393760
## -Mike Kingery	128.115086
## -Mike LaValliere	201.098914
## -Mike Marshall	440.652212
## -Mike Pagliarulo	504.869880
## -Mark Salas	231.475625
## -Mike Schmidt	3.139113
## -Mike Scioscia	417.086896
## -Mickey Tettleton	241.268349
## -Milt Thompson	217.678139

## -Mitch Webster	441.881635
## -Mookie Wilson	493.624943
## -Marvell Wynne	284.016590
## -Mike Young	401.264186
## -Ozzie Guillen	324.894309
## -Oddibe McDowell	501.810890
## -Ozzie Smith	686.981609
## -Ozzie Virgil	444.956471
## -Phil Bradley	543.164445
## -Phil Garner	722.623764
## -Pete Incaviglia	484.034112
## -Paul Molitor	672.675700
## -Pete Rose	1364.617503
## -Pat Sheridan	279.700373
## -Pat Tabler	495.994651
## -Rafael Belliard	198.022466
## -Rick Burleson	590.154782
## -Randy Bush	387.072445
## -Rick Cerone	392.123234
## -Ron Cey	1003.867923
## -Rob Deer	519.139309
## -Rick Dempsey	647.817829
## -Ron Hassey	510.575813
## -Rickey Henderson	966.613986
## -Reggie Jackson	1510.284211
## -Ron Kittle	477.777964
## -Ray Knight	666.794783
## -Rick Leach	268.118655
## -Rick Manning	577.536575
## -Rance Mulliniks	497.688659
## -Ron Oester	564.876710
## -Rey Quinones	181.239621
## -Rafael Ramirez	474.663241
## -Ronn Reynolds	83.573300
## -Ron Roenicke	327.980139
## -Ryne Sandberg	663.468344
## -Rafael Santana	265.513224
## -Rick Schu	196.546088
## -Ruben Sierra	299.361734
## -Roy Smalley	880.503862
## -Robby Thompson	339.965596
## -Rob Wilfong	392.450576
## -Robin Yount	999.184187
## -Steve Balboni	606.290443
## -Scott Bradley	174.508097
## -Sid Bream	483.183379
## -Steve Buechele	358.938788
## -Shawon Dunston	393.517303
## -Scott Fletcher	473.810251
## -Steve Garvey	1188.870771
## -Steve Jeltz	301.844484
## -Steve Lombardozzi	315.214575
## -Spike Owen	424.370515
## -Steve Sax	624.706033

```
## -Tony Bernazard      714.598482
## -Tom Brookens       405.608645
## -Tom Brunansky      699.063676
## -Tony Fernandez     524.288818
## -Tim Flannery       388.226519
## -Tom Foley          214.590496
## -Tony Gwynn         619.065399
## -Terry Harper       302.980156
## -Tommy Herr         598.934922
## -Tim Hulett         365.984484
## -Terry Kennedy      25.348237
## -Tito Landrum       202.389743
## -Tim Laudner        279.237159
## -Tom Paciorek       514.218319
## -Tony Pena          573.317939
## -Terry Pendleton    378.775475
## -Tony Phillips      468.871210
## -Terry Puhl         440.451140
## -Ted Simmons        921.037584
## -Tim Teufel         292.877000
## -Tim Wallach        594.151239
## -Vince Coleman      399.914248
## -Von Hayes          765.539141
## -Vance Law          416.398595
## -Wally Backman      388.702894
## -Wade Boggs         748.920743
## -Will Clark         311.680275
## -Wally Joyner       534.939928
## -Willie McGee       500.700105
## -Willie Randolph    881.217755
## -Wayne Tolleson     419.493876
## -Willie Upshaw      746.289110
## -Willie Wilson      730.899765
```

```
pcr_fit$fitted.values[ ,1]
```

```
##      -Alan Ashby      -Alvin Davis      -Andre Dawson
##      534.899561      579.689505      904.686853
## -Andres Galarraga    -Alfredo Griffin    -Al Newman
##      263.801258      645.241123      112.509033
## -Argenis Salazar     -Andres Thomas      -Andre Thornton
##      168.771416      170.828426      950.732270
##      -Alan Trammell    -Alex Trevino       -Andy VanSlyke
##      873.626137      305.360701      436.661287
##      -Alan Wiggins     -Bill Almon         -Buddy Bell
##      293.902861      424.637802      1137.546564
## -Buddy Biancalana    -Bruce Bochy        -Barry Bonds
##      155.425391      188.802022      349.673079
## -Bobby Bonilla       -Bob Brenly         -Bill Buckner
##      306.937740      544.890543      1171.050729
##      -Brett Butler     -Bob Dernier        -Bo Diaz
##      619.469738      317.371887      527.037942
##      -Bill Doran       -Brian Downing      -Billy Hatcher
##      553.510495      1027.435942      267.743963
##      -Brook Jacoby     -Bob Kearney        -Bill Madlock
```

##	573.640397	260.145419	828.154618
##	-Bob Melvin	-BillyJo Robidoux	-Bill Schroeder
##	160.341023	157.164040	215.073201
##	-Chris Bando	-Chris Brown	-Carmen Castillo
##	270.906350	336.897882	245.695109
##	-Chili Davis	-Carlton Fisk	-Curt Ford
##	635.082343	990.813880	152.057824
##	-Carney Lansford	-Chet Lemon	-Candy Maldonado
##	800.296972	798.428045	385.565595
##	-Carmelo Martinez	-Craig Reynolds	-Cal Ripken
##	294.671148	455.357652	816.013349
##	-Cory Snyder	-Chris Speier	-Curt Wilkerson
##	354.887937	677.086225	191.328206
##	-Dave Anderson	-Don Baylor	-Daryl Boston
##	187.545893	1269.790965	185.472994
##	-Darnell Coles	-Dave Concepcion	-Doug DeCinces
##	467.833685	847.852967	977.592331
##	-Darrell Evans	-Dwight Evans	-Damaso Garcia
##	1383.033711	1243.479719	515.950461
##	-Dan Gladden	-Dave Henderson	-Donnie Hill
##	329.398060	496.785308	278.446398
##	-Davey Lopes	-Don Mattingly	-Dale Murphy
##	816.675610	836.295962	1042.609499
##	-Dwayne Murphy	-Dave Parker	-Dan Pasqua
##	679.449308	1171.990484	310.853337
##	-Darrell Porter	-Dick Schofield	-Don Slaught
##	755.609960	432.895758	353.217450
##	-Darryl Strawberry	-Dale Sveum	-Danny Tartabull
##	634.480399	225.196755	497.690849
##	-Denny Walling	-Dave Winfield	-Eric Davis
##	507.636677	1276.471160	483.696763
##	-Eddie Milner	-Eddie Murray	-Ed Romero
##	485.119308	1081.793186	277.389488
##	-Frank White	-George Bell	-Glenn Braggs
##	919.390095	718.485223	132.715774
##	-George Brett	-Greg Brock	-Gary Carter
##	1085.029508	419.812412	1094.470984
##	-Glenn Davis	-Gary Gaetti	-Greg Gagne
##	598.272618	758.507588	367.313319
##	-George Hendrick	-Glenn Hubbard	-Garth Iorg
##	926.981248	554.446465	364.614060
##	-Gary Matthews	-Graig Nettles	-Gary Pettis
##	1027.084279	1169.671530	513.097457
##	-Gary Redus	-Garry Templeton	-Greg Walker
##	409.573131	655.720706	418.405706
##	-Gary Ward	-Glenn Wilson	-Harold Baines
##	563.470479	575.422502	772.513890
##	-Hubie Brooks	-Howard Johnson	-Hal McRae
##	490.500283	288.461324	880.665049
##	-Harold Reynolds	-Harry Spilman	-Herm Winningham
##	265.629922	199.316823	140.760652
##	-Jesse Barfield	-Juan Beniquez	-John Cangelosi
##	813.355050	641.277799	313.836487
##	-Jose Canseco	-Joe Carter	-Jack Clark

##	572.503580	657.355214	702.421322
##	-Jose Cruz	-Jody Davis	-Jim Dwyer
##	1037.401914	616.777499	406.473355
##	-Julio Franco	-Jim Gantner	-Johnny Grubb
##	585.287321	597.244982	641.384815
##	-Jack Howell	-John Kruk	-Jeffrey Leonard
##	147.620802	209.574995	492.600456
##	-Jim Morrison	-John Moses	-Jerry Mumphrey
##	644.975740	303.309699	604.847517
##	-Jim Presley	-Johnny Ray	-Jeff Reed
##	578.200893	611.989854	110.651650
##	-Jim Rice	-Jerry Royster	-John Russell
##	1284.370296	506.180144	292.027107
##	-Juan Samuel	-John Shelby	-Joel Skinner
##	538.824553	379.157241	219.278494
##	-Jim Sundberg	-Jose Uribe	-Joel Youngblood
##	762.587665	320.876006	427.261739
##	-Kevin Bass	-Kal Daniels	-Kirk Gibson
##	543.844975	143.163243	736.670206
##	-Ken Griffey	-Keith Hernandez	-Kent Hrbek
##	932.393834	1113.791814	793.778528
##	-Ken Landreaux	-Kevin McReynolds	-Kevin Mitchell
##	501.784163	618.473864	264.453697
##	-Keith Moreland	-Ken Oberkfell	-Ken Phelps
##	681.565140	615.477250	508.502972
##	-Kirby Puckett	-Kurt Stillwell	-Leon Durham
##	670.663483	152.872622	712.747579
##	-Len Dykstra	-Larry Herndon	-Lee Lacy
##	365.045533	594.276399	740.600581
##	-Len Matuszek	-Lloyd Moseby	-Lance Parrish
##	237.563705	785.841661	751.767833
##	-Larry Parrish	-Larry Sheets	-Lou Whitaker
##	967.433703	335.512186	885.532137
##	-Mike Aldrete	-Marty Barrett	-Mike Davis
##	150.347333	545.723588	547.640871
##	-Mike Diaz	-Mariano Duncan	-Mike Easler
##	178.972401	273.575977	722.977781
##	-Mel Hall	-Mike Heath	-Mike Kingery
##	505.516661	431.393760	128.115086
##	-Mike LaValliere	-Mike Marshall	-Mike Pagliarulo
##	201.098914	440.652212	504.869880
##	-Mark Salas	-Mike Schmidt	-Mike Scioscia
##	231.475625	3.139113	417.086896
##	-Mickey Tettleton	-Milt Thompson	-Mitch Webster
##	241.268349	217.678139	441.881635
##	-Mookie Wilson	-Marvell Wynne	-Mike Young
##	493.624943	284.016590	401.264186
##	-Ozzie Guillen	-Oddibe McDowell	-Ozzie Smith
##	324.894309	501.810890	686.981609
##	-Ozzie Virgil	-Phil Bradley	-Phil Garner
##	444.956471	543.164445	722.623764
##	-Pete Incaviglia	-Paul Molitor	-Pete Rose
##	484.034112	672.675700	1364.617503
##	-Pat Sheridan	-Pat Tabler	-Rafael Belliard

##	279.700373	495.994651	198.022466
##	-Rick Burleson	-Randy Bush	-Rick Cerone
##	590.154782	387.072445	392.123234
##	-Ron Cey	-Rob Deer	-Rick Dempsey
##	1003.867923	519.139309	647.817829
##	-Ron Hassey	-Rickey Henderson	-Reggie Jackson
##	510.575813	966.613986	1510.284211
##	-Ron Kittle	-Ray Knight	-Rick Leach
##	477.777964	666.794783	268.118655
##	-Rick Manning	-Rance Mulliniks	-Ron Oester
##	577.536575	497.688659	564.876710
##	-Rey Quinones	-Rafael Ramirez	-Ronn Reynolds
##	181.239621	474.663241	83.573300
##	-Ron Roenicke	-Ryne Sandberg	-Rafael Santana
##	327.980139	663.468344	265.513224
##	-Rick Schu	-Ruben Sierra	-Roy Smalley
##	196.546088	299.361734	880.503862
##	-Robby Thompson	-Rob Wilfong	-Robin Yount
##	339.965596	392.450576	999.184187
##	-Steve Balboni	-Scott Bradley	-Sid Bream
##	606.290443	174.508097	483.183379
##	-Steve Buechele	-Shawon Dunston	-Scott Fletcher
##	358.938788	393.517303	473.810251
##	-Steve Garvey	-Steve Jeltz	-Steve Lombardozzi
##	1188.870771	301.844484	315.214575
##	-Spike Owen	-Steve Sax	-Tony Bernazard
##	424.370515	624.706033	714.598482
##	-Tom Brookens	-Tom Brunansky	-Tony Fernandez
##	405.608645	699.063676	524.288818
##	-Tim Flannery	-Tom Foley	-Tony Gwynn
##	388.226519	214.590496	619.065399
##	-Terry Harper	-Tommy Herr	-Tim Lulett
##	302.980156	598.934922	365.984484
##	-Terry Kennedy	-Tito Landrum	-Tim Laudner
##	25.348237	202.389743	279.237159
##	-Tom Paciorek	-Tony Pena	-Terry Pendleton
##	514.218319	573.317939	378.775475
##	-Tony Phillips	-Terry Puhl	-Ted Simmons
##	468.871210	440.451140	921.037584
##	-Tim Teufel	-Tim Wallach	-Vince Coleman
##	292.877000	594.151239	399.914248
##	-Von Hayes	-Vance Law	-Wally Backman
##	765.539141	416.398595	388.702894
##	-Wade Boggs	-Will Clark	-Wally Joyner
##	748.920743	311.680275	534.939928
##	-Willie McGee	-Willie Randolph	-Wayne Tolleson
##	500.700105	881.217755	419.493876
##	-Willie Upshaw	-Willie Wilson	
##	746.289110	730.899765	

```
b_pcr <- solve(t(Z) %*% Z) %*% t(Z) %*% y
b_pcr
```

```
##      [,1]
## [1,] 106.57139
```

```
## [2,] 21.64469
## [3,] -24.34057
## [4,] -37.05637
## [5,] 58.52540
## [6,] -62.32493
## [7,] -24.68560
## [8,] 15.85835
## [9,] 29.63320
## [10,] 99.83800
## [11,] -30.16950
## [12,] -21.03272
## [13,] -72.54015
## [14,] -277.21304
## [15,] 74.31240
## [16,] -423.53176
## [17,] 347.71831
## [18,] 562.66764
## [19,] -83.41315
```

```
yhat <- Z %*% b_pcr
```

```
yhat + mean(y)
```

```
## [,1]
## -Alan Ashby 362.13607
## -Alvin Davis 712.69521
## -Andre Dawson 1171.31111
## -Andres Galarrraga 556.78751
## -Alfredo Griffin 493.25150
## -Al Newman 247.38521
## -Argenis Salazar 70.75830
## -Andres Thomas 129.42440
## -Andre Thornton 706.10341
## -Alan Trammell 865.74907
## -Alex Trevino 237.80173
## -Andy VanSlyke 502.91783
## -Alan Wiggins 342.96013
## -Bill Almon 361.17384
## -Buddy Bell 1066.88070
## -Buddy Biancalana 87.25752
## -Bruce Bochy 177.64831
## -Barry Bonds 417.90855
## -Bobby Bonilla 324.56970
## -Bob Brenly 562.32257
## -Bill Buckner 1338.21801
## -Brett Butler 680.66805
## -Bob Dernier 292.80582
## -Bo Diaz 545.17664
## -Bill Doran 621.86526
## -Brian Downing 742.23955
## -Billy Hatcher 147.42584
## -Brook Jacoby 595.38968
## -Bob Kearney 172.45029
## -Bill Madlock 760.99757
## -Bob Melvin 162.72855
```

## -BillyJo Robidoux	325.77618
## -Bill Schroeder	204.99453
## -Chris Bando	312.89351
## -Chris Brown	385.04880
## -Carmen Castillo	254.06756
## -Chili Davis	695.62494
## -Carlton Fisk	798.80191
## -Curt Ford	260.75192
## -Carney Lansford	731.04924
## -Chet Lemon	765.89092
## -Candy Maldonado	129.39050
## -Carmelo Martinez	258.05837
## -Craig Reynolds	270.87181
## -Cal Ripken	1105.95646
## -Cory Snyder	293.69591
## -Chris Speier	235.55340
## -Curt Wilkerson	58.28587
## -Dave Anderson	134.85979
## -Don Baylor	1129.37608
## -Daryl Boston	137.28189
## -Darnell Coles	391.24947
## -Dave Concepcion	572.72023
## -Doug DeCinces	693.86774
## -Darrell Evans	1081.64350
## -Dwight Evans	1153.18169
## -Damaso Garcia	557.64634
## -Dan Gladden	391.03243
## -Dave Henderson	362.46206
## -Donnie Hill	277.84737
## -Davey Lopes	743.71691
## -Don Mattingly	1458.44408
## -Dale Murphy	1040.82838
## -Dwayne Murphy	481.12687
## -Dave Parker	1260.47123
## -Dan Pasqua	495.50389
## -Darrell Porter	392.63032
## -Dick Schofield	307.24083
## -Don Slaught	290.00378
## -Darryl Strawberry	723.53234
## -Dale Sveum	205.73340
## -Danny Tartabull	360.07062
## -Denny Walling	492.13835
## -Dave Winfield	1419.02466
## -Eric Davis	542.69321
## -Eddie Milner	313.30011
## -Eddie Murray	1635.11490
## -Ed Romero	151.34100
## -Frank White	886.24901
## -George Bell	742.80971
## -Glenn Braggs	135.16430
## -George Brett	1407.97928
## -Greg Brock	475.48206
## -Gary Carter	1173.90857
## -Glenn Davis	780.78613

## -Gary Gaetti	612.53367
## -Greg Gagne	191.59403
## -George Hendrick	888.88230
## -Glenn Hubbard	517.09720
## -Garth Iorg	312.99228
## -Gary Matthews	1054.00265
## -Graig Nettles	708.17394
## -Gary Pettis	380.29352
## -Gary Redus	498.08625
## -Garry Templeton	670.68156
## -Greg Walker	531.11449
## -Gary Ward	625.52794
## -Glenn Wilson	575.26920
## -Harold Baines	752.25825
## -Hubie Brooks	654.85110
## -Howard Johnson	336.23923
## -Hal McRae	741.10070
## -Harold Reynolds	125.08887
## -Harry Spilman	197.37420
## -Herm Winningham	210.77872
## -Jesse Barfield	902.86308
## -Juan Beniquez	690.09178
## -John Cangelosi	236.98139
## -Jose Canseco	292.78201
## -Joe Carter	555.18910
## -Jack Clark	962.73464
## -Jose Cruz	872.64315
## -Jody Davis	654.03404
## -Jim Dwyer	312.18340
## -Julio Franco	731.91901
## -Jim Gantner	584.41989
## -Johnny Grubb	481.04844
## -Jack Howell	148.53951
## -John Kruk	383.75089
## -Jeffrey Leonard	412.45475
## -Jim Morrison	614.63901
## -John Moses	144.17992
## -Jerry Mumphrey	688.33484
## -Jim Presley	314.08795
## -Johnny Ray	946.50849
## -Jeff Reed	130.47328
## -Jim Rice	1788.52448
## -Jerry Royster	366.06488
## -John Russell	352.57518
## -Juan Samuel	568.35834
## -John Shelby	197.97458
## -Joel Skinner	49.73097
## -Jim Sundberg	272.82864
## -Jose Uribe	344.01271
## -Joel Youngblood	313.13207
## -Kevin Bass	568.41659
## -Kal Daniels	256.15329
## -Kirk Gibson	780.59074
## -Ken Griffey	1037.33472

## -Keith Hernandez	1628.62826
## -Kent Hrbek	977.71844
## -Ken Landreaux	435.66143
## -Kevin McReynolds	619.41617
## -Kevin Mitchell	389.34777
## -Keith Moreland	622.21839
## -Ken Oberkfell	544.08738
## -Ken Phelps	453.68260
## -Kirby Puckett	640.69895
## -Kurt Stillwell	149.34174
## -Leon Durham	1079.42003
## -Len Dykstra	591.61217
## -Larry Herndon	540.86672
## -Lee Lacy	688.17838
## -Len Matuszek	267.92584
## -Lloyd Moseby	703.90513
## -Lance Parrish	876.39202
## -Larry Parrish	790.93350
## -Larry Sheets	299.39917
## -Lou Whitaker	885.69074
## -Mike Aldrete	283.91880
## -Marty Barrett	674.69231
## -Mike Davis	386.43544
## -Mike Diaz	347.54273
## -Mariano Duncan	168.41174
## -Mike Easler	696.70828
## -Mel Hall	497.54420
## -Mike Heath	425.08893
## -Mike Kingery	77.47730
## -Mike LaValliere	387.89277
## -Mike Marshall	280.03873
## -Mike Pagliarulo	439.89540
## -Mark Salas	164.95487
## -Mike Schmidt	250.29291
## -Mike Scioscia	424.07680
## -Mickey Tettleton	238.76602
## -Milt Thompson	303.00760
## -Mitch Webster	577.38589
## -Mookie Wilson	652.65195
## -Marvell Wynne	185.96473
## -Mike Young	430.28592
## -Ozzie Guillen	141.03860
## -Oddibe McDowell	410.97244
## -Ozzie Smith	754.70816
## -Ozzie Virgil	491.30884
## -Phil Bradley	694.90928
## -Phil Garner	525.50574
## -Pete Incaviglia	237.58587
## -Paul Molitor	749.37071
## -Pete Rose	1263.29637
## -Pat Sheridan	255.15092
## -Pat Tabler	768.42701
## -Rafael Belliard	270.14963
## -Rick Burleson	468.94834

## -Randy Bush	287.32981
## -Rick Cerone	340.73679
## -Ron Cey	904.60492
## -Rob Deer	473.59752
## -Rick Dempsey	352.88121
## -Ron Hassey	589.74809
## -Rickey Henderson	981.45067
## -Reggie Jackson	1395.12114
## -Ron Kittle	237.71435
## -Ray Knight	679.31517
## -Rick Leach	246.93216
## -Rick Manning	392.15366
## -Rance Mulliniks	440.11707
## -Ron Oester	508.35362
## -Rey Quinones	140.75995
## -Rafael Ramirez	209.38305
## -Ronn Reynolds	166.28956
## -Ron Roenicke	444.10982
## -Ryne Sandberg	1002.61887
## -Rafael Santana	282.49921
## -Rick Schu	297.65652
## -Ruben Sierra	157.54173
## -Roy Smalley	467.61059
## -Robby Thompson	397.18030
## -Rob Wilfong	167.41822
## -Robin Yount	1377.46449
## -Steve Balboni	518.65875
## -Scott Bradley	210.36365
## -Sid Bream	816.38609
## -Steve Buechele	188.24849
## -Shawon Dunston	336.35145
## -Scott Fletcher	446.45272
## -Steve Garvey	1433.31490
## -Steve Jeltz	403.64008
## -Steve Lombardozzi	329.83061
## -Spike Owen	214.63046
## -Steve Sax	875.67242
## -Tony Bernazard	799.51623
## -Tom Brookens	412.93596
## -Tom Brunansky	432.70748
## -Tony Fernandez	639.15667
## -Tim Flannery	457.11404
## -Tom Foley	353.63919
## -Tony Gwynn	770.09888
## -Terry Harper	244.66328
## -Tommy Herr	807.59695
## -Tim Hulett	15.97069
## -Terry Kennedy	296.21124
## -Tito Landrum	243.45262
## -Tim Laudner	226.95106
## -Tom Paciorek	400.35996
## -Tony Pena	847.03704
## -Terry Pendleton	293.67549
## -Tony Phillips	458.69344

```
## -Terry Puhl 343.33733
## -Ted Simmons 862.34459
## -Tim Teufel 387.20023
## -Tim Wallach 488.78712
## -Vince Coleman 315.85673
## -Von Hayes 1144.62837
## -Vance Law 426.69943
## -Wally Backman 586.27068
## -Wade Boggs 1240.33178
## -Will Clark 510.90089
## -Wally Joyner 726.99281
## -Willie McGee 622.94451
## -Willie Randolph 914.31671
## -Wayne Tolleson 243.69098
## -Willie Upshaw 1023.30030
## -Willie Wilson 705.77807
```

```
pcr_fit$fitted.values[ ,19]
```

```
## -Alan Ashby -Alvin Davis -Andre Dawson
## 362.13607 712.69521 1171.31111
## -Andres Galarraga -Alfredo Griffin -Al Newman
## 556.78751 493.25150 247.38521
## -Argenis Salazar -Andres Thomas -Andre Thornton
## 70.75830 129.42440 706.10341
## -Alan Trammell -Alex Trevino -Andy VanSlyke
## 865.74907 237.80173 502.91783
## -Alan Wiggins -Bill Almon -Buddy Bell
## 342.96013 361.17384 1066.88070
## -Buddy Biancalana -Bruce Bochy -Barry Bonds
## 87.25752 177.64831 417.90855
## -Bobby Bonilla -Bob Brenly -Bill Buckner
## 324.56970 562.32257 1338.21801
## -Brett Butler -Bob Dernier -Bo Diaz
## 680.66805 292.80582 545.17664
## -Bill Doran -Brian Downing -Billy Hatcher
## 621.86526 742.23955 147.42584
## -Brook Jacoby -Bob Kearney -Bill Madlock
## 595.38968 172.45029 760.99757
## -Bob Melvin -BillyJo Robidoux -Bill Schroeder
## 162.72855 325.77618 204.99453
## -Chris Bando -Chris Brown -Carmen Castillo
## 312.89351 385.04880 254.06756
## -Chili Davis -Carlton Fisk -Curt Ford
## 695.62494 798.80191 260.75192
## -Carney Lansford -Chet Lemon -Candy Maldonado
## 731.04924 765.89092 129.39050
## -Carmelo Martinez -Craig Reynolds -Cal Ripken
## 258.05837 270.87181 1105.95646
## -Cory Snyder -Chris Speier -Curt Wilkerson
## 293.69591 235.55340 58.28587
## -Dave Anderson -Don Baylor -Daryl Boston
## 134.85979 1129.37608 137.28189
## -Darnell Coles -Dave Concepcion -Doug DeCinces
## 391.24947 572.72023 693.86774
```


##	-Darrell Evans	-Dwight Evans	-Damaso Garcia
##	1081.64350	1153.18169	557.64634
##	-Dan Gladden	-Dave Henderson	-Donnie Hill
##	391.03243	362.46206	277.84737
##	-Davey Lopes	-Don Mattingly	-Dale Murphy
##	743.71691	1458.44408	1040.82838
##	-Dwayne Murphy	-Dave Parker	-Dan Pasqua
##	481.12687	1260.47123	495.50389
##	-Darrell Porter	-Dick Schofield	-Don Slaught
##	392.63032	307.24083	290.00378
##	-Darryl Strawberry	-Dale Sveum	-Danny Tartabull
##	723.53234	205.73340	360.07062
##	-Denny Walling	-Dave Winfield	-Eric Davis
##	492.13835	1419.02466	542.69321
##	-Eddie Milner	-Eddie Murray	-Ed Romero
##	313.30011	1635.11490	151.34100
##	-Frank White	-George Bell	-Glenn Braggs
##	886.24901	742.80971	135.16430
##	-George Brett	-Greg Brock	-Gary Carter
##	1407.97928	475.48206	1173.90857
##	-Glenn Davis	-Gary Gaetti	-Greg Gagne
##	780.78613	612.53367	191.59403
##	-George Hendrick	-Glenn Hubbard	-Garth Iorg
##	888.88230	517.09720	312.99228
##	-Gary Matthews	-Graig Nettles	-Gary Pettis
##	1054.00265	708.17394	380.29352
##	-Gary Redus	-Garry Templeton	-Greg Walker
##	498.08625	670.68156	531.11449
##	-Gary Ward	-Glenn Wilson	-Harold Baines
##	625.52794	575.26920	752.25825
##	-Hubie Brooks	-Howard Johnson	-Hal McRae
##	654.85110	336.23923	741.10070
##	-Harold Reynolds	-Harry Spilman	-Herm Winningham
##	125.08887	197.37420	210.77872
##	-Jesse Barfield	-Juan Beniquez	-John Cangelosi
##	902.86308	690.09178	236.98139
##	-Jose Canseco	-Joe Carter	-Jack Clark
##	292.78201	555.18910	962.73464
##	-Jose Cruz	-Jody Davis	-Jim Dwyer
##	872.64315	654.03404	312.18340
##	-Julio Franco	-Jim Gantner	-Johnny Grubb
##	731.91901	584.41989	481.04844
##	-Jack Howell	-John Kruk	-Jeffrey Leonard
##	148.53951	383.75089	412.45475
##	-Jim Morrison	-John Moses	-Jerry Mumphrey
##	614.63901	144.17992	688.33484
##	-Jim Presley	-Johnny Ray	-Jeff Reed
##	314.08795	946.50849	130.47328
##	-Jim Rice	-Jerry Royster	-John Russell
##	1788.52448	366.06488	352.57518
##	-Juan Samuel	-John Shelby	-Joel Skinner
##	568.35834	197.97458	49.73097
##	-Jim Sundberg	-Jose Uribe	-Joel Youngblood
##	272.82864	344.01271	313.13207

##	-Kevin Bass	-Kal Daniels	-Kirk Gibson
##	568.41659	256.15329	780.59074
##	-Ken Griffey	-Keith Hernandez	-Kent Hrbek
##	1037.33472	1628.62826	977.71844
##	-Ken Landreaux	-Kevin McReynolds	-Kevin Mitchell
##	435.66143	619.41617	389.34777
##	-Keith Moreland	-Ken Oberkfell	-Ken Phelps
##	622.21839	544.08738	453.68260
##	-Kirby Puckett	-Kurt Stillwell	-Leon Durham
##	640.69895	149.34174	1079.42003
##	-Len Dykstra	-Larry Herndon	-Lee Lacy
##	591.61217	540.86672	688.17838
##	-Len Matuszek	-Lloyd Moseby	-Lance Parrish
##	267.92584	703.90513	876.39202
##	-Larry Parrish	-Larry Sheets	-Lou Whitaker
##	790.93350	299.39917	885.69074
##	-Mike Aldrete	-Marty Barrett	-Mike Davis
##	283.91880	674.69231	386.43544
##	-Mike Diaz	-Mariano Duncan	-Mike Easler
##	347.54273	168.41174	696.70828
##	-Mel Hall	-Mike Heath	-Mike Kingery
##	497.54420	425.08893	77.47730
##	-Mike LaValliere	-Mike Marshall	-Mike Pagliarulo
##	387.89277	280.03873	439.89540
##	-Mark Salas	-Mike Schmidt	-Mike Scioscia
##	164.95487	250.29291	424.07680
##	-Mickey Tettleton	-Milt Thompson	-Mitch Webster
##	238.76602	303.00760	577.38589
##	-Mookie Wilson	-Marvell Wynne	-Mike Young
##	652.65195	185.96473	430.28592
##	-Ozzie Guillen	-Oddibe McDowell	-Ozzie Smith
##	141.03860	410.97244	754.70816
##	-Ozzie Virgil	-Phil Bradley	-Phil Garner
##	491.30884	694.90928	525.50574
##	-Pete Incaviglia	-Paul Molitor	-Pete Rose
##	237.58587	749.37071	1263.29637
##	-Pat Sheridan	-Pat Tabler	-Rafael Belliard
##	255.15092	768.42701	270.14963
##	-Rick Burleson	-Randy Bush	-Rick Cerone
##	468.94834	287.32981	340.73679
##	-Ron Cey	-Rob Deer	-Rick Dempsey
##	904.60492	473.59752	352.88121
##	-Ron Hassey	-Rickey Henderson	-Reggie Jackson
##	589.74809	981.45067	1395.12114
##	-Ron Kittle	-Ray Knight	-Rick Leach
##	237.71435	679.31517	246.93216
##	-Rick Manning	-Rance Mulliniks	-Ron Oester
##	392.15366	440.11707	508.35362
##	-Rey Quinones	-Rafael Ramirez	-Ronn Reynolds
##	140.75995	209.38305	166.28956
##	-Ron Roenicke	-Ryne Sandberg	-Rafael Santana
##	444.10982	1002.61887	282.49921
##	-Rick Schu	-Ruben Sierra	-Roy Smalley
##	297.65652	157.54173	467.61059

##	-Robby Thompson	-Rob Wilfong	-Robin Yount
##	397.18030	167.41822	1377.46449
##	-Steve Balboni	-Scott Bradley	-Sid Bream
##	518.65875	210.36365	816.38609
##	-Steve Buechele	-Shawon Dunston	-Scott Fletcher
##	188.24849	336.35145	446.45272
##	-Steve Garvey	-Steve Jeltz	-Steve Lombardozzi
##	1433.31490	403.64008	329.83061
##	-Spike Owen	-Steve Sax	-Tony Bernazard
##	214.63046	875.67242	799.51623
##	-Tom Brookens	-Tom Brunansky	-Tony Fernandez
##	412.93596	432.70748	639.15667
##	-Tim Flannery	-Tom Foley	-Tony Gwynn
##	457.11404	353.63919	770.09888
##	-Terry Harper	-Tommy Herr	-Tim Hulett
##	244.66328	807.59695	15.97069
##	-Terry Kennedy	-Tito Landrum	-Tim Laudner
##	296.21124	243.45262	226.95106
##	-Tom Paciorek	-Tony Pena	-Terry Pendleton
##	400.35996	847.03704	293.67549
##	-Tony Phillips	-Terry Puhl	-Ted Simmons
##	458.69344	343.33733	862.34459
##	-Tim Teufel	-Tim Wallach	-Vince Coleman
##	387.20023	488.78712	315.85673
##	-Von Hayes	-Vance Law	-Wally Backman
##	1144.62837	426.69943	586.27068
##	-Wade Boggs	-Will Clark	-Wally Joyner
##	1240.33178	510.90089	726.99281
##	-Willie McGee	-Willie Randolph	-Wayne Tolleson
##	622.94451	914.31671	243.69098
##	-Willie Upshaw	-Willie Wilson	
##	1023.30030	705.77807	

4) PCR coefficients in terms of the predictor variables

```
V <- svd$v
b_star <- b1 * V[, 1, drop = F]
```

```
b_star
```

```
##           [,1]
## [1,] 21.13207878
## [2,] 20.87321071
## [3,] 21.77988064
## [4,] 21.13705999
## [5,] 25.06279956
## [6,] 22.26529508
## [7,] 30.11445915
## [8,] 35.21789413
## [9,] 35.24760132
```

```
## [10,] 33.99408860
## [11,] 36.04328244
## [12,] 36.27081015
## [13,] 33.76212997
## [14,] -5.80503669
## [15,] -2.74157997
## [16,] 8.28029613
## [17,] -0.08969488
## [18,] -0.83758395
## [19,] -4.46643991
```

```
pcr_fit$coefficients[ , , 1]
```

```
##      AtBat      Hits      HmRun      Runs      RBI      Walks
## 21.13207878 20.87321071 21.77988064 21.13705999 25.06279956 22.26529508
##      Years      CAtBat      CHits      CHmRun      CRuns      CRBI
## 30.11445915 35.21789413 35.24760132 33.99408860 36.04328244 36.27081015
##      CWalks      LeagueN      DivisionW      PutOuts      Assists      Errors
## 33.76212997 -5.80503669 -2.74157997 8.28029613 -0.08969488 -0.83758395
## NewLeagueN
## -4.46643991
```

```
b_star <- matrix(0,19,19)
```

```
# Cumulative
for(i in 1:19){
  b_star[,i] <- svd$v[,1:i] %*% solve(diag(svd$d)[1:i,1:i]) %*%
    t(svd$u[,1:i]) %*% y
}
```

```
b_star[,1:2]
```

```
##      [,1]      [,2]
## [1,] 21.13207878 29.438966
## [2,] 20.87321071 29.039128
## [3,] 21.77988064 26.912608
## [4,] 21.13705999 29.312723
## [5,] 25.06279956 31.870731
## [6,] 22.26529508 27.235049
## [7,] 30.11445915 24.434849
## [8,] 35.21789413 31.042550
## [9,] 35.24760132 31.288812
## [10,] 33.99408860 31.260422
## [11,] 36.04328244 32.314419
## [12,] 36.27081015 32.632509
## [13,] 33.76212997 29.599532
## [14,] -5.80503669 -7.865898
## [15,] -2.74157997 -3.535498
## [16,] 8.28029613 11.651168
## [17,] -0.08969488 3.560723
## [18,] -0.83758395 3.507803
## [19,] -4.46643991 -6.145712
```

```
pcr_fit$coefficients[, , 1:2]
```

```
##           1 comps   2 comps
## AtBat      21.13207878 29.438966
## Hits       20.87321071 29.039128
## HmRun      21.77988064 26.912608
## Runs       21.13705999 29.312723
## RBI        25.06279956 31.870731
## Walks      22.26529508 27.235049
## Years      30.11445915 24.434849
## CAtBat     35.21789413 31.042550
## CHits      35.24760132 31.288812
## CHmRun     33.99408860 31.260422
## CRuns      36.04328244 32.314419
## CRBI       36.27081015 32.632509
## CWalks     33.76212997 29.599532
## LeagueN    -5.80503669 -7.865898
## DivisionW  -2.74157997 -3.535498
## PutOuts     8.28029613 11.651168
## Assists    -0.08969488  3.560723
## Errors     -0.83758395  3.507803
## NewLeagueN -4.46643991 -6.145712
```

Partial Least Squares Regression

```
pls_fit <- pls(Salary ~ ., data = hitters, scale = TRUE, validation = "none")

X <- model.matrix(Salary ~., hitters)
X <- X[,-1]
X <- scale(X)
y <- hitters["Salary"]
#y <- scale(hitters["Salary"])

r <- qr(X)$rank

norm <- function(a){
  return (sqrt(sum(a^2)))
}

b <- c(0) # coefficients
yhat <- matrix(0, 263, r)

w1 <- t(X) %*% y
w1 <- w1 / norm(w1)
z1 <- (X %*% w1) / as.numeric((t(w1) %*% w1))
p1 <- (t(X) %*% z1) / as.numeric((t(z1) %*% z1))
X <- X - z1 %*% t(p1)
b[1] <- (t(y) %*% z1) / as.numeric((t(z1) %*% z1)) # y
b[1] <- as.numeric(b[1])

yhat[,1] <- b[1] * z1
```

```
y <- y - (b[1] * z1)
```

```
w1
```

```
##           [,1]
## AtBat      0.225613698
## Hits       0.250704950
## HmRun      0.196042374
## Runs       0.239951404
## RBI        0.256867120
## Walks      0.253672504
## Years      0.228977607
## CAtBat     0.300689133
## CHits      0.313704738
## CHmRun     0.300000612
## CRuns      0.321573310
## CRBI       0.324023910
## CWalks     0.279935903
## LeagueN    -0.008162140
## DivisionW  -0.110023005
## PutOuts    0.171726124
## Assists    0.014536887
## Errors     -0.003086530
## NewLeagueN -0.001619909
```

```
pls_fit$loading.weights[,1]
```

```
##           AtBat      Hits      HmRun      Runs      RBI
## 0.225613698 0.250704950 0.196042374 0.239951404 0.256867120
##           Walks      Years      CAtBat      CHits      CHmRun
## 0.253672504 0.228977607 0.300689133 0.313704738 0.300000612
##           CRuns      CRBI      CWalks      LeagueN      DivisionW
## 0.321573310 0.324023910 0.279935903 -0.008162140 -0.110023005
##           PutOuts      Assists      Errors      NewLeagueN
## 0.171726124 0.014536887 -0.003086530 -0.001619909
```

```
z1
```

```
##           [,1]
## -Alan Ashby      -0.109016869
## -Alvin Davis      0.667094747
## -Andre Dawson     3.471702089
## -Andres Galarrraga -2.129859403
## -Alfredo Griffin  0.977084193
## -Al Newman       -4.003668559
## -Argenis Salazar  -3.668496934
## -Andres Thomas    -3.426206256
## -Andre Thornton   3.518419879
## -Alan Trammell     3.293191704
## -Alex Trevino     -2.301230051
## -Andy VanSlyke    -0.686753352
## -Alan Wiggins     -2.446847074
## -Bill Almon       -1.205335595
## -Buddy Bell       5.480656763
## -Buddy Biancalana -3.885201227
```

## -Bruce Bochy	-3.478168267
## -Barry Bonds	-1.350151263
## -Bobby Bonilla	-1.984359710
## -Bob Brenly	0.306549186
## -Bill Buckner	6.059721106
## -Brett Butler	1.069483194
## -Bob Dernier	-2.008647650
## -Bo Diaz	0.106237867
## -Bill Doran	0.452310476
## -Brian Downing	4.405505097
## -Billy Hatcher	-2.422475189
## -Brook Jacoby	0.612270006
## -Bob Kearney	-2.865047715
## -Bill Madlock	2.384432534
## -Bob Melvin	-3.488454774
## -BillyJo Robidoux	-3.582975253
## -Bill Schroeder	-3.107271050
## -Chris Bando	-2.539685703
## -Chris Brown	-1.756032029
## -Carmen Castillo	-2.897887550
## -Chili Davis	1.140021877
## -Carlton Fisk	3.724912592
## -Curt Ford	-3.501966570
## -Carney Lansford	2.294769649
## -Chet Lemon	2.234842582
## -Candy Maldonado	-1.388701314
## -Carmelo Martinez	-2.390093439
## -Craig Reynolds	-1.008311318
## -Cal Ripken	2.889453611
## -Cory Snyder	-1.573887344
## -Chris Speier	0.879084598
## -Curt Wilkerson	-3.523056206
## -Dave Anderson	-3.394454867
## -Don Baylor	6.559487304
## -Daryl Boston	-3.552996619
## -Darnell Coles	-0.424632585
## -Dave Concepcion	2.445077079
## -Doug DeCinces	3.808529591
## -Darrell Evans	7.788960289
## -Dwight Evans	6.489077820
## -Damaso Garcia	-0.157923762
## -Dan Gladden	-1.968369966
## -Dave Henderson	-0.555604495
## -Donnie Hill	-2.601846605
## -Davey Lopes	2.333068388
## -Don Mattingly	3.587307718
## -Dale Murphy	4.763718480
## -Dwayne Murphy	1.001834939
## -Dave Parker	5.903012676
## -Dan Pasqua	-2.071010780
## -Darrell Porter	1.293437029
## -Dick Schofield	-0.940311037
## -Don Slaught	-1.834411655
## -Darryl Strawberry	1.265291379

## -Dale Sveum	-2.897800682
## -Danny Tartabull	-0.272181904
## -Denny Walling	-0.352954077
## -Dave Winfield	6.798262415
## -Eric Davis	-0.226020494
## -Eddie Milner	-0.437144542
## -Eddie Murray	5.293002320
## -Ed Romero	-2.594410246
## -Frank White	3.420649424
## -George Bell	2.012567404
## -Glenn Braggs	-3.889398151
## -George Brett	4.761771342
## -Greg Brock	-1.052045439
## -Gary Carter	5.466992218
## -Glenn Davis	1.260980551
## -Gary Gaetti	2.123410598
## -Greg Gagne	-1.566407175
## -George Hendrick	2.997571604
## -Glenn Hubbard	0.177535219
## -Garth Iorg	-1.732043160
## -Gary Matthews	4.346777596
## -Graig Nettles	5.288291459
## -Gary Pettis	-0.049968974
## -Gary Redus	-1.095322685
## -Garry Templeton	1.028686786
## -Greg Walker	-1.190154817
## -Gary Ward	0.024401248
## -Glenn Wilson	0.751224811
## -Harold Baines	2.136357384
## -Hubie Brooks	-0.341350028
## -Howard Johnson	-2.283362630
## -Hal McRae	2.414194245
## -Harold Reynolds	-2.568424356
## -Harry Spilman	-3.385647396
## -Herm Winningham	-3.695431442
## -Jesse Barfield	2.900354339
## -Juan Beniquez	0.779922430
## -John Cangelosi	-1.935486375
## -Jose Canseco	0.550795374
## -Joe Carter	1.487546218
## -Jack Clark	1.491859899
## -Jose Cruz	4.385478361
## -Jody Davis	1.223044061
## -Jim Dwyer	-1.616247644
## -Julio Franco	0.706183728
## -Jim Gantner	0.565610252
## -Johnny Grubb	0.552606547
## -Jack Howell	-3.962291284
## -John Kruk	-3.019653872
## -Jeffrey Leonard	-0.579928228
## -Jim Morrison	1.243063332
## -John Moses	-2.277702853
## -Jerry Mumphrey	0.511024691
## -Jim Presley	0.475975628

## -Johnny Ray	1.137269838
## -Jeff Reed	-4.168254643
## -Jim Rice	6.983062100
## -Jerry Royster	-0.674243090
## -John Russell	-2.005608722
## -Juan Samuel	0.475205694
## -John Shelby	-1.476325208
## -Joel Skinner	-3.179833527
## -Jim Sundberg	1.952189221
## -Jose Uribe	-1.805482159
## -Joel Youngblood	-1.409171397
## -Kevin Bass	0.347095806
## -Kal Daniels	-3.754026332
## -Kirk Gibson	1.935776049
## -Ken Griffey	3.539560807
## -Keith Hernandez	5.905891172
## -Kent Hrbek	2.750552766
## -Ken Landreaux	-0.596967760
## -Kevin McReynolds	1.090986875
## -Kevin Mitchell	-2.308857337
## -Keith Moreland	1.620384268
## -Ken Oberkfell	0.791157118
## -Ken Phelps	-0.387204371
## -Kirby Puckett	1.537986435
## -Kurt Stillwell	-3.581297379
## -Leon Durham	2.219381531
## -Len Dykstra	-1.183404214
## -Larry Herndon	0.229212371
## -Lee Lacy	1.819336261
## -Len Matuszek	-2.923743426
## -Lloyd Moseby	2.521686366
## -Lance Parrish	1.978003322
## -Larry Parrish	3.636390540
## -Larry Sheets	-1.935038190
## -Lou Whitaker	3.378102607
## -Mike Aldrete	-3.589666858
## -Marty Barrett	0.481845456
## -Mike Davis	0.042035765
## -Mike Diaz	-3.241705979
## -Mariano Duncan	-2.367437804
## -Mike Easler	1.731517117
## -Mel Hall	-0.181697071
## -Mike Heath	-1.059525695
## -Mike Kingery	-4.100012371
## -Mike LaValliere	-2.884803787
## -Mike Marshall	-0.997636569
## -Mike Pagliarulo	-0.113963714
## -Mark Salas	-3.036402416
## -Mike Schmidt	-5.093352549
## -Mike Scioscia	-0.935664281
## -Mickey Tettleton	-2.898703363
## -Milt Thompson	-2.824312058
## -Mitch Webster	-0.376251036
## -Mookie Wilson	-0.252480871

## -Marvell Wynne	-2.445254747
## -Mike Young	-1.264350733
## -Ozzie Guillen	-1.930366288
## -Oddibe McDowell	-0.134204824
## -Ozzie Smith	1.694822466
## -Ozzie Virgil	-0.673336611
## -Phil Bradley	0.181334050
## -Phil Garner	1.377048312
## -Pete Incaviglia	-0.381477266
## -Paul Molitor	1.181050424
## -Pete Rose	6.884745171
## -Pat Sheridan	-2.528343542
## -Pat Tabler	-0.072141572
## -Rafael Belliard	-3.014006382
## -Rick Burleson	0.005246871
## -Randy Bush	-1.561934661
## -Rick Cerone	-1.579850615
## -Ron Cey	3.888835238
## -Rob Deer	0.092130042
## -Rick Dempsey	0.895532374
## -Ron Hassey	-0.280207059
## -Rickey Henderson	4.265284959
## -Reggie Jackson	8.313627283
## -Ron Kittle	-0.840061630
## -Ray Knight	1.262836425
## -Rick Leach	-2.657924148
## -Rick Manning	-0.022715814
## -Rance Mulliniks	-0.479426823
## -Ron Oester	0.393336477
## -Rey Quinones	-3.338662614
## -Rafael Ramirez	-0.574959311
## -Ronn Reynolds	-4.270224908
## -Ron Roenicke	-1.783676482
## -Ryne Sandberg	1.592097752
## -Rafael Santana	-2.295826156
## -Rick Schu	-3.135361054
## -Ruben Sierra	-2.296606079
## -Roy Smalley	2.803945408
## -Robby Thompson	-1.504046657
## -Rob Wilfong	-1.740073478
## -Robin Yount	4.257717128
## -Steve Balboni	0.919625843
## -Scott Bradley	-3.608542443
## -Sid Bream	0.323044213
## -Steve Buechele	-1.706598737
## -Shawon Dunston	-0.867529219
## -Scott Fletcher	-0.520252279
## -Steve Garvey	6.061348220
## -Steve Jeltz	-1.832877533
## -Steve Lombardozzi	-2.020500485
## -Spike Owen	-1.017179486
## -Steve Sax	1.195779758
## -Tony Bernazard	1.900625567
## -Tom Brookens	-1.404684737

```
## -Tom Brunansky      1.495259659
## -Tony Fernandez     0.271171902
## -Tim Flannery       -1.355633229
## -Tom Foley          -2.925616135
## -Tony Gwynn         1.125699219
## -Terry Harper       -2.422545480
## -Tommy Herr         0.938608380
## -Tim Hulett         -1.709245124
## -Terry Kennedy      -4.919119033
## -Tito Landrum       -3.147470296
## -Tim Laudner        -2.707915106
## -Tom Paciorek       -0.819168541
## -Tony Pena          0.817574160
## -Terry Pendleton    -1.109920228
## -Tony Phillips      -0.603829697
## -Terry Puhl         -1.332381004
## -Ted Simmons        2.831048104
## -Tim Teufel         -2.175814789
## -Tim Wallach        0.695564750
## -Vince Coleman      -0.790111860
## -Von Hayes          2.956482839
## -Vance Law          -1.019784058
## -Wally Backman      -1.139543120
## -Wade Boggs         2.358374778
## -Will Clark         -1.681342236
## -Wally Joyner       0.544625341
## -Willie McGee       -0.057645801
## -Willie Randolph    3.265348575
## -Wayne Tolleson     -1.189812453
## -Willie Upshaw      2.491700072
## -Willie Wilson      1.717116059
```

```
pls_fit$scores[,1]
```

```
##      -Alan Ashby      -Alvin Davis      -Andre Dawson
##      -0.109016869      0.667094747      3.471702089
## -Andres Galarraga    -Alfredo Griffin      -Al Newman
##      -2.129859403      0.977084193      -4.003668559
## -Argenis Salazar     -Andres Thomas    -Andre Thornton
##      -3.668496934      -3.426206256      3.518419879
##      -Alan Trammell    -Alex Trevino     -Andy VanSlyke
##      3.293191704      -2.301230051      -0.686753352
##      -Alan Wiggins     -Bill Almon       -Buddy Bell
##      -2.446847074      -1.205335595      5.480656763
## -Buddy Biancalana    -Bruce Bochy      -Barry Bonds
##      -3.885201227      -3.478168267      -1.350151263
## -Bobby Bonilla       -Bob Brenly       -Bill Buckner
##      -1.984359710      0.306549186      6.059721106
##      -Brett Butler     -Bob Dernier      -Bo Diaz
##      1.069483194      -2.008647650      0.106237867
##      -Bill Doran       -Brian Downing    -Billy Hatcher
##      0.452310476      4.405505097      -2.422475189
##      -Brook Jacoby     -Bob Kearney      -Bill Madlock
##      0.612270006      -2.865047715      2.384432534
##      -Bob Melvin      -BillyJo Robidoux -Bill Schroeder
```

##	-3.488454774	-3.582975253	-3.107271050
##	-Chris Bando	-Chris Brown	-Carmen Castillo
##	-2.539685703	-1.756032029	-2.897887550
##	-Chili Davis	-Carlton Fisk	-Curt Ford
##	1.140021877	3.724912592	-3.501966570
##	-Carney Lansford	-Chet Lemon	-Candy Maldonado
##	2.294769649	2.234842582	-1.388701314
##	-Carmelo Martinez	-Craig Reynolds	-Cal Ripken
##	-2.390093439	-1.008311318	2.889453611
##	-Cory Snyder	-Chris Speier	-Curt Wilkerson
##	-1.573887344	0.879084598	-3.523056206
##	-Dave Anderson	-Don Baylor	-Daryl Boston
##	-3.394454867	6.559487304	-3.552996619
##	-Darnell Coles	-Dave Concepcion	-Doug DeCinces
##	-0.424632585	2.445077079	3.808529591
##	-Darrell Evans	-Dwight Evans	-Damaso Garcia
##	7.788960289	6.489077820	-0.157923762
##	-Dan Gladden	-Dave Henderson	-Donnie Hill
##	-1.968369966	-0.555604495	-2.601846605
##	-Davey Lopes	-Don Mattingly	-Dale Murphy
##	2.333068388	3.587307718	4.763718480
##	-Dwayne Murphy	-Dave Parker	-Dan Pasqua
##	1.001834939	5.903012676	-2.071010780
##	-Darrell Porter	-Dick Schofield	-Don Slaught
##	1.293437029	-0.940311037	-1.834411655
##	-Darryl Strawberry	-Dale Sveum	-Danny Tartabull
##	1.265291379	-2.897800682	-0.272181904
##	-Denny Walling	-Dave Winfield	-Eric Davis
##	-0.352954077	6.798262415	-0.226020494
##	-Eddie Milner	-Eddie Murray	-Ed Romero
##	-0.437144542	5.293002320	-2.594410246
##	-Frank White	-George Bell	-Glenn Braggs
##	3.420649424	2.012567404	-3.889398151
##	-George Brett	-Greg Brock	-Gary Carter
##	4.761771342	-1.052045439	5.466992218
##	-Glenn Davis	-Gary Gaetti	-Greg Gagne
##	1.260980551	2.123410598	-1.566407175
##	-George Hendrick	-Glenn Hubbard	-Garth Iorg
##	2.997571604	0.177535219	-1.732043160
##	-Gary Matthews	-Graig Nettles	-Gary Pettis
##	4.346777596	5.288291459	-0.049968974
##	-Gary Redus	-Garry Templeton	-Greg Walker
##	-1.095322685	1.028686786	-1.190154817
##	-Gary Ward	-Glenn Wilson	-Harold Baines
##	0.024401248	0.751224811	2.136357384
##	-Hubie Brooks	-Howard Johnson	-Hal McRae
##	-0.341350028	-2.283362630	2.414194245
##	-Harold Reynolds	-Harry Spilman	-Herm Winningham
##	-2.568424356	-3.385647396	-3.695431442
##	-Jesse Barfield	-Juan Beniquez	-John Cangelosi
##	2.900354339	0.779922430	-1.935486375
##	-Jose Canseco	-Joe Carter	-Jack Clark
##	0.550795374	1.487546218	1.491859899
##	-Jose Cruz	-Jody Davis	-Jim Dwyer

##	4.385478361	1.223044061	-1.616247644
##	-Julio Franco	-Jim Gantner	-Johnny Grubb
##	0.706183728	0.565610252	0.552606547
##	-Jack Howell	-John Kruk	-Jeffrey Leonard
##	-3.962291284	-3.019653872	-0.579928228
##	-Jim Morrison	-John Moses	-Jerry Mumphrey
##	1.243063332	-2.277702853	0.511024691
##	-Jim Presley	-Johnny Ray	-Jeff Reed
##	0.475975628	1.137269838	-4.168254643
##	-Jim Rice	-Jerry Royster	-John Russell
##	6.983062100	-0.674243090	-2.005608722
##	-Juan Samuel	-John Shelby	-Joel Skinner
##	0.475205694	-1.476325208	-3.179833527
##	-Jim Sundberg	-Jose Uribe	-Joel Youngblood
##	1.952189221	-1.805482159	-1.409171397
##	-Kevin Bass	-Kal Daniels	-Kirk Gibson
##	0.347095806	-3.754026332	1.935776049
##	-Ken Griffey	-Keith Hernandez	-Kent Hrbek
##	3.539560807	5.905891172	2.750552766
##	-Ken Landreaux	-Kevin McReynolds	-Kevin Mitchell
##	-0.596967760	1.090986875	-2.308857337
##	-Keith Moreland	-Ken Oberkfell	-Ken Phelps
##	1.620384268	0.791157118	-0.387204371
##	-Kirby Puckett	-Kurt Stillwell	-Leon Durham
##	1.537986435	-3.581297379	2.219381531
##	-Len Dykstra	-Larry Herndon	-Lee Lacy
##	-1.183404214	0.229212371	1.819336261
##	-Len Matuszek	-Lloyd Moseby	-Lance Parrish
##	-2.923743426	2.521686366	1.978003322
##	-Larry Parrish	-Larry Sheets	-Lou Whitaker
##	3.636390540	-1.935038190	3.378102607
##	-Mike Aldrete	-Marty Barrett	-Mike Davis
##	-3.589666858	0.481845456	0.042035765
##	-Mike Diaz	-Mariano Duncan	-Mike Easler
##	-3.241705979	-2.367437804	1.731517117
##	-Mel Hall	-Mike Heath	-Mike Kingery
##	-0.181697071	-1.059525695	-4.100012371
##	-Mike LaValliere	-Mike Marshall	-Mike Pagliarulo
##	-2.884803787	-0.997636569	-0.113963714
##	-Mark Salas	-Mike Schmidt	-Mike Scioscia
##	-3.036402416	-5.093352549	-0.935664281
##	-Mickey Tettleton	-Milt Thompson	-Mitch Webster
##	-2.898703363	-2.824312058	-0.376251036
##	-Mookie Wilson	-Marvell Wynne	-Mike Young
##	-0.252480871	-2.445254747	-1.264350733
##	-Ozzie Guillen	-Oddibe McDowell	-Ozzie Smith
##	-1.930366288	-0.134204824	1.694822466
##	-Ozzie Virgil	-Phil Bradley	-Phil Garner
##	-0.673336611	0.181334050	1.377048312
##	-Pete Incaviglia	-Paul Molitor	-Pete Rose
##	-0.381477266	1.181050424	6.884745171
##	-Pat Sheridan	-Pat Tabler	-Rafael Belliard
##	-2.528343542	-0.072141572	-3.014006382
##	-Rick Burleson	-Randy Bush	-Rick Cerone

##	0.005246871	-1.561934661	-1.579850615
##	-Ron Cey	-Rob Deer	-Rick Dempsey
##	3.888835238	0.092130042	0.895532374
##	-Ron Hassey	-Rickey Henderson	-Reggie Jackson
##	-0.280207059	4.265284959	8.313627283
##	-Ron Kittle	-Ray Knight	-Rick Leach
##	-0.840061630	1.262836425	-2.657924148
##	-Rick Manning	-Rance Mulliniks	-Ron Oester
##	-0.022715814	-0.479426823	0.393336477
##	-Rey Quinones	-Rafael Ramirez	-Ronn Reynolds
##	-3.338662614	-0.574959311	-4.270224908
##	-Ron Roenicke	-Ryne Sandberg	-Rafael Santana
##	-1.783676482	1.592097752	-2.295826156
##	-Rick Schu	-Ruben Sierra	-Roy Smalley
##	-3.135361054	-2.296606079	2.803945408
##	-Robby Thompson	-Rob Wilfong	-Robin Yount
##	-1.504046657	-1.740073478	4.257717128
##	-Steve Balboni	-Scott Bradley	-Sid Bream
##	0.919625843	-3.608542443	0.323044213
##	-Steve Buechele	-Shawon Dunston	-Scott Fletcher
##	-1.706598737	-0.867529219	-0.520252279
##	-Steve Garvey	-Steve Jeltz	-Steve Lombardozzi
##	6.061348220	-1.832877533	-2.020500485
##	-Spike Owen	-Steve Sax	-Tony Bernazard
##	-1.017179486	1.195779758	1.900625567
##	-Tom Brookens	-Tom Brunansky	-Tony Fernandez
##	-1.404684737	1.495259659	0.271171902
##	-Tim Flannery	-Tom Foley	-Tony Gwynn
##	-1.355633229	-2.925616135	1.125699219
##	-Terry Harper	-Tommy Herr	-Tim Lulett
##	-2.422545480	0.938608380	-1.709245124
##	-Terry Kennedy	-Tito Landrum	-Tim Laudner
##	-4.919119033	-3.147470296	-2.707915106
##	-Tom Paciorek	-Tony Pena	-Terry Pendleton
##	-0.819168541	0.817574160	-1.109920228
##	-Tony Phillips	-Terry Puhl	-Ted Simmons
##	-0.603829697	-1.332381004	2.831048104
##	-Tim Teufel	-Tim Wallach	-Vince Coleman
##	-2.175814789	0.695564750	-0.790111860
##	-Von Hayes	-Vance Law	-Wally Backman
##	2.956482839	-1.019784058	-1.139543120
##	-Wade Boggs	-Will Clark	-Wally Joyner
##	2.358374778	-1.681342236	0.544625341
##	-Willie McGee	-Willie Randolph	-Wayne Tolleson
##	-0.057645801	3.265348575	-1.189812453
##	-Willie Upshaw	-Willie Wilson	
##	2.491700072	1.717116059	

p1

##	[,1]
## AtBat	0.225618535
## Hits	0.223197232
## HmRun	0.217916095
## Runs	0.224969645

```
## RBI      0.256635914
## Walks    0.229200091
## Years    0.266002421
## CAtBat   0.319851627
## CHits    0.321135571
## CHmRun   0.311269101
## CRuns    0.329115965
## CRBI     0.331190018
## CWalks   0.306858535
## LeagueN  -0.046244531
## DivisionW -0.039992026
## PutOuts  0.099952296
## Assists  0.009595614
## Errors   0.004863680
## NewLeagueN -0.032327743
```

```
pls_fit$loadings[,1]
```

```
##      AtBat      Hits      HmRun      Runs      RBI
## 0.225618535 0.223197232 0.217916095 0.224969645 0.256635914
##      Walks      Years      CAtBat      CHits      CHmRun
## 0.229200091 0.266002421 0.319851627 0.321135571 0.311269101
##      CRuns      CRBI      CWalks      LeagueN      DivisionW
## 0.329115965 0.331190018 0.306858535 -0.046244531 -0.039992026
##      PutOuts      Assists      Errors      NewLeagueN
## 0.099952296 0.009595614 0.004863680 -0.032327743
```

```
b[1]
```

```
## [1] 110.9953
```

```
pls_fit$Yloadings[,1]
```

```
## [1] 110.9953
```

```
yhat[,1]
```

```
## [1] -12.1003586  74.0443725  385.3425672 -236.4043541  108.4517397
## [6] -444.3883378 -407.1858673 -380.2927442  390.5280217  365.5287559
## [11] -255.4256883 -76.2263849 -271.5884914 -133.7865694  608.3270663
## [16] -431.2390224 -386.0602825 -149.8604260 -220.2545741  34.0255146
## [21]  672.6004788  118.7075933 -222.9504209  11.7919025  50.2043308
## [26]  488.9902993 -268.8833271  67.9590846 -318.0067912  264.6607717
## [31] -387.2020363 -397.6933638 -344.8924397 -281.8931416 -194.9112778
## [36] -321.6518581  126.5370545  413.4477395 -388.7017820  254.7086141
## [41]  248.0569922 -154.1392999 -265.2891055 -111.9178034  320.7157306
## [46] -174.6940762  97.5742465 -391.0426321 -376.7684897  728.0721711
## [51] -394.3658768 -47.1322153  271.3920303  422.7288322  864.5378769
## [56]  720.2570503 -17.5287931 -218.4797878 -61.6694800 -288.7927087
## [61]  258.9595936  398.1742470  528.7502964  111.1989559  655.2065818
## [66] -229.8724344  143.5654133 -104.3700927 -203.6110468  140.4413788
## [71] -321.6422163 -30.2109083 -39.1762388  754.5750829 -25.0872094
## [76] -48.5209836  587.4983077 -287.9673079  379.6759621  223.3854951
## [81] -431.7048612  528.5341732 -116.7720847  606.8103662  139.9628972
## [86]  235.6885671 -173.8638128  332.7163183  19.7055725 -192.2486264
## [91]  482.4718236  586.9754243  -5.5463206 -121.5756550  114.1793843
## [96] -132.1015747  2.7084236  83.3824130  237.1255994 -37.8882441
```

```
## [101] -253.4424888 267.9641813 -285.0829966 -375.7909019 -410.1754707
## [106] 321.9256601 86.5677133 -214.8298642 61.1356902 165.1106182
## [111] 165.5894165 486.7674261 135.7521257 -179.3958699 78.3830650
## [116] 62.7800718 61.3367219 -439.7956553 -335.1673460 -64.3692997
## [121] 137.9741703 -252.8142802 56.7213318 52.8310510 126.2315913
## [126] -462.6566173 775.0869768 -74.8378047 -222.6131143 52.7455920
## [131] -163.8651391 -352.9465326 216.6838014 -200.4000091 -156.4113826
## [136] 38.5259984 -416.6792274 214.8620167 392.8745650 655.5260813
## [141] 305.2983916 -66.2606074 121.0944005 -256.2722810 179.8550157
## [146] 87.8147108 -42.9778599 170.7092446 -397.5071278 246.3408884
## [151] -131.3522895 25.4414927 201.9377491 -324.5217385 279.8953000
## [156] 219.5490449 403.6222090 -214.7801178 374.9534659 -398.4361004
## [161] 53.4825744 4.6657717 -359.8140831 -262.7744367 192.1902381
## [166] -20.1675184 -117.6023578 -455.0820468 -320.1996221 -110.7329565
## [171] -12.6494350 -337.0263554 -565.3381242 -103.8543248 -321.7424096
## [176] -313.4853254 -41.7620914 -28.0241865 -271.4117506 -140.3369716
## [181] -214.2615588 -14.8961029 188.1173048 -74.7371899 20.1272247
## [186] 152.8458716 -42.3421783 131.0910299 764.1742611 -280.6342152
## [191] -8.0073744 -334.5405012 0.5823779 -173.3673849 -175.3559713
## [196] 431.6423805 10.2260004 99.3998722 -31.1016628 473.4265251
## [201] 922.7734402 -93.2428811 140.1688905 -295.0170516 -2.5213483
## [206] -53.2141175 43.6584949 -370.5758126 -63.8177733 -473.9748361
## [211] -197.9796817 176.7153458 -254.8258814 -348.0102977 -254.9124491
## [216] 311.2247233 -166.9420892 -193.1399539 472.5865315 102.0741337
## [221] -400.5312015 35.8563849 -189.4244153 -96.2916540 -57.7455506
## [226] 672.7810808 -203.4407665 -224.2660298 -112.9021282 132.7259165
## [231] 210.9604789 -155.9133845 165.9667739 30.0988029 -150.4688983
## [236] -324.7296004 124.9473070 -268.8911291 104.1811058 -189.7181518
## [241] -545.9990252 -349.3543665 -300.5658124 -90.9238467 90.7468779
## [246] -123.1959134 -67.0222501 -147.8880109 314.2329948 -241.5051853
## [251] 77.2044085 -87.6986920 328.1556591 -113.1912234 -126.4839148
## [256] 261.7684835 -186.6210628 60.4508457 -6.3984122 362.4382999
## [261] -132.0635738 276.5669627 190.5917885
```

```
pls_fit$fitted.values[, , 1]
```

```
##      -Alan Ashby      -Alvin Davis      -Andre Dawson
##      523.82552      609.97025      921.26845
## -Andres Galarraga -Alfredo Griffin      -Al Newman
##      299.52153      644.37762      91.53754
## -Argenis Salazar  -Andres Thomas      -Andre Thornton
##      128.74001      155.63314      926.45390
## -Alan Trammell    -Alex Trevino      -Andy VanSlyke
##      901.45464      280.50019      459.69950
## -Alan Wiggins     -Bill Almon      -Buddy Bell
##      264.33739      402.13931      1144.25295
## -Buddy Biancalana -Bruce Bochy      -Barry Bonds
##      104.68686      149.86560      386.06546
## -Bobby Bonilla    -Bob Brenly      -Bill Buckner
##      315.67131      569.95140      1208.52636
## -Brett Butler     -Bob Dernier      -Bo Diaz
##      654.63348      312.97546      547.71778
## -Bill Doran       -Brian Downing    -Billy Hatcher
##      586.13021      1024.91618      267.04256
## -Brook Jacoby     -Bob Kearney      -Bill Madlock
```


##	603.88497	217.91909	800.58665
##	-Bob Melvin	-BillyJo Robidoux	-Bill Schroeder
##	148.72385	138.23252	191.03344
##	-Chris Bando	-Chris Brown	-Carmen Castillo
##	254.03274	341.01460	214.27402
##	-Chili Davis	-Carlton Fisk	-Curt Ford
##	662.46294	949.37362	147.22410
##	-Carney Lansford	-Chet Lemon	-Candy Maldonado
##	790.63450	783.98287	381.78658
##	-Carmelo Martinez	-Craig Reynolds	-Cal Ripken
##	270.63678	424.00808	856.64161
##	-Cory Snyder	-Chris Speier	-Curt Wilkerson
##	361.23181	633.50013	144.88325
##	-Dave Anderson	-Don Baylor	-Daryl Boston
##	159.15739	1263.99805	141.56001
##	-Darnell Coles	-Dave Concepcion	-Doug DeCinces
##	488.79367	807.31791	958.65471
##	-Darrell Evans	-Dwight Evans	-Damaso Garcia
##	1400.46376	1256.18293	518.39709
##	-Dan Gladden	-Dave Henderson	-Donnie Hill
##	317.44609	474.25640	247.13317
##	-Davey Lopes	-Don Mattingly	-Dale Murphy
##	794.88548	934.10013	1064.67618
##	-Dwayne Murphy	-Dave Parker	-Dan Pasqua
##	647.12484	1191.13246	306.05345
##	-Darrell Porter	-Dick Schofield	-Don Slaught
##	679.49130	431.55579	332.31484
##	-Darryl Strawberry	-Dale Sveum	-Danny Tartabull
##	676.36726	214.28367	505.71497
##	-Denny Walling	-Dave Winfield	-Eric Davis
##	496.74964	1290.50096	510.83867
##	-Eddie Milner	-Eddie Murray	-Ed Romero
##	487.40490	1123.42419	247.95857
##	-Frank White	-George Bell	-Glenn Braggs
##	915.60184	759.31138	104.22102
##	-George Brett	-Greg Brock	-Gary Carter
##	1064.46006	419.15380	1142.73625
##	-Glenn Davis	-Gary Gaetti	-Greg Gagne
##	675.88878	771.61445	362.06207
##	-George Hendrick	-Glenn Hubbard	-Garth Iorg
##	868.64220	555.63145	343.67726
##	-Gary Matthews	-Graig Nettles	-Gary Pettis
##	1018.39771	1122.90131	530.37956
##	-Gary Redus	-Garry Templeton	-Greg Walker
##	414.35023	650.10527	403.82431
##	-Gary Ward	-Glenn Wilson	-Harold Baines
##	538.63431	619.30830	773.05148
##	-Hubie Brooks	-Howard Johnson	-Hal McRae
##	498.03764	282.48339	803.89006
##	-Harold Reynolds	-Harry Spilman	-Herm Winningham
##	250.84289	160.13498	125.75041
##	-Jesse Barfield	-Juan Beniquez	-John Cangelosi
##	857.85154	622.49360	321.09602
##	-Jose Canseco	-Joe Carter	-Jack Clark

##	597.06157	701.03650	701.51530
##	-Jose Cruz	-Jody Davis	-Jim Dwyer
##	1022.69331	671.67801	356.53001
##	-Julio Franco	-Jim Gantner	-Johnny Grubb
##	614.30895	598.70595	597.26260
##	-Jack Howell	-John Kruk	-Jeffrey Leonard
##	96.13023	200.75854	471.55658
##	-Jim Morrison	-John Moses	-Jerry Mumphrey
##	673.90005	283.11160	592.64721
##	-Jim Presley	-Johnny Ray	-Jeff Reed
##	588.75693	662.15747	73.26926
##	-Jim Rice	-Jerry Royster	-John Russell
##	1311.01286	461.08808	313.31277
##	-Juan Samuel	-John Shelby	-Joel Skinner
##	588.67147	372.06074	182.97935
##	-Jim Sundberg	-Jose Uribe	-Joel Youngblood
##	752.60968	335.52587	379.51450
##	-Kevin Bass	-Kal Daniels	-Kirk Gibson
##	574.45188	119.24665	750.78790
##	-Ken Griffey	-Keith Hernandez	-Kent Hrbek
##	928.80045	1191.45196	841.22427
##	-Ken Landreaux	-Kevin McReynolds	-Kevin Mitchell
##	469.66527	657.02028	279.65360
##	-Keith Moreland	-Ken Oberkfell	-Ken Phelps
##	715.78090	623.74059	492.94802
##	-Kirby Puckett	-Kurt Stillwell	-Leon Durham
##	706.63513	138.41875	782.26677
##	-Len Dykstra	-Larry Herndon	-Lee Lacy
##	404.57359	561.36737	737.86363
##	-Len Matuszek	-Lloyd Moseby	-Lance Parrish
##	211.40414	815.82118	755.47493
##	-Larry Parrish	-Larry Sheets	-Lou Whitaker
##	939.54809	321.14576	910.87935
##	-Mike Aldrete	-Marty Barrett	-Mike Davis
##	137.48978	589.40846	540.59165
##	-Mike Diaz	-Mariano Duncan	-Mike Easler
##	176.11180	273.15145	728.11612
##	-Mel Hall	-Mike Heath	-Mike Kingery
##	515.75836	418.32352	80.84384
##	-Mike LaValliere	-Mike Marshall	-Mike Pagliarulo
##	215.72626	425.19293	523.27645
##	-Mark Salas	-Mike Schmidt	-Mike Scioscia
##	198.89953	-29.41224	432.07156
##	-Mickey Tettleton	-Milt Thompson	-Mitch Webster
##	214.18347	222.44056	494.16379
##	-Mookie Wilson	-Marvell Wynne	-Mike Young
##	507.90170	264.51413	395.58891
##	-Ozzie Guillen	-Oddibe McDowell	-Ozzie Smith
##	321.66432	521.02978	724.04319
##	-Ozzie Virgil	-Phil Bradley	-Phil Garner
##	461.18869	556.05311	688.77175
##	-Pete Incaviglia	-Paul Molitor	-Pete Rose
##	493.58370	667.01691	1300.10014
##	-Pat Sheridan	-Pat Tabler	-Rafael Belliard

##	255.29167	527.91851	201.38538
##	-Rick Burleson	-Randy Bush	-Rick Cerone
##	536.50826	362.55850	360.56991
##	-Ron Cey	-Rob Deer	-Rick Dempsey
##	967.56826	546.15188	635.32575
##	-Ron Hassey	-Rickey Henderson	-Reggie Jackson
##	504.82422	1009.35241	1458.69932
##	-Ron Kittle	-Ray Knight	-Rick Leach
##	442.68300	676.09477	240.90883
##	-Rick Manning	-Rance Mulliniks	-Ron Oester
##	533.40453	482.71176	579.58438
##	-Rey Quinones	-Rafael Ramirez	-Ronn Reynolds
##	165.35007	472.10811	61.95105
##	-Ron Roenicke	-Ryne Sandberg	-Rafael Santana
##	337.94620	712.64123	281.10000
##	-Rick Schu	-Ruben Sierra	-Roy Smalley
##	187.91558	281.01343	847.15061
##	-Robby Thompson	-Rob Wilfong	-Robin Yount
##	368.98379	342.78593	1008.51241
##	-Steve Balboni	-Scott Bradley	-Sid Bream
##	638.00002	135.39468	571.78227
##	-Steve Buechele	-Shawon Dunston	-Scott Fletcher
##	346.50147	439.63423	478.18033
##	-Steve Garvey	-Steve Jeltz	-Steve Lombardozzi
##	1208.70696	332.48512	311.65985
##	-Spike Owen	-Steve Sax	-Tony Bernazard
##	423.02375	668.65180	746.88636
##	-Tom Brookens	-Tom Brunansky	-Tony Fernandez
##	380.01250	701.89266	566.02469
##	-Tim Flannery	-Tom Foley	-Tony Gwynn
##	385.45698	211.19628	660.87319
##	-Terry Harper	-Tommy Herr	-Tim Lulett
##	267.03475	640.10699	346.20773
##	-Terry Kennedy	-Tito Landrum	-Tim Laudner
##	-10.07314	186.57152	235.36007
##	-Tom Paciorek	-Tony Pena	-Terry Pendleton
##	445.00204	626.67276	412.72997
##	-Tony Phillips	-Terry Puhl	-Ted Simmons
##	468.90363	388.03787	850.15888
##	-Tim Teufel	-Tim Wallach	-Vince Coleman
##	294.42070	613.13029	448.22719
##	-Von Hayes	-Vance Law	-Wally Backman
##	864.08154	422.73466	409.44197
##	-Wade Boggs	-Will Clark	-Wally Joyner
##	797.69437	349.30482	596.37673
##	-Willie McGee	-Willie Randolph	-Wayne Tolleson
##	529.52747	898.36418	403.86231
##	-Willie Upshaw	-Willie Wilson	
##	812.49284	726.51767	

```
# dim(w1)
# [1] 19 1
# > dim(z1)
# [1] 263 1
```

```

# > dim(p1)
# [1] 19 1
#

w <- matrix(0, 19,r)
w[,1] = w1
z <- matrix(0, 263, r)
z[,1] = z1
p <- matrix(0, 19, r)
p[,1] = p1

mypls <- function(w, z, p, X, y, b){

  for(h in 2:r){
    w[,h] <- t(X) %*% y
    w[,h] <- w[,h, drop = F] / norm(w[,h, drop = F])

    z[,h] <- (X %*% w[,h, drop = F]) /
      as.numeric((t(w[,h, drop = F]) %*% w[,h, drop = F]))

    p[,h] <- (t(X) %*% z[,h, drop = F]) /
      as.numeric((t(z[,h, drop = F]) %*% z[,h, drop = F]))

    X <- X - z[,h, drop = F] %*% t(p[,h, drop = F])

    b[h] <- (t(y) %*% z[,h, drop = F]) /
      as.numeric((t(z[,h, drop = F]) %*% z[,h, drop = F]))

    b[h] <- as.numeric(b[h])

    for(i in 1:h){
      yhat[,h] <- yhat[,h] + b[i] * z[,i, drop = F]
    }

    y <- y - (b[h] * z[,h, drop = F])

  }
  return(list(w = w, z = z, p = p, b = b, yhat = yhat))
}

plsreturn <- mypls(w, z, p, X, y, b)

w <- plsreturn$w
z <- plsreturn$z
p <- plsreturn$p
b <- plsreturn$b      # y loadings
yhat <- plsreturn$yhat

head(w[,1:2])

```

```
##           [,1]           [,2]
```

```
## [1,] 0.2256137 -3.672182e-05
## [2,] 0.2507049 2.088446e-01
## [3,] 0.1960424 -1.660701e-01
## [4,] 0.2399514 1.137448e-01
## [5,] 0.2568671 1.755372e-03
## [6,] 0.2536725 1.857999e-01
```

```
head(pls_fit$loading.weights[,1:2])
```

```
##           Comp 1      Comp 2
## AtBat 0.2256137 -3.672182e-05
## Hits  0.2507049 2.088446e-01
## HmRun 0.1960424 -1.660701e-01
## Runs  0.2399514 1.137448e-01
## RBI   0.2568671 1.755372e-03
## Walks 0.2536725 1.857999e-01
```

```
head(z[,1:2])
```

```
##           [,1]      [,2]
## [1,] -0.1090169 -0.08794742
## [2,] 0.6670947 0.87856868
## [3,] 3.4717021 0.52704957
## [4,] -2.1298594 2.45419359
## [5,] 0.9770842 -0.79366161
## [6,] -4.0036686 0.14999902
```

```
head(pls_fit$scores[,1:2])
```

```
##           Comp 1      Comp 2
## -Alan Ashby -0.1090169 -0.08794742
## -Alvin Davis 0.6670947 0.87856868
## -Andre Dawson 3.4717021 0.52704957
## -Andres Galarrraga -2.1298594 2.45419359
## -Alfredo Griffin 0.9770842 -0.79366161
## -Al Newman -4.0036686 0.14999902
```

```
head(p[,1:2])
```

```
##           [,1]      [,2]
## [1,] 0.2256185 0.34657361
## [2,] 0.2231972 0.35568227
## [3,] 0.2179161 0.09120089
## [4,] 0.2249696 0.33745299
## [5,] 0.2566359 0.23123408
## [6,] 0.2292001 0.28332703
```

```
head(pls_fit$loadings[,1:2])
```

```
##           Comp 1      Comp 2
## AtBat 0.2256185 0.34657361
## Hits  0.2231972 0.35568227
## HmRun 0.2179161 0.09120089
## Runs  0.2249696 0.33745299
## RBI   0.2566359 0.23123408
## Walks 0.2292001 0.28332703
```

```

b[1:2]                # Q not coefficients? why Yloadings?

## [1] 110.99529  65.58384

pls_fit$Yloadings[,1:2]

##      Comp 1      Comp 2
## 110.99529  65.58384

# y <- hitters[, "Salary"]
( hitters[, "Salary"] - (yhat[,1] + mean(y)))

## [1] -48.825524 -129.970255 -421.268449 -208.021528 105.622378
## [6] -21.537544 -28.740015 -80.633138 173.546096 -384.311638
## [11] 231.999806 90.300503 435.662609 -162.139313 -369.252948
## [16] 70.313140 -14.865600 -286.065456 -200.671308 30.048603
## [21] -431.859361 110.366525 395.357539 202.282215 38.869787
## [26] -124.916181 -157.042555 8.615033 82.080909 49.413346
## [31] -58.723846 -70.732518 -11.033442 50.967259 -126.014604
## [36] 33.225976 152.537063 -74.373622 -77.224100 409.365504
## [41] -108.982874 33.213418 69.363223 -7.341079 493.358387
## [46] -271.231806 -358.500129 85.116750 65.842608 -313.998053
## [51] -66.560005 -383.793667 -487.317912 -108.654714 -865.463759
## [56] -322.849932 331.602911 -107.446094 -149.256402 27.866827
## [61] -344.885476 1040.899871 835.323821 -47.124838 -149.465464
## [66] -196.053448 -419.491295 43.444211 99.185165 543.632739
## [71] -144.283666 -360.714974 98.250357 570.959035 -210.838673
## [76] 2.595101 1336.575810 127.041426 -165.601844 415.688623
## [81] -34.221021 435.539945 -34.153797 782.834752 -460.888779
## [86] 128.385551 -207.062069 -168.642200 -20.631455 18.822744
## [91] -285.064706 -922.901306 -130.379562 -14.350227 87.394734
## [96] 96.175693 61.365694 43.191705 176.948519 251.962362
## [101] 15.016607 -478.890063 -163.342885 14.865020 -35.750411
## [106] 379.648458 -192.493595 -221.096018 -432.061572 -451.036500
## [111] 598.484701 -249.360308 336.654992 -81.530012 160.691053
## [116] 251.294046 -232.262604 -1.130227 -90.758536 -371.556582
## [121] -396.400052 -203.111602 7.352786 -388.756933 -5.157473
## [126] 1.730735 1101.487141 -211.088077 -158.312768 51.328526
## [131] -72.060743 -72.979350 72.390316 -140.525873 70.485500
## [136] 55.548119 -32.746655 549.212101 71.199553 608.548037
## [141] 468.775726 267.834725 -32.020283 -154.653601 327.552102
## [146] 101.259407 -192.948022 -341.635127 -63.418754 401.066229
## [151] -202.073593 -336.367375 -212.863631 53.595856 -28.321182
## [156] 44.525073 -352.048091 -176.145764 -490.879348 -62.489782
## [161] -14.408456 239.408346 -86.111799 -123.151445 -28.116120
## [166] 34.241636 231.676476 -12.843835 -115.726260 244.807074
## [171] -348.276447 -61.899527 2156.745242 442.928443 -94.183473
## [176] -82.440557 -284.163791 292.098304 -24.514132 -45.588911
## [181] -146.664323 -321.029779 1215.956813 238.811308 193.946893
## [186] -238.771754 -321.583704 592.983088 -550.100143 -65.291667
## [191] 52.081492 -71.385381 -86.508260 -62.558497 -110.569911
## [196] 82.431737 -331.151883 -235.325754 55.175781 660.647593
## [201] -971.199322 -17.683001 -176.094773 9.091169 -133.404534
## [206] -32.711765 170.415623 -95.350070 402.891891 128.048954
## [211] -146.946200 27.358772 -31.100001 -47.915584 -183.513433

```

```
## [216] -107.150605 -228.983793 -1.118928 -8.512414 -538.000016
## [221] -45.394681 -371.782267 -211.501467 -284.634228 -3.180332
## [226] 241.293037 -182.485116 -206.659852 -73.023754 -578.651799
## [231] -216.886361 -38.345498 238.107344 -216.024685 -58.789984
## [236] 38.803718 79.126811 157.965247 284.893012 -161.207730
## [241] 930.073143 100.095484 9.639930 -210.002035 523.327240
## [246] -252.729969 -43.903632 511.962129 -350.158877 -16.920697
## [251] 136.869709 -288.227190 435.918459 102.265341 140.558033
## [256] 802.305634 -229.304819 -431.376728 170.472530 -23.364182
## [261] -18.862308 147.507155 273.482329
```

again, why + mean(y)? both doesn't have intercept

```
pls_fit$residuals[,1]
```

```
##      -Alan Ashby      -Alvin Davis      -Andre Dawson
##      -48.825524      -129.970255      -421.268449
## -Andres Galarraaga -Alfredo Griffin      -Al Newman
##      -208.021528      105.622378      -21.537544
## -Argenis Salazar   -Andres Thomas   -Andre Thornton
##      -28.740015      -80.633138      173.546096
##      -Alan Trammell   -Alex Trevino   -Andy VanSlyke
##      -384.311638      231.999806      90.300503
##      -Alan Wiggins    -Bill Almon    -Buddy Bell
##      435.662609      -162.139313      -369.252948
## -Buddy Biancalana   -Bruce Bochy   -Barry Bonds
##      70.313140      -14.865600      -286.065456
## -Bobby Bonilla      -Bob Brenly   -Bill Buckner
##      -200.671308      30.048603      -431.859361
## -Brett Butler       -Bob Dernier   -Bo Diaz
##      110.366525      395.357539      202.282215
##      -Bill Doran      -Brian Downing -Billy Hatcher
##      38.869787      -124.916181      -157.042555
## -Brook Jacoby       -Bob Kearney   -Bill Madlock
##      8.615033      82.080909      49.413346
##      -Bob Melvin     -BillyJo Robidoux -Bill Schroeder
##      -58.723846      -70.732518      -11.033442
##      -Chris Bando     -Chris Brown   -Carmen Castillo
##      50.967259      -126.014604      33.225976
##      -Chili Davis     -Carlton Fisk   -Curt Ford
##      152.537063      -74.373622      -77.224100
## -Carney Lansford    -Chet Lemon    -Candy Maldonado
##      409.365504      -108.982874      33.213418
## -Carmelo Martinez   -Craig Reynolds -Cal Ripken
##      69.363223      -7.341079      493.358387
##      -Cory Snyder     -Chris Speier   -Curt Wilkerson
##      -271.231806      -358.500129      85.116750
## -Dave Anderson      -Don Baylor     -Daryl Boston
##      65.842608      -313.998053      -66.560005
## -Darnell Coles      -Dave Concepcion -Doug DeCinces
##      -383.793667      -487.317912      -108.654714
## -Darrell Evans      -Dwight Evans   -Damaso Garcia
##      -865.463759      -322.849932      331.602911
##      -Dan Gladden     -Dave Henderson -Donnie Hill
##      -107.446094      -149.256402      27.866827
```

##	-Davey Lopes	-Don Mattingly	-Dale Murphy
##	-344.885476	1040.899871	835.323821
##	-Dwayne Murphy	-Dave Parker	-Dan Pasqua
##	-47.124838	-149.465464	-196.053448
##	-Darrell Porter	-Dick Schofield	-Don Slaught
##	-419.491295	43.444211	99.185165
##	-Darryl Strawberry	-Dale Sveum	-Danny Tartabull
##	543.632739	-144.283666	-360.714974
##	-Denny Walling	-Dave Winfield	-Eric Davis
##	98.250357	570.959035	-210.838673
##	-Eddie Milner	-Eddie Murray	-Ed Romero
##	2.595101	1336.575810	127.041426
##	-Frank White	-George Bell	-Glenn Braggs
##	-165.601844	415.688623	-34.221021
##	-George Brett	-Greg Brock	-Gary Carter
##	435.539945	-34.153797	782.834752
##	-Glenn Davis	-Gary Gaetti	-Greg Gagne
##	-460.888779	128.385551	-207.062069
##	-George Hendrick	-Glenn Hubbard	-Garth Iorg
##	-168.642200	-20.631455	18.822744
##	-Gary Matthews	-Graig Nettles	-Gary Pettis
##	-285.064706	-922.901306	-130.379562
##	-Gary Redus	-Garry Templeton	-Greg Walker
##	-14.350227	87.394734	96.175693
##	-Gary Ward	-Glenn Wilson	-Harold Baines
##	61.365694	43.191705	176.948519
##	-Hubie Brooks	-Howard Johnson	-Hal McRae
##	251.962362	15.016607	-478.890063
##	-Harold Reynolds	-Harry Spilman	-Herm Winningham
##	-163.342885	14.865020	-35.750411
##	-Jesse Barfield	-Juan Beniquez	-John Cangelosi
##	379.648458	-192.493595	-221.096018
##	-Jose Canseco	-Joe Carter	-Jack Clark
##	-432.061572	-451.036500	598.484701
##	-Jose Cruz	-Jody Davis	-Jim Dwyer
##	-249.360308	336.654992	-81.530012
##	-Julio Franco	-Jim Gantner	-Johnny Grubb
##	160.691053	251.294046	-232.262604
##	-Jack Howell	-John Kruk	-Jeffrey Leonard
##	-1.130227	-90.758536	-371.556582
##	-Jim Morrison	-John Moses	-Jerry Mumphrey
##	-396.400052	-203.111602	7.352786
##	-Jim Presley	-Johnny Ray	-Jeff Reed
##	-388.756933	-5.157473	1.730735
##	-Jim Rice	-Jerry Royster	-John Russell
##	1101.487141	-211.088077	-158.312768
##	-Juan Samuel	-John Shelby	-Joel Skinner
##	51.328526	-72.060743	-72.979350
##	-Jim Sundberg	-Jose Uribe	-Joel Youngblood
##	72.390316	-140.525873	70.485500
##	-Kevin Bass	-Kal Daniels	-Kirk Gibson
##	55.548119	-32.746655	549.212101
##	-Ken Griffey	-Keith Hernandez	-Kent Hrbek
##	71.199553	608.548037	468.775726

##	-Ken Landreaux	-Kevin McReynolds	-Kevin Mitchell
##	267.834725	-32.020283	-154.653601
##	-Keith Moreland	-Ken Oberkfell	-Ken Phelps
##	327.552102	101.259407	-192.948022
##	-Kirby Puckett	-Kurt Stillwell	-Leon Durham
##	-341.635127	-63.418754	401.066229
##	-Len Dykstra	-Larry Herndon	-Lee Lacy
##	-202.073593	-336.367375	-212.863631
##	-Len Matuszek	-Lloyd Moseby	-Lance Parrish
##	53.595856	-28.321182	44.525073
##	-Larry Parrish	-Larry Sheets	-Lou Whitaker
##	-352.048091	-176.145764	-490.879348
##	-Mike Aldrete	-Marty Barrett	-Mike Davis
##	-62.489782	-14.408456	239.408346
##	-Mike Diaz	-Mariano Duncan	-Mike Easler
##	-86.111799	-123.151445	-28.116120
##	-Mel Hall	-Mike Heath	-Mike Kingery
##	34.241636	231.676476	-12.843835
##	-Mike LaValliere	-Mike Marshall	-Mike Pagliarulo
##	-115.726260	244.807074	-348.276447
##	-Mark Salas	-Mike Schmidt	-Mike Scioscia
##	-61.899527	2156.745242	442.928443
##	-Mickey Tettleton	-Milt Thompson	-Mitch Webster
##	-94.183473	-82.440557	-284.163791
##	-Mookie Wilson	-Marvell Wynne	-Mike Young
##	292.098304	-24.514132	-45.588911
##	-Ozzie Guillen	-Oddibe McDowell	-Ozzie Smith
##	-146.664323	-321.029779	1215.956813
##	-Ozzie Virgil	-Phil Bradley	-Phil Garner
##	238.811308	193.946893	-238.771754
##	-Pete Incaviglia	-Paul Molitor	-Pete Rose
##	-321.583704	592.983088	-550.100143
##	-Pat Sheridan	-Pat Tabler	-Rafael Belliard
##	-65.291667	52.081492	-71.385381
##	-Rick Burleson	-Randy Bush	-Rick Cerone
##	-86.508260	-62.558497	-110.569911
##	-Ron Cey	-Rob Deer	-Rick Dempsey
##	82.431737	-331.151883	-235.325754
##	-Ron Hassey	-Rickey Henderson	-Reggie Jackson
##	55.175781	660.647593	-971.199322
##	-Ron Kittle	-Ray Knight	-Rick Leach
##	-17.683001	-176.094773	9.091169
##	-Rick Manning	-Rance Mulliniks	-Ron Oester
##	-133.404534	-32.711765	170.415623
##	-Rey Quinones	-Rafael Ramirez	-Ronn Reynolds
##	-95.350070	402.891891	128.048954
##	-Ron Roenicke	-Ryne Sandberg	-Rafael Santana
##	-146.946200	27.358772	-31.100001
##	-Rick Schu	-Ruben Sierra	-Roy Smalley
##	-47.915584	-183.513433	-107.150605
##	-Robby Thompson	-Rob Wilfong	-Robin Yount
##	-228.983793	-1.118928	-8.512414
##	-Steve Balboni	-Scott Bradley	-Sid Bream
##	-538.000016	-45.394681	-371.782267

##	-Steve Buechele	-Shawon Dunston	-Scott Fletcher
##	-211.501467	-284.634228	-3.180332
##	-Steve Garvey	-Steve Jeltz	-Steve Lombardozzi
##	241.293037	-182.485116	-206.659852
##	-Spike Owen	-Steve Sax	-Tony Bernazard
##	-73.023754	-578.651799	-216.886361
##	-Tom Brookens	-Tom Brunansky	-Tony Fernandez
##	-38.345498	238.107344	-216.024685
##	-Tim Flannery	-Tom Foley	-Tony Gwynn
##	-58.789984	38.803718	79.126811
##	-Terry Harper	-Tommy Herr	-Tim Lulett
##	157.965247	284.893012	-161.207730
##	-Terry Kennedy	-Tito Landrum	-Tim Laudner
##	930.073143	100.095484	9.639930
##	-Tom Paciorek	-Tony Pena	-Terry Pendleton
##	-210.002035	523.327240	-252.729969
##	-Tony Phillips	-Terry Puhl	-Ted Simmons
##	-43.903632	511.962129	-350.158877
##	-Tim Teufel	-Tim Wallach	-Vince Coleman
##	-16.920697	136.869709	-288.227190
##	-Von Hayes	-Vance Law	-Wally Backman
##	435.918459	102.265341	140.558033
##	-Wade Boggs	-Will Clark	-Wally Joyner
##	802.305634	-229.304819	-431.376728
##	-Willie McGee	-Willie Randolph	-Wayne Tolleson
##	170.472530	-23.364182	-18.862308
##	-Willie Upshaw	-Willie Wilson	
##	147.507155	273.482329	