

Running a Fantasy Baseball League Using SAS Software

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Abstract

Fantasy baseball leagues have been around since the late 1970's and have increased greatly in popularity in last several years. Actual major league players' statistics are used to determine the results in the fantasy league. These leagues give owners a chance to own and manage their own major league baseball teams without having to put together a \$150 million investment group. This paper presents a SAS/AF application that helps manage and run a fantasy baseball league.

This application utilizes SAS/FSP software to enter data from each day's major league box scores and then play a schedule of head-to-head 'games' between teams in the league. SAS software is used to keep track of game results and players' statistics and to produce weekly reports for the owners in the league. Reports include those produced by PROC REPORT as well as custom reports using the DATA step. This application was initially developed on a mainframe and has since been ported to Unix and Windows and updated to use Frames, including 6.11 enhancements such as the Data Table and External File Viewer objects.

1. Introduction

This paper presents a SAS/AF application that helps manage and run a fantasy baseball league. Before the application is presented, the basic rules of the game are given. This will provide some background for the data needed to play the game. The underlying database design is then presented. This design provides the framework for building the application. Once this is in place, the application provides an interface for collecting the necessary data, playing the game, and finally managing the data necessary for producing reports for the league.

2. Rules of the Game

A fantasy baseball league consists of a group of owners who meet once a year to draft players for their team and then play a schedule of games as the major leagues play their games. This draft can be conducted in many ways such as a standard sequential draft, or bidding on players with a fixed salary cap. The particular league that is used in this example, uses a modification of the sequential draft to give all teams a fair chance of drafting a competitive team. How the players are drafted is not important in this application, however. The important part is the playing of the games, which is discussed in this section.

For every date on the schedule, each team in the league is matched with another team for the purpose of "playing a game." Using the lineups for the current week and the Major League box scores for the given date, a scoresheet is filled out and used to determine the run total for each team. (Note: Box scores from the second game of a doubleheader are not to be used, except for starting pitchers). The team with the highest run total is declared the winner for that game.

A *lineup* is simply the arrangement of the Active roster that determines how players will enter into a game during a particular week. The Active list is divided into two parts: *Hitters* and *Pitchers*. Within each part, the order of the players is used to determine how players enter the scoresheet. Within the Pitchers list, up to seven of the players are marked as *Relievers*.

To begin scoring a game, the scorer begins at the top of the Hitters list and checks the box scores to see if the player played on the date of the game. If the player did not play, he is left off the scoresheet. If he did play, the position is noted and the player's name is written on the scoresheet in that position. The first player on the list who cannot fill a fielding position — either because he appears in the box score as a pinch hitter (PH), pinch runner (PR), or designated hitter (DH), or because a player has already been assigned to the position he played — is assigned to the DH position. Once the DH position is filled, any further player who cannot fill a fielding position is left off the scoresheet.

This is repeated for each player in the Hitters section of the lineup, in the order listed. This is also done until the Hitters portion of the scoresheet is filled, or until the Hitters list is exhausted. If no player in the lineup played a particular position, that position is left blank.

For each hitter entered into the scoresheet, the scorer records the number of At-bats, Hits, Doubles, Triples, Home runs, Stolen bases, Sacrifices/Sacrifice Flies, and Errors/Passed Balls in the appropriate column of the scoresheet. (Note: This is done even if he has zero At-bats). For positions left unfilled, simply record five At-Bats, and put a zero in all other columns.

Next, the Pitching part of the scoresheet is filled in. First, the starting pitcher is determined. Beginning at the top of the Pitchers list, the scorer looks for Starting pitchers only. The box scores are checked to see if the player started a Major League game (box scores from the second games of double headers may be used). If so, the scorer fills in the Starter's position with his name and his totals for Innings Pitched, Hits, Bases-on-balls, Strike Outs and Errors. This is continued until the list of Pitchers is exhausted, or until a Starter has been found. In searching for a starter, all pitchers are checked, including those designated as relievers. Being a designated reliever does not preclude a player from being the starting pitcher.

If the Starter pitched a complete game, or at least nine innings, the Pitching section is complete. However, if the Starter pitched fewer than nine innings (yet not a complete game) the reliever section is filled in. Starting at the top of the Pitchers list again, and looking only at those players designated as relievers, the scorer checks the box scores to see if the player appeared as a reliever (second games of double headers are not used). If so, the player and his statistics are entered into a reliever spot. If after entering the first reliever, the combined total of innings pitched is less than nine (for starter and reliever), the search continues for another reliever into the scoresheet. This is continued until the total of innings pitched is at least nine, or three relievers have been entered.

Once all the statistics for a game have been collected, the score for a game can be computed. First, *Runs Scored (RS)* is computed for the team. The columns are totalled to obtain team totals for all of the statistics. Based on these team totals, the *Offensive Factor (OF)* is computed as follows:

$$OF = 4.75(\text{Hits}) + 5.75(2B) + 11.0(3B) + 15.75(HR) + 4.75(\text{Steal}) + 3.25(\text{Sac} + \text{Sac Fly})$$

Then, the offensive runs scored are equal to:

$$RS = OF / (\text{Team At-Bats})$$

The *Runs Allowed (RA)* is then calculated. This involves computing two pitching factors: one for the starter and one for the relievers. First, the columns are totalled for the starters and relievers separately. Then, these totals are used to compute the Pitching Factor for each set of pitchers:

$$PF = 1.75(\text{Hits}) + 1.5(\text{BB}) - 0.45(K)$$

The computation of *Pitching Runs (PR)* depends on whether a complete game was pitched or not. If a complete game was pitched — i.e. the starter had a complete game in the Major Leagues, or the total innings pitched (starter + relievers) is at least nine — then

$$PR = (\text{Starter PF} + \text{Reliever PF}) / (\text{Total IP})$$

When less than a complete game is pitched — i.e., the total innings pitched was less than 9 and the starter did not pitch a complete game in the Major Leagues — then

$$PR = (\text{Starter PF} + \text{Reliever PF} + \text{Penalty Factor}) / 9$$

where the *Penalty Factor* is computed as

$$\text{Penalty factor} = 3.5(\text{Min}[7 - (\text{Starter IP}), 9 - (\text{Total IP})]) + 5(\text{Min}[2 - (\text{Reliever IP}), 9 - (\text{Total IP})])$$

Before computing *Runs Allowed*, the *Adjusted Runs (AR)* is computed. If a starting pitcher was entered into the scoresheet, then $AR = \text{Min}[PR, 3.50]$. If no starter was entered into the scoresheet, then $AR = \text{Min}[PR, 3.83]$. Finally, *Runs Allowed (RA)* is computed as

$$RA = AR + 0.16(\text{Errors} + \text{Passed Balls})$$

The score for a team is equal to the sum of its Runs Scored plus the opponents Runs Allowed. The score must be computed to enough decimal places so that the final scores of the two teams can be distinguished. The team with the highest score is declared the winner of the game.

3. Database Design

There are essentially two groups of data sets that are used in the application. The first data sets are those that are created by the user. These include those created once in a season; those created or revised weekly; and those created or revised daily. These data sets are used to play the game. The second group is created or revised by the application automatically as the game is played. These are primarily used for reporting purposes.

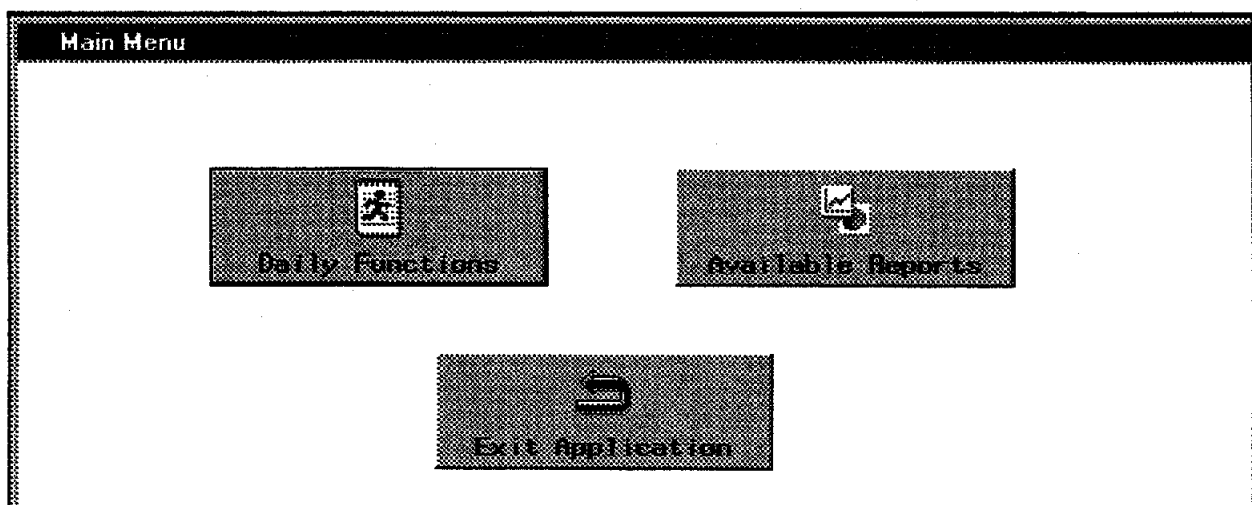
Looking at this first group, there are three individual data sets and one collection of data sets. One data set, SCHEDULE, controls the daily schedule of games. This data set is created at the beginning of the season and indicates the game matchups for each day. The lineups for each day are in a series of data sets. The naming convention for these data sets is RddMMMy, where dd is the day of the month, MMM the 3-character month, and yy the 2-digit year for when this lineup first takes effect. Another data set, ROSTDATA, controls which lineup is used on a given day. Finally, based on the lineup for a given day, data is entered from the daily box scores and saved in a data set, STAT. This data set will contain all of the players' statistics for the year and in conjunction with SCHEDULE and the appropriate roster data set will be used to score the games.

Once the games are scored, three data sets, which are used for reporting, are updated. The first is a summary data set, SUMMARY, which contains one observation for each team and each day. This data set allows quick information to be compiled on a team basis. The other two data sets, HITTING and PITCHING, are subsets of STAT that contain data for individual players, if they played in the major leagues on a particular day. These two data sets allow reporting of individual players for each team, both those that appeared in league games, as well as those that did not.

4. Introduction to the Application

The application is a user interface to assist in scoring games and collecting data for reporting. In this regard there are two areas: 'Daily Functions' used for playing the game and 'Available Reports' used for producing weekly as well as standard reports. The main menu as seen in Figure 1 illustrates this. There are icons for each of these areas that give the user menus of activities. These two areas will be discussed in the following sections. An 'Exit Application' icon to quit the application is provided as well.

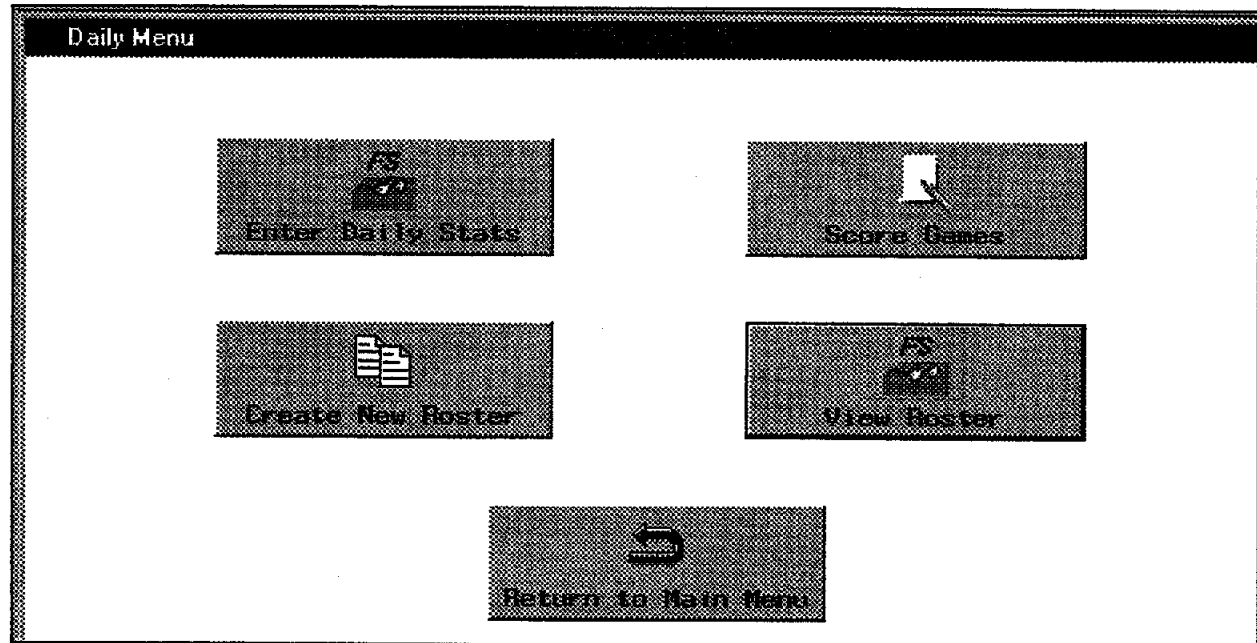
Figure 1: Main Menu



5. Daily Functions

Upon selecting the 'Daily Functions' menu, the user is provided four choices: Enter Daily Statistics, Score Games, Create New Roster, and View Roster. This menu is shown in Figure 2. These selections allow the user to perform most of the daily chores needed for scoring the games. The 'Enter Daily Stats' selection gives the user the ability to enter statistics for any day. The 'Score Games' will create scoresheets for any given day and gives the user the opportunity to update data based on the scored game. In order to enter statistics and score games for a given day, there must be a roster for that day. The maintenance of the rosters are provided in 'Create New Roster' where a new roster can be created from another, and 'View Roster' where rosters can be viewed and edited. Finally, a 'Return to Main Menu' button allows the user to exit this menu.

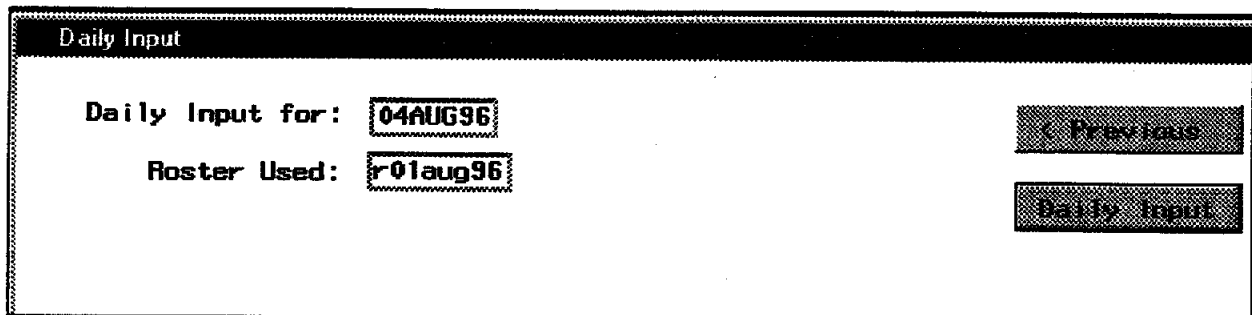
Figure 2: Daily Menu



5.1 Enter Daily Statistics

To enter data for a particular day, a user clicks on the 'Enter Daily Stats' icon. This opens the 'Daily Input' screen shown in Figure 3. The user may then enter the date for which statistics are to be entered. By default, this date is set to the day before the current date, since this is typically the day for which statistics are needed. As a note, the applicable roster is displayed. This is determined by the data set ROSTDATA and cannot be changed on this screen.

Figure 3: Daily Input Screen



Once the user has entered a date, clicking on the 'Daily Input' button, opens an FSEDIT input screen as shown in Figure 4. If data already exists in the data set STAT for this date, STAT is opened for editing using a

WHERE clause for the specified date. If no data exists, then a temporary data set WORK.NEWDAY is created from the names in the applicable roster data set, but with missing values for most of the variables, such as the position played, number of at bats, etc. In either case, statistics for a day can now be entered. Several error checks are built into this screen. For example, only valid positions can be entered, and a popup selection list appears when an invalid value is entered. Also, the number of doubles, triples and home runs cannot exceed the number of hits. This helps to ensure more accurate data entry. When the user closes the FSEDIT window, the new data is saved or appended to STAT. The user may then enter data for other dates or return to the 'Daily Functions' menu by clicking on 'Previous'.

Figure 4: FSEDIT Screen for Entering Data

***** UFBL DAILY STATISTICS *****

Date: 04AUG96

Player: B Anderson Team: BAL Position: OF

***** HITTING STATISTICS *****

AB: 4 H: 1 DBL: ____ TPL: ____
 HR: ____ SB: ____ SAC: ____ E: ____

***** PITCHING STATISTICS *****

IP(Full): ____ IP(Part): ____ CG: N
 BB: ____ SO: ____ PE: ____

5.2 Score Games

If data has been entered for a particular day, that day's game can be scored. This is done by clicking on the 'Score Games' icon on the 'Daily Functions' menu. The 'Generate Scoresheets' screen is shown in Figure 5. The user can enter the date for which to score games. Again, this is initially set to the previous day. To score the games,

Figure 5: Initial Screen for Scoring Games

Generate Scoresheets

Generate Games for: 04AUG96

Previous

Play Games

Update

the user clicks on the 'Play Games' button. At this point, a SAS program is run that uses data from SCHEDULE, STAT and the current roster to create a custom DATA step report for each game for that date. These reports are

stored in a file with the naming convention ddMMMyy.TXT, where dd is the day of the month, MMM the 3-character month, and yy the 2-digit year. This file is automatically viewed with the External File Viewer as seen in Figure 6. The user can then scroll through the report to see the scoresheets for all the games played that day.

Figure 6: Display of Scored Games

Generate Games for: **04AUG96**

UFBL Game Summary
04AUG96

 * CARPETBAGGERS 5.16 *
 * ENGINES 4.77 *

CARPETBAGGERS

Player	Pos	AB	H	2b	3b	HR	SB	SAC	E
Griffey	OF	4	1	0	0	0	0	1	0
Bagwell	1B	4	2	2	0	0	0	0	1
Galarraga	1D	4	2	0	0	0	0	0	0
Fryman	3B	4	1	0	0	0	0	1	1
Lankford	OF	3	1	0	0	0	1	0	0

After the user has reviewed the games, the reporting data sets, SUMMARY, HITTING and PITCHING, can be updated by clicking on 'Update.' This prompts the application to add new observations to each of these data sets for this particular day's games. SUMMARY will have summary information for each team such as numbers of at-bats, hits, doubles, etc.; whether the team won or loss; and who was the winning or losing pitcher. This data set is used for producing team level results. The HITTING and PITCHING data sets will have added the statistics for individual players who played in the major leagues that day and whether they played in the fantasy league game. These data sets are used to produce reports for each player.

The user may generate scoresheets for any number of games while on this screen. Once the user has completed all games, clicking on 'Previous' returns the application to the 'Daily Functions' menu.

5.3 Create New Roster

In order to play a day's game a roster or lineup must be available for that day. After the initial roster is created at the beginning of the season, new rosters are created by copying the current roster and making changes submitted by the owners. This is generally done once a week, although injured players can be replaced on any weekday. To facilitate this, the 'Create New Roster' icon on the 'Daily Functions' menu allows the user to easily make a copy of a given roster.

The initial 'Create New Roster from Existing' screen is shown in Figure 7. Typically a user would copy yesterday's roster to today, so the current day's date is displayed in the second input field and the previous day's date in the first. However, these values can be changed. The new data set with the usual roster naming convention mentioned earlier will be created by clicking on 'Create Roster.' A message will appear indicating that the data set was copied successfully. The user may create additional rosters or return to the previous menu by clicking on 'Previous.'

Figure 7: Screen for Creating a New Roster

Create New Roster From Existing

Copy Roster for: 04AUG96 to 05AUG96

Previous
Create Roster

5.4 View Roster

A roster may be viewed and edited by clicking on the 'View Roster' icon on the 'Daily Functions' menu. The current roster is displayed automatically as seen in Figure 8. To change rosters, the user simply enters the day of the roster that is needed, and the applicable roster, based on the ROSTDATA data set, is displayed in a Data Table. This data set is open for editing at the member level, and the Data Table works similar to a spreadsheet for easy editing. Rows can be deleted, if a player is dropped from a roster, or rows can also be added as new players are added. Also, to assist in the editing, the 'Sort' button sorts the data set by TEAM, POSITION and ORDER. This allows the user to scroll through each team in the order the players would enter a game. Finally, the 'Print' button produces a custom DATA step report of the roster in the OUTPUT window.

Figure 8: Screen for Viewing a Roster

View Roster

Date 05AUG96
Previous

Roster Data Set r-05aug96

Print
Sort

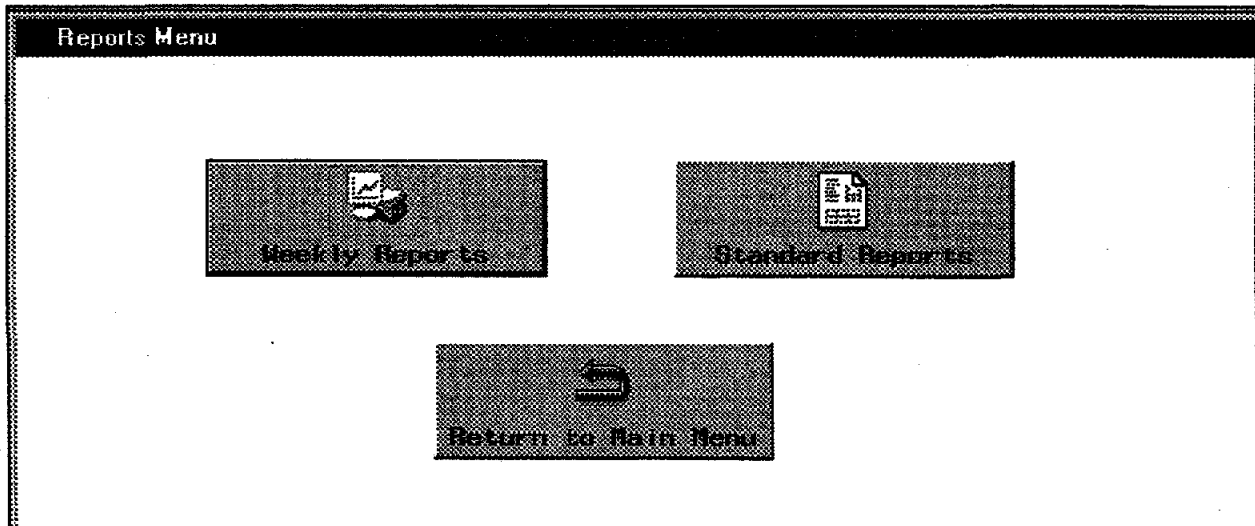
	ORDER	ML TEAM	FRST	L NAME	POSITION	REPLACE	TEAM	RELIEVER	RCODE
1	1	SF	B	Bonds	H		Cajuns		
2	2	COL	V	Castilla	H		Cajuns		
3	3	BAL	B	Anderson	H		Cajuns		
4	4	LA	R	Mondesi	H		Cajuns		
5	5	NYN	C	Baerga	H		Cajuns		
6	6	NYN	T	Hundley	H		Cajuns		
7	7	ATL	M	Grissom	H		Cajuns		
8	8	CAL	J	Snow	H		Cajuns		
9	9	OAK	T	Steinbach	H		Cajuns		
10	10	LA	C	Curtis	H		Cajuns		

6. Available Reports

An important part of a fantasy baseball league are the reports. Reports keep the owners informed of the position of their team in the standings, the results of the last week's games and the performance of their team's players as well as the other teams' players. These are typically created and distributed weekly, but this application allows

many reports to be created at any time through the 'Available Reports' menu selected from the 'Main Menu.' This menu is shown in Figure 9.

Figure 9: Reports Menu



There are two selections available: Standard Reports and Weekly Reports. The 'Standard Reports' allows the user to produce reports at any time and for a variety of time periods. The 'Weekly Reports' is used once a week to automatically produce files that are sent to the owners. These two selections will be discussed in the following sections.

6.1 Standard Reports

Clicking on 'Standard Reports' presents the user with the initial 'Generate Reports' screen shown in Figure 10. The user has the choices of four reports which are chosen via the radio box labelled 'Report.' These are (1) Standings: the current standings with daily results for the dates provided, (2) Team Summary: team statistics for hitting and pitching categories, (3) Individual Hitting: individual players' hitting statistics ranked by batting average, and (4) Individual Pitching: individual players' pitching statistics ranked by earned run average.

These reports can be produced for the season-to-date, month-to-date, week-to-date or any specified range of dates. The user chooses the dates with the radio box labelled 'Dates for Reports.' If 'Specified Range' is chosen, two input fields appear for the user to enter the beginning and ending dates for the range. Once these selections have been made, the user produces the reports by clicking on 'Run Report.' The report is generated and saved to a temporary file and then viewed with the External File Viewer as shown in Figure 11, where the standings with results for the current week are displayed. Scroll bars can be used to view the rest of the report.

Figure 10: Initial Generate Reports Screen

Generate Reports	
Report ☒ Standings ☐ Team Summary ☐ Individual Hitting ☐ Individual Pitching	Dates for Reports ☒ Season to Date ☐ This Month ☐ This Week ☐ Specified Range
Previous Run Report	
Empty report area	

Figure 11: Standings Report

Generate Reports																																																																									
Report ☒ Standings ☐ Team Summary ☐ Individual Hitting ☐ Individual Pitching	Dates for Reports ☐ Season to Date ☐ This Month ☒ This Week ☐ Specified Range																																																																								
Previous Run Report																																																																									
UFBL Standings As of 08AUG96 <table border="1"> <thead> <tr> <th></th> <th>W</th> <th>L</th> <th>PCT</th> <th>GB</th> <th>LAST WEEK</th> <th>LAST 2 WEEKS</th> <th>STREAK</th> </tr> </thead> <tbody> <tr> <td>CAMPERS</td> <td>49</td> <td>32</td> <td>0.605</td> <td>-</td> <td>4-1</td> <td>6-4</td> <td>L1</td> </tr> <tr> <td>SHOELACES</td> <td>47</td> <td>34</td> <td>0.580</td> <td>2</td> <td>1-4</td> <td>3-7</td> <td>W1</td> </tr> <tr> <td>TOMATOES</td> <td>44</td> <td>37</td> <td>0.543</td> <td>5</td> <td>2-3</td> <td>3-7</td> <td>W2</td> </tr> <tr> <td>CAJUNS</td> <td>40</td> <td>41</td> <td>0.494</td> <td>9</td> <td>3-2</td> <td>6-4</td> <td>W1</td> </tr> <tr> <td>SHUFFALOES</td> <td>39</td> <td>42</td> <td>0.481</td> <td>10</td> <td>3-2</td> <td>6-4</td> <td>L2</td> </tr> <tr> <td>CARPETBAGGERS</td> <td>38</td> <td>43</td> <td>0.469</td> <td>11</td> <td>3-2</td> <td>6-4</td> <td>L2</td> </tr> <tr> <td>ENGINES</td> <td>36</td> <td>45</td> <td>0.444</td> <td>13</td> <td>2-3</td> <td>4-6</td> <td>W2</td> </tr> <tr> <td>PARROTHEADS</td> <td>31</td> <td>50</td> <td>0.383</td> <td>18</td> <td>2-3</td> <td>6-4</td> <td>L1</td> </tr> </tbody> </table>			W	L	PCT	GB	LAST WEEK	LAST 2 WEEKS	STREAK	CAMPERS	49	32	0.605	-	4-1	6-4	L1	SHOELACES	47	34	0.580	2	1-4	3-7	W1	TOMATOES	44	37	0.543	5	2-3	3-7	W2	CAJUNS	40	41	0.494	9	3-2	6-4	W1	SHUFFALOES	39	42	0.481	10	3-2	6-4	L2	CARPETBAGGERS	38	43	0.469	11	3-2	6-4	L2	ENGINES	36	45	0.444	13	2-3	4-6	W2	PARROTHEADS	31	50	0.383	18	2-3	6-4	L1
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For illustration purposes, reports for Team Summary and Individual Hitting are shown in Figures 12 and 13. Again, these can be generated for any date range the user specifies. The user may also display any number of reports

Figure 12: Team Summary Report

Generate Reports	
Report ☐ Standings ☒ Team Summary ☐ Individual Hitting ☐ Individual Pitching	Dates for Reports ☒ Season to Date ☐ This Month ☐ This Week ☐ Specified Range
Previous	
Run Report	

☐

UFBL Hitting Team Summary													
For Games Through 08AUG96													
Team	G	AB	H	2B	3B	HR	RBI	RUN	SB	S	E	AVG	S
CAMPERS	715	2764	836	147	17	146	518	540	96	36	46	0.302	0.5
ENGINES	717	2632	784	140	21	142	525	536	42	31	45	0.298	0.5
CAJUNS	719	2732	770	164	17	145	515	528	52	26	59	0.282	0.5
SHUFFALDOES	714	2775	811	160	6	128	491	501	59	36	44	0.292	0.4
TOMATOES	721	2712	780	144	8	135	509	515	42	31	43	0.288	0.4
SHOELACES	708	2674	796	149	13	115	480	488	46	35	49	0.298	0.4
CARPETBAGGERS	691	2568	709	138	13	114	446	462	79	44	62	0.276	0.4
PARROTHEADS	693	2576	757	162	18	74	399	410	47	31	45	0.294	0.4

☐

Team Pitching Statistics													
For Games Through 08AUG96													

Figure 13: Individual Hitting Report

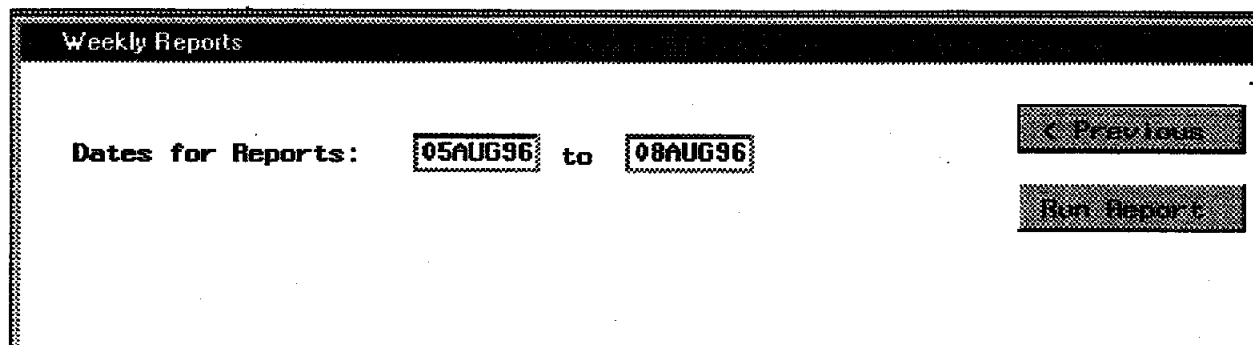
UFBL Hitting Summary													
As of 08AU													
Name	G	AB	H	2B	3B	HR	SB	S	RBI	RUN	AVG	SLG	Pos
ARodriguez(JT)	63	260	97	26	0	17	7	5	65	65	.373	.669	JBu
CKnoblauch(PH)	74	288	106	23	5	8	17	4	54	59	.368	.566	RLa
MVaughn(SS)	79	317	111	15	1	26	0	3	80	80	.350	.650	BBa
FThomas(SL)	61	222	77	9	0	18	0	3	59	58	.347	.631	BJo
LWalker(SL)	36	136	46	9	4	11	11	0	40	44	.338	.706	SSo
RAIomar(SL)	72	281	95	18	0	12	10	7	51	53	.338	.530	CGa
JFranco(CA)	22	89	30	4	1	3	1	0	15	15	.337	.506	DBe
JCanseco(CA)	49	184	62	13	1	16	2	2	48	48	.337	.679	TFr
TGwynn(PH)	49	194	65	11	2	2	6	3	27	28	.335	.443	SBe
PD'Neill(SS)	61	218	73	15	1	5	0	5	36	35	.335	.482	BSa
CJones(SE)	79	314	105	20	3	19	4	5	70	71	.334	.599	MAI

6.2 Weekly Reports

Each week a series of reports are generated and sent to all the owners. These include the Standings, Team Summary, Individual Hitting and Individual Pitching reports described above as well as reports pertaining to a specific team. These latter reports provide the owners with a summary of the past week's games and detail reports on their individual players, including both players who appeared in games and those who did not. The application provides a way of producing these reports automatically through the 'Weekly Reports' selection on the 'Available Reports' menu.

Clicking 'Weekly Reports' produces the 'Weekly Reports' screen shown in Figure 13. By default, the range of dates is set to the past Monday through the day immediately prior to the current day. The example in Figure 14 was run on August 9. The user can, of course, enter any range of dates. Clicking 'Run Report' will prompt the application to generate the appropriate reports.

Figure 14: Weekly Reports Screen



The screenshot shows a window titled "Weekly Reports". Inside the window, the text "Dates for Reports:" is followed by two date input fields. The first field contains "05AUG96" and the second field contains "08AUG96", with the word "to" between them. To the right of these fields are two buttons: "Previous" and "Run Report".

These reports are written to files assigned to each owner with the ending date included in the file name and a file containing reports sent to all owners. This allows easy management of distributing these weekly reports, as these files can then be sent via email or printed and mailed via standard mail.

Summary

This paper is presented with the purpose of showing how the SAS System can be used to help manage and run a fantasy baseball league. However, many of the tasks and solutions presented here can be applied in many areas that have standard data to be input and reports to be produced and distributed.