Name Jerry

Student Number

# STA 441s 2024 Quiz 8

1. For the Diversity data,

   (a) (3 points) give the lower and upper 95% prediction interval for employee 508. The answer is a pair of numbers. Write the two numbers in the space below. On your printout, circle the numbers and write "Question 1a" beside them.

   11.8346, 22.8328

   (b) (3 points) What percentage of of the observations in the replication sample were within the prediction interval? The answer is a number between zero and one hundred. Write the number in the space below. On your printout, circle the number and write "Question 1b" beside it.

   93.7

2. For the Raptors data, you fit a first-order autoregressive model. Based on that model,

   (a) (1 point) What is the estimated first-order autocorrelation between the error terms? The answer is a number on your printout. Write the number in the space below. On your printout, circle the number and write "Question 2a" beside it.

   0.1752

   (b) (1 point) You tested Home versus away game, controlling for Opponents' won-lost record, Days since last game, and Weekend versus weekday. Please fill in the table below

| $t$, $\chi^2$ or $F$ Statistic (a number) | $p$-value (a number or range) | Reject $H_0$? (Yes or No) | Statistically Significant? (Yes or No) |
|---|---|---|---|
| t = 4.05 | 0.0001 | Yes | Yes |

   On your printout, circle the test statistic and write "Question 2b" beside it.

   (c) (2 points) In plain, non-statistical language, what do you conclude from the test of Home versus away? Don't touch the time series issue.

   Allowing for opponent's won-lost record, days since last game and weekend versus weekday, the Raptors did better at home.

```
1          OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
72
73         /* 441s24HW8DiversityPred.sas  */
74         title 'STA441s24 HW8 Check: Prediction for the Diversity Data';
75
76         /* Read data from Excel spreadsheets */
77         proc import datafile="/home/u1407221/441s24/data/DiversityExplore.xlsx"
78                     out=explor dbms=xlsx replace;
79                     getnames=yes;

NOTE: One or more variables were converted because the data type is not supported by the V9 engine. For more details, run with
      options MSGLEVEL=I.
NOTE: The import data set has 500 observations and 47 variables.
NOTE: WORK.EXPLOR data set was successfully created.
NOTE: PROCEDURE IMPORT used (Total process time):
      real time           0.20 seconds
      user cpu time       0.20 seconds
      system cpu time     0.00 seconds
      memory              3640.78k
      OS Memory           37376.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        129  Switch Count  4
      Page Faults                       0
      Page Reclaims                     809
      Page Swaps                        0
      Voluntary Context Switches        29
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           520


80         proc import datafile="/home/u1407221/441s24/data/DiversityReplic.xlsx"
81                     out=replic dbms=xlsx replace;
82                     getnames=yes;
83

NOTE: One or more variables were converted because the data type is not supported by the V9 engine. For more details, run with
      options MSGLEVEL=I.
NOTE: The import data set has 500 observations and 47 variables.
NOTE: WORK.REPLIC data set was successfully created.
NOTE: PROCEDURE IMPORT used (Total process time):
      real time           0.22 seconds
      user cpu time       0.22 seconds
      system cpu time     0.01 seconds
      memory              3640.78k
      OS Memory           37376.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        130  Switch Count  4
      Page Faults                       0
      Page Reclaims                     706
      Page Swaps                        0
      Voluntary Context Switches        31
      Involuntary Context Switches      1
      Block Input Operations            0
      Block Output Operations           520


84         proc format;
85              value ynfmt  0 = 'No'  1 = 'Yes';
NOTE: Format YNFMT is already on the library WORK.FORMATS.
NOTE: Format YNFMT has been output.
86              value sexfmt 0 = 'Male' 1 = 'Female';
NOTE: Format SEXFMT is already on the library WORK.FORMATS.
NOTE: Format SEXFMT has been output.
87              value marfmt 1 = 'Never married'
88                           2 = 'Married'
89                           3 = 'Divorced or separated'
90                           4 = 'Widowed';
NOTE: Format MARFMT is already on the library WORK.FORMATS.
NOTE: Format MARFMT has been output.
91

NOTE: PROCEDURE FORMAT used (Total process time):
      real time           0.00 seconds
      user cpu time       0.00 seconds
      system cpu time     0.00 seconds
      memory              257.21k
      OS Memory           34728.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        131  Switch Count  0
      Page Faults                       0
      Page Reclaims                     17
      Page Swaps                        0
```

```
      Voluntary Context Switches        0
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           40


92         data diversity;
93              set explor replic; /* Combined data set */
94              /* Convert some character variables to numeric.
95                 Must have different names. First the dummy variables. */
96              if id<501 then sample=1; else sample=2;
97              sex = input(Gender, 8.); minority = input(VisMinority, 8.);
98              foreign = input(CAN_Foreign_Born, 8.);
99              education = input(EDUClevel, 8.); /* Numeric version of education level */
100             mstatus = input(MaritalStatus, 8.);
101             /* I really want age to have the same name. */
102             numericage = input(age, 8.);
103             drop age; rename numericage=age;
104             /* Indicator for Married */
105            if mstatus = . then married = .;
106               else if mstatus = 2 then married = 1;
107               else married = 0;
108             /* Compute scales */
109             comorg = sum(of com1-com10);
110             relcol = sum(of relc1-relc5);
111             relman = sum(of relm1-relm12);
112             fairad = sum(of fair1-fair6);
113             jobsat = sum(of sat1-sat4);
114             comdiv = sum(of sm1-sm3);
115             label
116                mstatus  = 'Marital Status'
117         comorg   = 'Commitment to the organization'
118             relcol   = 'Relations with colleagues at work'
119             relman   = 'Relations with magnagement'
120             fairad   = 'Fair opportunities for advancement'
121             jobsat   = 'Job satisfaction'
122             comdiv   = "Senior management's commitment to diversity"
123             minority = 'Visible minority'
124             foreign  = 'Born outside Canada'
125             educ     = 'Numeric EDUClevel';
126
127             format sex sexfmt.;
128             format minority foreign married ynfmt.;
129             format mstatus marfmt.;
130
131        /*
132        proc freq data=diversity;
133             tables sample;
134             tables id*sample / norow nocol nopercent missing;
135        */
136

NOTE: Variable educ is uninitialized.
NOTE: There were 500 observations read from the data set WORK.EXPLOR.
NOTE: There were 500 observations read from the data set WORK.REPLIC.
NOTE: The data set WORK.DIVERSITY has 1000 observations and 60 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      user cpu time       0.01 seconds
      system cpu time     0.00 seconds
      memory              2132.15k
      OS Memory           35508.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        132  Switch Count  2
      Page Faults                       0
      Page Reclaims                     145
      Page Swaps                        0
      Voluntary Context Switches        13
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           1032


137        data predict;
138             set diversity;
139             keeper =  jobsat+relcol+relman+fairad+minority;
140             /* keeper will be missing if any of the vars are missing */
141             if keeper ne .; /* Discards all other cases */
142             jobsat2 = jobsat; /* Save value of jobsat for future use */
143             if sample=2 then jobsat=. ;
144             /* Response variable is now missing for replication sample.
145                But it is preserved in jobsat2 */
146

NOTE: Missing values were generated as a result of performing an operation on missing values.
```

```
      Each place is given by: (Number of times) at (Line):(Column).
      53 at 139:43
NOTE: There were 1000 observations read from the data set WORK.DIVERSITY.
NOTE: The data set WORK.PREDICT has 947 observations and 62 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      user cpu time       0.00 seconds
      system cpu time     0.00 seconds
      memory              1892.87k
      OS Memory           35504.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        133  Switch Count  2
      Page Faults                       0
      Page Reclaims                     161
      Page Swaps                        0
      Voluntary Context Switches        13
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           1040


147         proc reg plots=none data=predict;
148              title2 'Re-running the 4-var Model to generate y-hat and prediction intervals';
149              model jobsat = relcol relman fairad minority;
150              output out = predata    predicted = Yhat
151                                      L95       = lowpred
152                                      U95       = hipred;
153              /* Data set predata has everything in predict plus
154                 Yhat and the lower and upper 95% prediction limits. */
155

NOTE: The data set WORK.PREDATA has 947 observations and 65 variables.
NOTE: PROCEDURE REG used (Total process time):
      real time           0.06 seconds
      user cpu time       0.06 seconds
      system cpu time     0.01 seconds
      memory              6173.37k
      OS Memory           37832.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        134  Switch Count  4
      Page Faults                       0
      Page Reclaims                     534
      Page Swaps                        0
      Voluntary Context Switches        33
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           1088


156         proc print data=predata(obs=10);
157              title2 'Q1a: First 10 cases of rplication sample';
158              var id relcol relman fairad minority jobsat2 Yhat lowpred hipred;
159              where sample=2;
160

NOTE: There were 10 observations read from the data set WORK.PREDATA.
      WHERE sample=2;
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.02 seconds
      user cpu time       0.02 seconds
      system cpu time     0.00 seconds
      memory              1560.43k
      OS Memory           36528.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        135  Switch Count  1
      Page Faults                       0
      Page Reclaims                     174
      Page Swaps                        0
      Voluntary Context Switches        10
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           24


161         proc iml;
NOTE: IML Ready
162              title2 'Predicted y for the first case should be 9.6871';
163              b0 = 3.14157;
163      !                    b1 = 0.11140;
163      !                                b2 = 0.06051;
163      !                                            b3 = 0.33468;
163      !                                                        b4 = -0.94482;
164              yhat = b0 + b1*16 + b2*40 + b3*7 + b4*0 ;
164      !                                            print yhat;
165
```

```
166
167        /* Does 95 Percent Prediction Interval really contain 95 percent of values?  */
168
NOTE: Exiting IML.
NOTE: PROCEDURE IML used (Total process time):
      real time           0.00 seconds
      user cpu time       0.01 seconds
      system cpu time     0.00 seconds
      memory              482.75k
      OS Memory           36008.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        136  Switch Count  1
      Page Faults                       0
      Page Reclaims                     95
      Page Swaps                        0
      Voluntary Context Switches        11
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           16


169        data predictB;
170             set predata;
171             if (lowpred < jobsat2 < hipred) then ininterval='Yes';
172                else ininterval='No';
173

NOTE: There were 947 observations read from the data set WORK.PREDATA.
NOTE: The data set WORK.PREDICTB has 947 observations and 66 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      user cpu time       0.00 seconds
      system cpu time     0.00 seconds
      memory              1895.09k
      OS Memory           36784.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        137  Switch Count  2
      Page Faults                       0
      Page Reclaims                     185
      Page Swaps                        0
      Voluntary Context Switches        14
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           1032


174        proc freq data=predictB;
175             title2 'Does 95 Percent Prediction Interval Work?';
176             tables sample * ininterval / nocol nopercent;
177
178        quit;

NOTE: There were 947 observations read from the data set WORK.PREDICTB.
NOTE: PROCEDURE FREQ used (Total process time):
      real time           0.01 seconds
      user cpu time       0.02 seconds
      system cpu time     0.00 seconds
      memory              1723.12k
      OS Memory           37044.00k
      Timestamp           03/08/2024 02:07:32 AM
      Step Count                        138  Switch Count  5
      Page Faults                       0
      Page Reclaims                     254
      Page Swaps                        0
      Voluntary Context Switches        35
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           528


179
180
181
182
183
184        OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
196
```

## STA441s24 HW8 Check: Prediction for the Diversity Data
## Re-running the 4-var Model to generate y-hat and prediction intervals

**The REG Procedure**
**Model: MODEL1**
**Dependent Variable: jobsat Job satisfaction**

| | |
|---|---|
| Number of Observations Read | 947 |
| Number of Observations Used | 471 |
| Number of Observations with Missing Values | 476 |

**Analysis of Variance**

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 4 | 2818.95457 | 704.73864 | 90.58 | <.0001 |
| Error | 466 | 3625.81401 | 7.78072 | | |
| Corrected Total | 470 | 6444.76858 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 2.78939 | R-Square | 0.4374 |
| Dependent Mean | 14.78769 | Adj R-Sq | 0.4326 |
| Coeff Var | 18.86295 | | |

**Parameter Estimates**

| Variable | Label | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|---|
| Intercept | Intercept | 1 | 3.14157 | 0.83473 | 3.76 | 0.0002 |
| relcol | Relations with colleagues at work | 1 | 0.11140 | 0.04600 | 2.42 | 0.0158 |
| relman | Relations with magnagement | 1 | 0.06051 | 0.01685 | 3.59 | 0.0004 |
| fairad | Fair opportunities for advancement | 1 | 0.33468 | 0.03597 | 9.30 | <.0001 |
| minority | Visible minority | 1 | -0.94482 | 0.28033 | -3.37 | 0.0008 |

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## STA441s24 HW8 Check: Prediction for the Diversity Data
## Q1a: First 10 cases of rplication sample

| Obs | id | relcol | relman | fairad | minority | jobsat2 | Yhat | lowpred | hipred |
|---|---|---|---|---|---|---|---|---|---|
| 472 | 501 | 16 | 40 | 7 | No | 7 | 9.6871 | 4.1336 | 15.2405 |
| 473 | 502 | 22 | 54 | 24 | Yes | 15 | 15.9473 | 10.4421 | 21.4525 |
| 474 | 503 | 20 | 37 | 19 | Yes | 8 | 13.0225 | 7.5159 | 18.5291 |
| 475 | 504 | 24 | 41 | 18 | No | 16 | 14.3202 | 8.8169 | 19.8235 |
| 476 | 505 | 20 | 59 | 24 | No | 19 | 16.9719 | 11.4654 | 22.4783 |
| 477 | 506 | 25 | 58 | 26 | No | 19 | 18.1377 | 12.6376 | 23.6378 |
| 478 | 507 | 22 | 48 | 24 | No | 16 | 16.5291 | 11.0360 | 22.0221 |
| 479 | 508 | 23 | 54 | 25 | No | 14 | 17.3382 | 11.8436 | 22.8328 |
| 480 | 509 | 16 | 37 | 17 | Yes | 12 | 11.9075 | 6.3931 | 17.4219 |
| 481 | 510 | 21 | 48 | 20 | No | 13 | 15.0790 | 9.5880 | 20.5699 |

Question 1a

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## STA441s24 HW8 Check: Prediction for the Diversity Data
## Predicted y for the first case should be 9.6871

| yhat |
|---|
| 9.68713 |

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## STA441s24 HW8 Check: Prediction for the Diversity Data
## Does 95 Percent Prediction Interval Work?

**The FREQ Procedure**

| Frequency<br>Row Pct | Table of sample by ininterval | | |
|---|---|---|---|
| | ininterval | | |
| sample | No | Yes | Total |
| 1 | 25<br>5.31 | 446<br>94.69 | 471 |
| 2 | 30<br>6.30 | 446<br>93.70 | 476 |
| Total | 55 | 892 | 947 |

Question 1b

```
1          OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
72
73
74         proc reg data=bball plots=none;
75          title2 'Q2A: Basic OLS Model with proc reg';
76              model ptspread = record home dayslg weekend  / dwprob;
77              /* output out=bball2 residual=rspread; */
78

NOTE: PROCEDURE REG used (Total process time):
      real time           0.07 seconds
      user cpu time       0.08 seconds
      system cpu time     0.01 seconds
      memory              4962.68k
      OS Memory           33728.00k
      Timestamp           03/08/2024 01:09:57 AM
      Step Count                        39  Switch Count  2
      Page Faults                       0
      Page Reclaims                     519
      Page Swaps                        0
      Voluntary Context Switches        14
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           56


79         proc autoreg data=bball;
80              title2 'Q2B: First order autoregression';
81              model ptspread = record dayslg home weekend  / nlag=1 method = ml;
82

NOTE: The graph in the RTF(WEB) destination will be rendered as an image due to the use of a gradient contour.
NOTE: The graph in the RTF(WEB) destination will be rendered as an image due to the use of a surface plot.
NOTE: The graph in the RTF(WEB) destination will be rendered as an image due to the use of a bivariate histogram.
NOTE: The graph in the PDF(WEB) destination will be rendered as an image due to the use of a gradient contour.
NOTE: The graph in the PDF(WEB) destination will be rendered as an image due to the use of a surface plot.
NOTE: The graph in the PDF(WEB) destination will be rendered as an image due to the use of a bivariate histogram.
NOTE: PROCEDURE AUTOREG used (Total process time):
      real time           0.95 seconds
      user cpu time       0.36 seconds
      system cpu time     0.07 seconds
      memory              34895.12k
      OS Memory           65300.00k
      Timestamp           03/08/2024 01:09:58 AM
      Step Count                        40  Switch Count  17
      Page Faults                       0
      Page Reclaims                     18502
      Page Swaps                        0
      Voluntary Context Switches        978
      Involuntary Context Switches      2
      Block Input Operations            0
      Block Output Operations           3088


83         proc autoreg data=bball;
84              title2 'Q2C: 6th order autoregression';
85              model ptspread = record dayslg home weekend  / nlag=6 method = ml;
86
87
88         OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
100
```

## Q2A: Basic OLS Model with proc reg

**The REG Procedure**
**Model: MODEL1**
**Dependent Variable: ptspread**

| | |
|---|---|
| **Number of Observations Read** | 88 |
| **Number of Observations Used** | 88 |

| Analysis of Variance | | | | | |
|---|---|---|---|---|---|
| **Source** | **DF** | **Sum of Squares** | **Mean Square** | **F Value** | **Pr > F** |
| **Model** | 4 | 3265.57333 | 816.39333 | 7.83 | <.0001 |
| **Error** | 83 | 8656.14258 | 104.29087 | | |
| **Corrected Total** | 87 | 11922 | | | |

| | | | |
|---|---|---|---|
| **Root MSE** | 10.21229 | **R-Square** | 0.2739 |
| **Dependent Mean** | 0.55682 | **Adj R-Sq** | 0.2389 |
| **Coeff Var** | 1834.04398 | | |

| Parameter Estimates | | | | | | |
|---|---|---|---|---|---|---|
| **Variable** | **Label** | **DF** | **Parameter Estimate** | **Standard Error** | **t Value** | **Pr > \|t\|** |
| **Intercept** | Intercept | 1 | 13.94643 | 5.09429 | 2.74 | 0.0076 |
| **record** | Opponent's WL record last year | 1 | -0.02514 | 0.00857 | -2.93 | 0.0043 |
| **home** | | 1 | 9.29330 | 2.29521 | 4.05 | 0.0001 |
| **dayslg** | Days since last game | 1 | -1.70622 | 1.21340 | -1.41 | 0.1634 |
| **weekend** | | 1 | -6.48584 | 2.55504 | -2.54 | 0.0130 |

---

## Q2A: Basic OLS Model with proc reg

**The REG Procedure**
**Model: MODEL1**
**Dependent Variable: ptspread**

| | |
|---|---|
| **Durbin-Watson D** | 1.646 |
| **Pr < DW** | 0.0595 |
| **Pr > DW** | 0.9405 |
| **Number of Observations** | 88 |
| **1st Order Autocorrelation** | 0.175 |

**Note:** Pr<DW is the p-value for testing positive autocorrelation, and Pr>DW is the p-value for testing negative autocorrelation.

---

## Q2B: First order autoregression

**The AUTOREG Procedure**

| | |
|---|---|
| **Dependent Variable** | ptspread |

## Q2B: First order autoregression

### The AUTOREG Procedure

| Ordinary Least Squares Estimates | | | |
|---|---|---|---|
| SSE | 8656.14258 | DFE | 83 |
| MSE | 104.29087 | Root MSE | 10.21229 |
| SBC | 675.92438 | AIC | 663.537696 |
| MAE | 8.08544089 | AICC | 664.269403 |
| MAPE | 112.00488 | HQC | 668.52798 |
| Durbin-Watson | 1.6459 | Total R-Square | 0.2739 |

| Parameter Estimates | | | | | | |
|---|---|---|---|---|---|---|
| Variable | DF | Estimate | Standard Error | t Value | Approx Pr > \|t\| | Variable Label |
| Intercept | 1 | 13.9464 | 5.0943 | 2.74 | 0.0076 | |
| record | 1 | -0.0251 | 0.008573 | -2.93 | 0.0043 | Opponent's WL record last year |
| dayslg | 1 | -1.7062 | 1.2134 | -1.41 | 0.1634 | Days since last game |
| home | 1 | 9.2933 | 2.2952 | 4.05 | 0.0001 | |
| weekend | 1 | -6.4858 | 2.5550 | -2.54 | 0.0130 | |

Question 2b

**Estimates of Autocorrelations**

| Lag | Covariance | Correlation | -1.0 -0.5 0.0 0.5 1.0 |
|---|---|---|---|
| 0 | 98.3653 | 1.0000 | |
| 1 | 17.2377 | 0.1752 | |

Question 2a

| Preliminary MSE | 95.3445 |
|---|---|

| Estimates of Autoregressive Parameters | | | |
|---|---|---|---|
| Lag | Coefficient | Standard Error | t Value |
| 1 | -0.175241 | 0.108723 | -1.61 |

Algorithm converged.

## Q2B: First order autoregression

### The AUTOREG Procedure

| Maximum Likelihood Estimates | | | |
|---|---|---|---|
| SSE | 8371.95082 | DFE | 82 |
| MSE | 102.09696 | Root MSE | 10.10430 |
| SBC | 677.498628 | AIC | 662.634607 |
| MAE | 7.90114303 | AICC | 663.671644 |
| MAPE | 111.032514 | HQC | 668.622948 |

| | | | |
|---|---|---|---|
| **Log Likelihood** | -325.3173 | **Transformed Regression R-Square** | 0.3060 |
| **Durbin-Watson** | 1.9884 | **Total R-Square** | 0.2978 |
| | | **Observations** | 88 |

**Parameter Estimates**

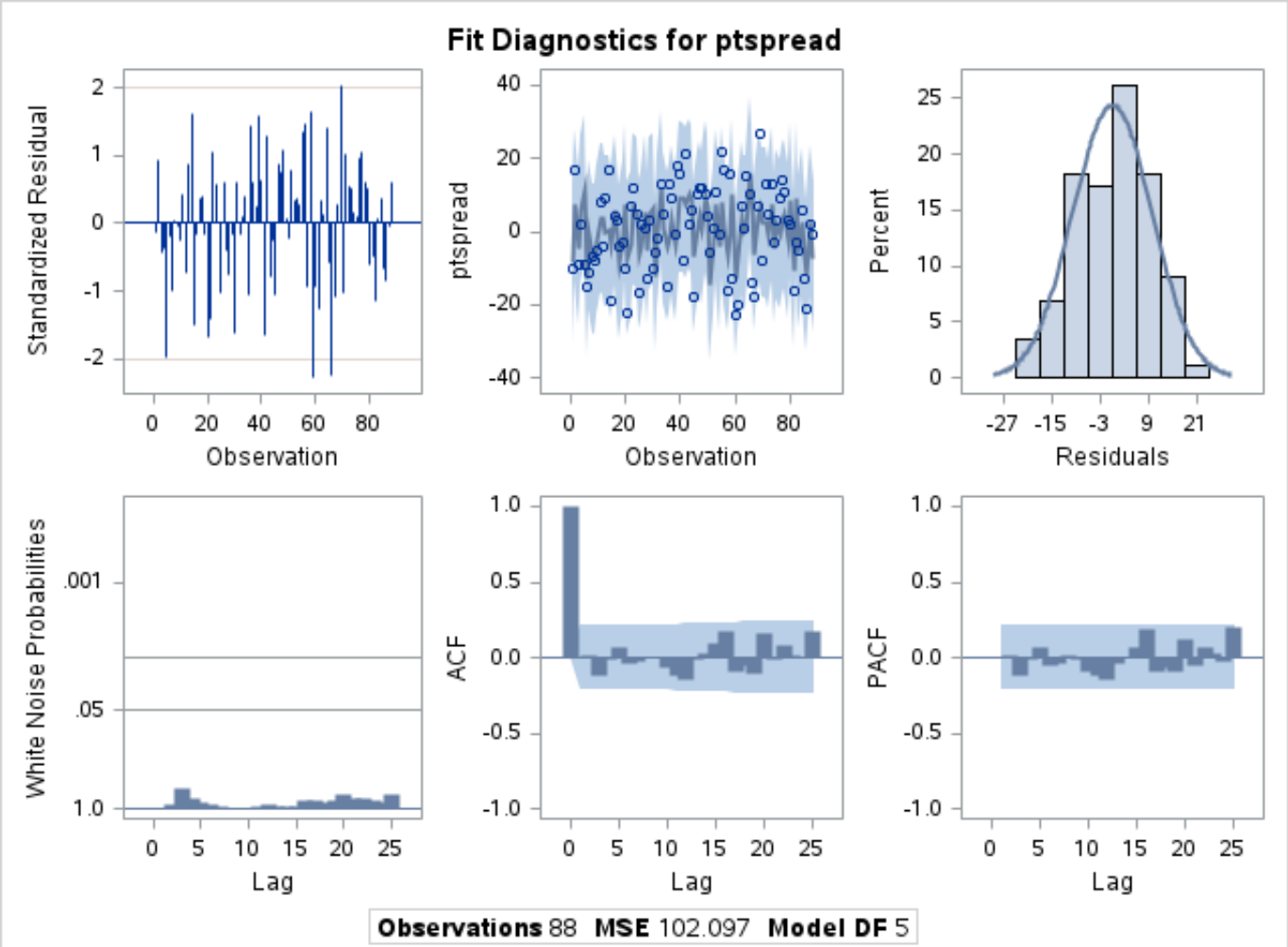
| Variable | DF | Estimate | Standard Error | t Value | Approx Pr > \|t\| | Variable Label |
|---|---|---|---|---|---|---|
| **Intercept** | 1 | 15.2900 | 4.8306 | 3.17 | 0.0022 | |
| **record** | 1 | -0.0275 | 0.007990 | -3.44 | 0.0009 | Opponent's WL record last year |
| **dayslg** | 1 | -1.8417 | 1.1085 | -1.66 | 0.1004 | Days since last game |
| **home** | 1 | 9.3582 | 2.1925 | 4.27 | <.0001 | |
| **weekend** | 1 | -6.0093 | 2.3605 | -2.55 | 0.0128 | |
| **AR1** | 1 | -0.1843 | 0.1097 | -1.68 | 0.0968 | |

**Autoregressive parameters assumed given**

| Variable | DF | Estimate | Standard Error | t Value | Approx Pr > \|t\| | Variable Label |
|---|---|---|---|---|---|---|
| **Intercept** | 1 | 15.2900 | 4.8305 | 3.17 | 0.0022 | |
| **record** | 1 | -0.0275 | 0.007989 | -3.44 | 0.0009 | Opponent's WL record last year |
| **dayslg** | 1 | -1.8417 | 1.1082 | -1.66 | 0.1004 | Days since last game |
| **home** | 1 | 9.3582 | 2.1862 | 4.28 | <.0001 | |
| **weekend** | 1 | -6.0093 | 2.3448 | -2.56 | 0.0122 | |

## Q2B: First order autoregression

**The AUTOREG Procedure**




## Q2C: 6th order autoregression

### The AUTOREG Procedure

| Dependent Variable | ptspread |
|---|---|

## Q2C: 6th order autoregression

### The AUTOREG Procedure

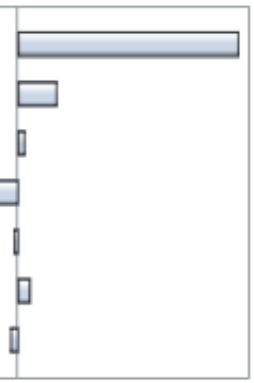
| Ordinary Least Squares Estimates | | | |
|---|---|---|---|
| SSE | 8656.14258 | DFE | 83 |
| MSE | 104.29087 | Root MSE | 10.21229 |
| SBC | 675.92438 | AIC | 663.537696 |
| MAE | 8.08544089 | AICC | 664.269403 |
| MAPE | 112.00488 | HQC | 668.52798 |
| Durbin-Watson | 1.6459 | Total R-Square | 0.2739 |

| Parameter Estimates | | | | | | |
|---|---|---|---|---|---|---|
| Variable | DF | Estimate | Standard Error | t Value | Approx Pr > \|t\| | Variable Label |
| Intercept | 1 | 13.9464 | 5.0943 | 2.74 | 0.0076 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **record** | 1 | -0.0251 | 0.008573 | -2.93 | 0.0043 | Opponent's WL record last year |
| **dayslg** | 1 | -1.7062 | 1.2134 | -1.41 | 0.1634 | Days since last game |
| **home** | 1 | 9.2933 | 2.2952 | 4.05 | 0.0001 | |
| **weekend** | 1 | -6.4858 | 2.5550 | -2.54 | 0.0130 | |

**Estimates of Autocorrelations**

| Lag | Covariance | Correlation | -1.0 -0.5 0.0 0.5 1.0 |
|---|---|---|---|
| 0 | 98.3653 | 1.0000 | |
| 1 | 17.2377 | 0.1752 | |
| 2 | 2.9061 | 0.0295 | |
| 3 | -10.0934 | -0.1026 | |
| 4 | -1.6468 | -0.0167 | |
| 5 | 5.3408 | 0.0543 | |
| 6 | -3.1962 | -0.0325 | |



| | |
|---|---|
| **Preliminary MSE** | 93.3420 |

**Estimates of Autoregressive Parameters**

| Lag | Coefficient | Standard Error | t Value |
|---|---|---|---|
| **1** | -0.180526 | 0.113699 | -1.59 |
| **2** | -0.025621 | 0.115242 | -0.22 |
| **3** | 0.123630 | 0.115271 | 1.07 |
| **4** | -0.011829 | 0.115271 | -0.10 |
| **5** | -0.073402 | 0.115242 | -0.64 |
| **6** | 0.067765 | 0.113699 | 0.60 |

Algorithm converged.

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## Q2C: 6th order autoregression

### The AUTOREG Procedure

| Maximum Likelihood Estimates | | | |
|---|---|---|---|
| **SSE** | 8149.12894 | **DFE** | 77 |
| **MSE** | 105.83284 | **Root MSE** | 10.28751 |
| **SBC** | 697.632125 | **AIC** | 670.38142 |
| **MAE** | 7.80660688 | **AICC** | 673.855105 |
| **MAPE** | 114.315286 | **HQC** | 681.360045 |
| **Log Likelihood** | -324.19071 | **Transformed Regression R-Square** | 0.3798 |
| **Durbin-Watson** | 1.9995 | **Total R-Square** | 0.3164 |
| | | **Observations** | 88 |

**Parameter Estimates**

| Variable | DF | Estimate | Standard Error | t Value | Approx Pr > \|t\| | Variable Label |
|---|---|---|---|---|---|---|
| Intercept | 1 | 16.9930 | 4.7961 | 3.54 | 0.0007 | |
| record | 1 | -0.0296 | 0.008202 | -3.61 | 0.0005 | Opponent's WL record last year |
| dayslg | 1 | -2.0634 | 1.1703 | -1.76 | 0.0818 | Days since last game |
| home | 1 | 9.6636 | 2.2332 | 4.33 | <.0001 | |
| weekend | 1 | -7.1992 | 2.2117 | -3.26 | 0.0017 | |
| AR1 | 1 | -0.1921 | 0.1152 | -1.67 | 0.0996 | |
| AR2 | 1 | -0.0304 | 0.1181 | -0.26 | 0.7972 | |
| AR3 | 1 | 0.1458 | 0.1185 | 1.23 | 0.2221 | |
| AR4 | 1 | -0.0168 | 0.1189 | -0.14 | 0.8879 | |
| AR5 | 1 | -0.0872 | 0.1181 | -0.74 | 0.4625 | |
| AR6 | 1 | 0.0838 | 0.1156 | 0.72 | 0.4708 | |

| Autoregressive parameters assumed given | | | | | | |
|---|---|---|---|---|---|---|
| Variable | DF | Estimate | Standard Error | t Value | Approx Pr > \|t\| | Variable Label |
| Intercept | 1 | 16.9930 | 4.7028 | 3.61 | 0.0005 | |
| record | 1 | -0.0296 | 0.008018 | -3.70 | 0.0004 | Opponent's WL record last year |
| dayslg | 1 | -2.0634 | 1.1398 | -1.81 | 0.0742 | Days since last game |
| home | 1 | 9.6636 | 2.1608 | 4.47 | <.0001 | |
| weekend | 1 | -7.1992 | 2.1543 | -3.34 | 0.0013 | |

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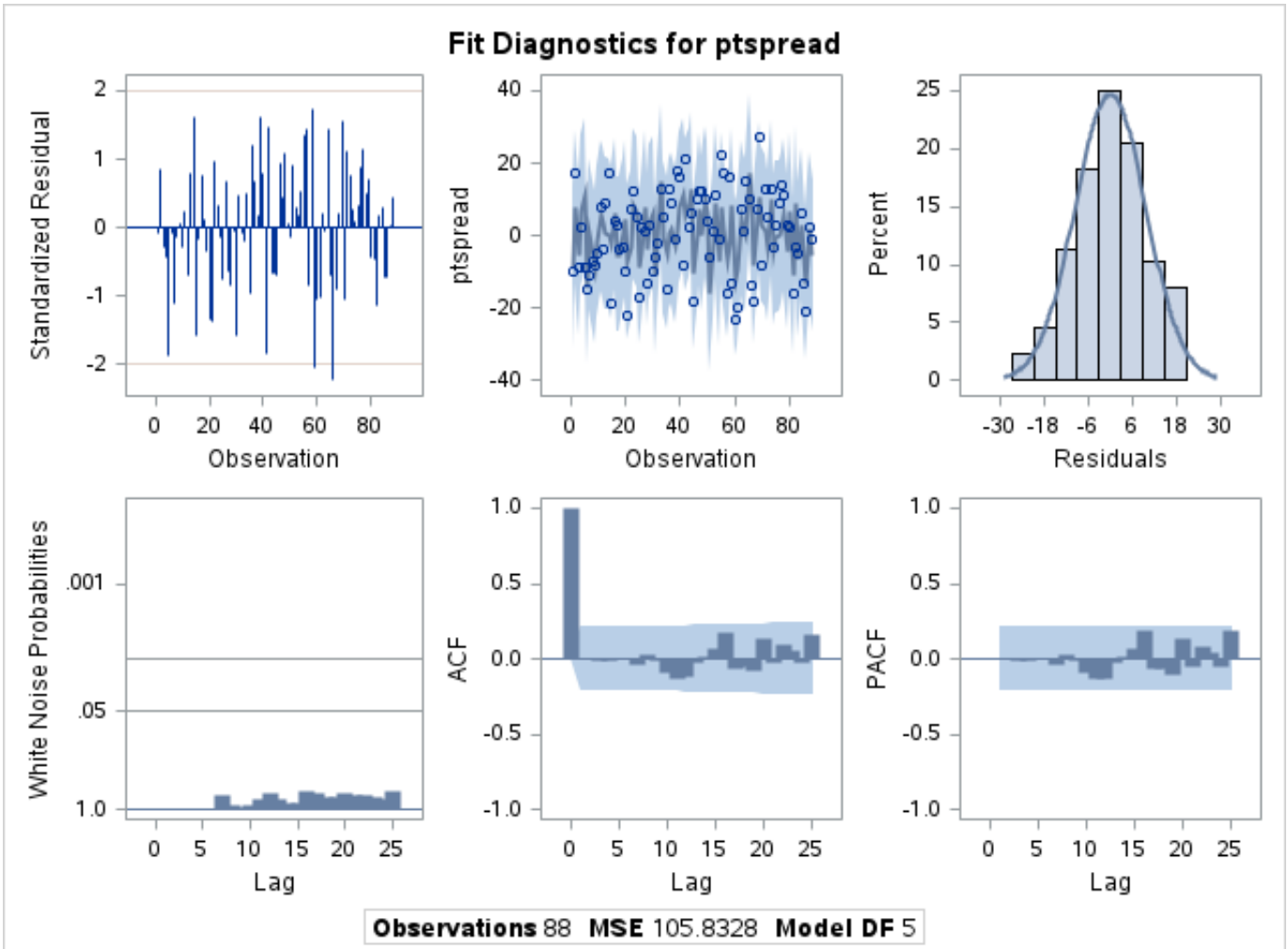
## Q2C: 6th order autoregression

**The AUTOREG Procedure**


Fit Diagnostics for ptspread
Standardized Residual
Observation
ptspread
Observation
Percent
Residuals
White Noise Probabilities
.001
.05
1.0
Lag
ACF
Lag
PACF
Lag
Observations 88 MSE 105.8328 Model DF 5