

RotoRithms’ Sport Data

The VBA Scripts that Made It All Possible

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IS 520

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# Executive Summary

To maximize on the growing reliance on predictive analytics and sports data manipulation, RotoRithms has developed a business model to offer the raw data and dynamic predictive analytic models that forecast individual player value based on current player performance. This report will prove just how that data was made possible post web scraping processing, but pre-analysis to be delivered globally on the website through VBA scripts.

## Objectives

To get reliable data up on the new website available for purchase by February 25, 2015 for historical data of the NBA, NFL, MLB, NCAAB, College Football, and NHL. Then devise the automated system to upload new and current data for sports during their seasons to the website by 8 AM Eastern Time for on-site purchases.

<http://www.rotorithms.com/why-rr/>

## Highlights

* Data was sorted by sport into appropriate folders prior to SAS processing
* Cleaned data with missing data values
* User forms to call specific Mozenda API’s run web scraping scripts

## Keys to Success

* VBA Instruction from BYU’s Dr. Allen
* Mozenda Data Scraping Software
* EmailItIn FTP Server
* WordPress

# Description of Business

I was approached and connected with Jerrod Nelms PhD about joining their start-up and filling the role as data-scientist. I was tasked with scraping all the required data by various fantasy leagues, and then delivering that information in a reliable format to the virtual machine used for data storage and ultimately data processing to upload to the website. Through the use of Mozenda’s data scraping software, and EmailItIn’s FTP service I was able to compile all the raw data onto RotoRithm’s server for data integrity testing that I would oversee. It is during this testing phase that I developed several scripts through Excel’s VBA platform to clean and organize the data.

## Services Performed

Over the span of 2-3 months I have created 15+ agents that will either scrape ESPN for historical data for individual sports, or scrape ESPN for current data of those same sports. Please refer to the appendix for an example of the XML file created to initially retrieve the data from ESPN. I then scheduled those same agents to publish their data to EmailItIn’s FTP service where the attached data sheets were downloaded to google drive directly on the virtual machine used for most of the data mining and testing services.

Before the data, now on the virtual machine, could undergo SAS testing, the data needed to be prepped. Typically this included adding missing date fields so the predictive analytics model will accurately reflect statistically reliable trends. Ultimately any data integrity issues that needed and could be resolved through VBA scripts, I was able to create a solution to fix those issues.

## Summary of Benefits

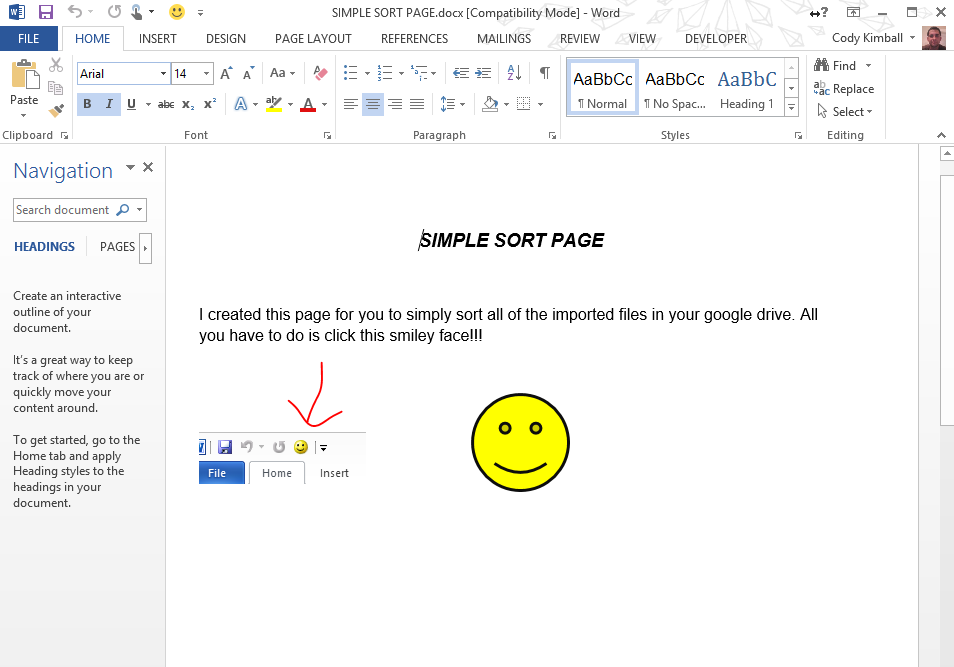
* VBA scripts will save numerous hours for RotoRithms of having to pull up the google drive folder and finding the files and then placing those files into the appropriate folders to be able to start analyzing. This automated macro is saved to the ribbon and can be easily accessed from any open Word document as requested by RotoRithm.
* All data documents are properly cleaned to now include key date fields to run predictive analytics on
* On a semi-regular basis, a macro I wrote will reverse compile a pdf document that tried to compile into a Word document but the formatting is off, and then macro will save over 2 hours each time the Word document needs to be reformatted correctly in a Word environment.
* Then to minimize number of times to run the algorithms to determine most profitable players to pick up for fantasy leagues, my Macro will be able to compile all the disparate documents into a single file.
* For any rescrapes of particular days for a particular sport, I created a customizable user form that enables the user to dynamically call Mozenda APIs to run the Mozenda Script that will pull in the information directly to the Google Drive folder.

# Implementation Documentation

## Sort Data

After I created the agents that systematically scraped ESPN for the data typically needed by fantasy leagues, and other interested third parties, the data was sent to an FTP service and deposited in a single google drive folder called “Email It In.” In this data was a massive repository of data for the NBA, MLB, NHL, NCAAB, College Football, and the NFL. However, all the data in this single folder was highly inefficient and time consuming to copy and paste all the files for a specific sport and put those files into the relevant sport delineated folder.

To optimize this daily process, I wrote this script to determine what sport the data in each file is pertaining to. Then based on what sport the data is pertaining to, each file is moved to a different folder delineated by the designated sport. As requested, I assigned the macro that would perform this function to the Microsoft Word template so any Word file open will have the smiley face as part of the Quick Access Toolbar, and once clicked on will execute this macro.



## Clean Data

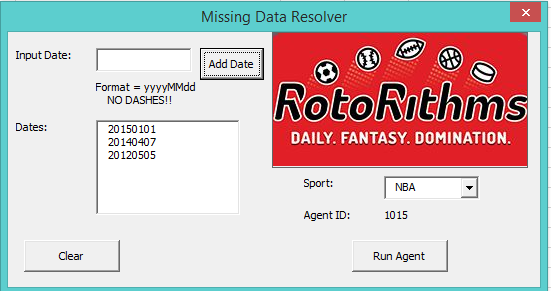
During the early stages of scraping ESPN, it wasn’t clear which fields needed to be captured, and which fields were irrelevant. One of the crucial fields that was initially overlooked was that of the date of the games for the current dataset. Knowing that each file was labeled with the date that the agent ran to scrape all the information, I knew that the date that should have been captured should have been the title date minus one (since ESPN was scraped the following day once all the information was uploaded to the website.)

I created a few custom macros that would identify whether or not the file has the date field, and if the date was not found, it would determine what the date is that should be included from the file name. Then a column would be inserted in the appropriate location prior to pasting the new date field into each cell that there is data in the current row. This proved to be a huge time and cost saver to having to pay to rescrape the entire season simply to append a field to a few files missing the date field.

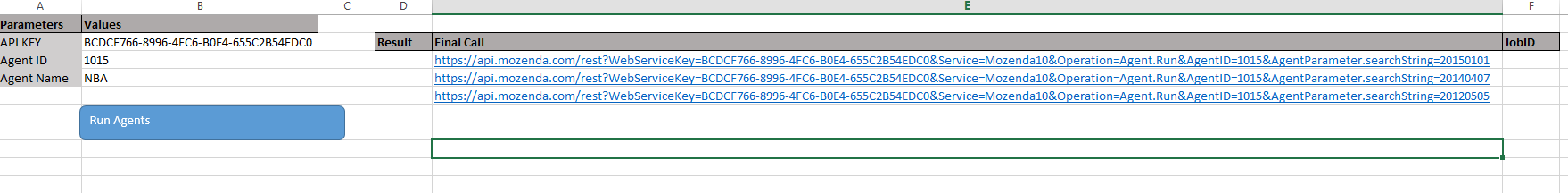
## Missing Data

Recently I realized that due to time zone difference, Jerrod often becomes aware of missing days where certain agents did not run. By the time I wake up and have time after school and work, a whole day’s work is delayed and piled on to the next day. Wanting to make things more convenient for those working for RotoRithms, I created a form that allows anyone with access to the workbook to open a form and input key values like date and which sport they want scraped.

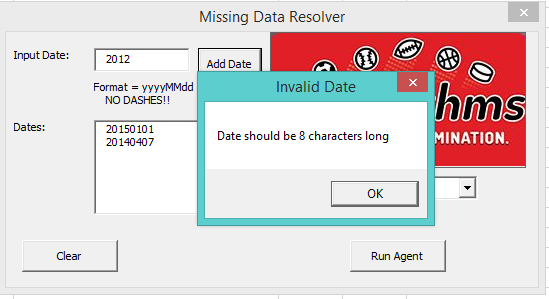
I rearranged the XML files that are used to scrape the internet for data from having hardcoded days to plugin and scrape, to now where the agent waits for a parameter to be passed in that will indicate what day to scrape. The form will call the API key I set up for RotoRithms’ account which will allow the user to simply type in the date into the input date field, and add it to the list of dates to rescrape. As seen on the right of the form is the ability to choose the sport to be scraped, and the Agent ID is populated so you can verify in the Mozenda Web Console which agent will be used for these rescrapes.



When the user has a list of dates they want, and the sport selected, they will click run agent. This will create custom API calls and capture them in a list order on the worksheet used to launch the form “Missing Data Resolver.” These calls will open an Internet Explorer window and will show whether or not the agent was executed successfully. After about five minutes an excel sheet will appear in your google drive “EmailItIn” folder with the appropriate data.



To avoid user input errors, there are check on date input validity. Since ESPN organizes all their games by date in the format “?date=yyyyMMdd” the form too needs to collect date inputs in the same format. As seen below, if improper dates are input into the API call that will be created, validation error messages will be raised to make sure you are properly inputting a date, as well as picking a sport.

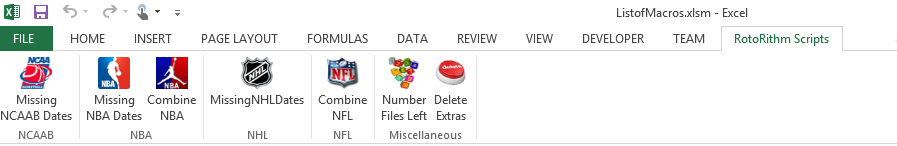


Currently there is not an agent to scrape specific days for College Football, but this could be added easily. In the attempt one tries to run an agent on College Football (since it is a valid sport typically scraped as indicated by Worksheet “SportsList”) a message will notify the user that there currently isn’t an agent for this. This and a date picker input box will be rolled out in version 2.0 to help optimize rescrapes, and we can discuss if other kinds of agents and scrapes should be added to the form.

## Data Preparation

Once all the data was cleaned to now have the proper dates, and columns rearranged to be consistent with each other, the data is ready to be put through Jerrod’s predictive analytics algorithm. However, at this rate a huge time consumer would be opening each file into the SAS software and then closing the existing file before opening the next file. This was another problem that I was able to solve through VBA.

I created a custom ribbon that appended to the end of the existing spreadsheets entitled RotoRithm Scripts. Within this ribbon are several icons, as shown below, for quick access to the macros that need to be run, namely that of combining the separate files into one file. What the script does is copy the contents of each file into a new worksheet of a single file till all the files have been copied into the Collection workbook. Then it copies each worksheet’s content into a single worksheet, and deletes the worksheet whose content has been copied over already.



## Miscellaneous Tasks

Having proved myself with VBA, often times I was asked to write quick smaller scripts to perform random tasks. These tasks ranged from fixing improperly formatted documents to determining the number of files left to be analyzed within the folder. On a semi-regular basis, Jerrod would download files into a Word document, but the formatting was such that one would need to go to the end of each line and then go to the next line and hit a backspace to join the two separated lines, then add a space to properly space the sentence. Typically this would need to be done over a couple hundred times. However, instead by running this macro you are able to instantly format the entire document.

Sometimes rather than pulling up individual file folders, it would be so much easier to click a button and have all the files left for each sport automatically counted. By clicking on the Number of Files left tab in the custom RotoRithm ribbon, the spreadsheet with the macro will show a total amount of files left for each sport.

Lastly, I was tasked with deleting all extra worksheets that are in a workbook after compiling all the data into a single worksheet. This single compiled worksheet provides the most efficient source of data to run predictive analytics on, and so the other worksheets are no longer needed. Rather than going through and manually deleting a worksheet for every day of a sport’s season, I wrote the script that too can be accessed through the RotoRithm ribbon and will delete all the worksheets that aren’t named “NBACollection.” This can be altered so it can be used with any sports really easily, but as for now that was the only sport workbook that needed this automation.

# Difficulties Encountered

Although the nature of this project was expectedly time consuming, there were some unexpected difficulties that caused the project to take longer than expected. One of these difficulties that could have been avoided, but instead significantly delayed the completion of this project, was proper saving of completed work.

Often times, files with the source VBA script were deleted by others using the same virtual machine due to miscommunications. This was an infuriating headache at times, but besides the obvious saving of work on my local machine for emergencies sake, I was able to save the macros globally to the Microsoft Word or Excel template so the macro could be accessed from any Word or Excel file.

Another delay that I encountered was that of a lack of step by step debugging. Too often I found myself coding away expecting things would work because I assumed I knew exactly what I was doing. Often times logic errors could have been resolved by using a few debug print statements to see that the correct file was not being opened upon execution.

Lastly, I struggled to properly capture the return message from the API calls created by the User Form. Although this form was not requested, I felt that it would prove to be extremely beneficial to avoid major time delays. With a little more time I would be able to modify the table that is updated with each API call created to run agents with certain date parameters on Mozendas servers, to capture the return message. I would then be able to parse the message to determine if the agent was able to run successfully, as well as capturing the identifying job ID for that request. These along with creating a date picker so that on the Missing Data Resolver form the user can simply click on a date from a calendar and add instead of typing in the field value would also be an aesthetic control to add to the form.

# Appendix

## Mozenda XML Example

This is an example of the XML file created as I designed the agent that would scrape ESPN’s website for the daily data for MLB.

<!-- Copyright (C) 2015 Mozenda, Inc. All rights reserved. -->

<Agent>

<Version>1.0j</Version>

<IeVersion>10.0</IeVersion>

<AgentDefinition>

<!--- - - - - - - - Actions - - - - - - - - -->

<ActionList>

<Action>

<ActionID>Action-0</ActionID>

<ActionType>LoadPage</ActionType>

<Page>0</Page>

<DestinationPage>1</DestinationPage>

<TopLevelNav>True</TopLevelNav>

<TopLevelNavCount>1</TopLevelNavCount>

<PageUrl>http://espn.go.com/mlb/schedule</PageUrl>

</Action>

<!-- Page 1 -->

<Action>

<ActionID>Action-1</ActionID>

<ActionType>PagePlaceHolder</ActionType>

<Page>1</Page>

<WaitAjax>2</WaitAjax>

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<BaseUrl>http://espn.go.com/mlb/schedule</BaseUrl>

<QueryStringVariable>date</QueryStringVariable>

<CaptureScreenShot>False</CaptureScreenShot>

</Action>

<Action>

<ActionID>Action-60</ActionID>

<ActionType>WaitSeconds</ActionType>

<Page>1</Page>

<Value>1</Value>

</Action>

<Action>

<ActionID>Action-73</ActionID>

<ActionType>CaptureDefaultValue</ActionType>

<Description>Performs an action on the current page</Description>

<Page>1</Page>

<FieldExpression>%DateInput%</FieldExpression>

<Value>%\_today-2:yyyyMMdd%</Value>

</Action>

<Action>

<ActionID>Action-75</ActionID>

<ActionType>LoadPage</ActionType>

<Page>1</Page>

<DestinationPage>2</DestinationPage>

<TopLevelNav>True</TopLevelNav>

<TopLevelNavCount>1</TopLevelNavCount>

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</Action>

<!-- Page 2 -->

<Action>

<ActionID>Action-62</ActionID>

<ActionType>PagePlaceHolder</ActionType>

<Page>2</Page>

<WaitAjax>2</WaitAjax>

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<BaseUrl>http://espn.go.com/mlb/schedule</BaseUrl>

<QueryStringVariable>date</QueryStringVariable>

<CaptureScreenShot>False</CaptureScreenShot>

</Action>

<Action>

<ActionID>Action-63</ActionID>

<ActionType>WaitSeconds</ActionType>

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<Value>3</Value>

</Action>

<Action>

<ActionID>Action-64</ActionID>

<ActionType>BeginAnchorList</ActionType>

<Page>2</Page>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>//\*[@id=&amp;quot;sched-container&amp;quot;]/div[2]/table/tbody[1]/tr/td[3]/a[1]</ItemXPath>

<ItemXPath>/html[1]/body[1]/div[5]/section[1]/section[1]/div[1]/section[1]/div[1]/div[2]/div[2]/table/tbody[1]/tr/td[3]/a[1]</ItemXPath>

<ListName>GameList1</ListName>

</Action>

<Action>

<ActionID>Action-65</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>2</Page>

<FieldExpression>%Date%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>ancestor::table[1]/tbody[1]/tr[@class=&amp;quot;stathead&amp;quot;]/td[1]</ItemXPath>

<ItemXPath>ancestor::table[1]/preceding-sibling::table/tbody[1]/tr[@class=&amp;quot;stathead&amp;quot;]/td[1]</ItemXPath>

<ItemXPath>ancestor::tbody[1]/preceding-sibling::thead[1]/preceding-sibling::caption[1]</ItemXPath>

</Action>

<Action>

<ActionID>Action-66</ActionID>

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<Description>Captures the text of the list item</Description>

<Page>2</Page>

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<Criterion>

<AndOr>Or</AndOr>

<Operator>IsNotEmpty</Operator>

<ComparisonElement>

<ItemType>PlaceHolder</ItemType>

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</ComparisonElement>

</Criterion>

<Criterion>

<AndOr>And</AndOr>

<Operator>DoesNotEqual</Operator>

<ComparisonElement>

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<XPath>.</XPath>

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</ComparisonElement>

</Criterion>

<CriteriaFailedResponse>EndListItem</CriteriaFailedResponse>

</Action>

<Action>

<ActionID>Action-67</ActionID>

<ActionType>GetElementValue</ActionType>

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<Page>2</Page>

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<ItemXPath>.</ItemXPath>

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<Criterion>

<AndOr>Or</AndOr>

<Operator>IsNotEmpty</Operator>

<ComparisonElement>

<ItemType>PlaceHolder</ItemType>

<XPath>.</XPath>

</ComparisonElement>

</Criterion>

<CriteriaFailedResponse>EndListItem</CriteriaFailedResponse>

</Action>

<Action>

<ActionID>Action-68</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>2</Page>

<IsOptional>True</IsOptional>

<FieldExpression>regex:(.)\*/(?&amp;lt;Winning\_Pitcher\_First\_Name&amp;gt;(.|\\n|\\r)\*?)-(?&amp;lt;Winning\_Pitcher\_Last\_Name&amp;gt;(.|\\n|\\r)\*?)&amp;quot;</FieldExpression>

<FieldExpression>%Winning Pitcher First Name% %Winning Pitcher Last Name%</FieldExpression>

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<ItemXPath>../following-sibling::td[1]/a[1]</ItemXPath>

</Action>

<Action>

<ActionID>Action-69</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>2</Page>

<IsOptional>True</IsOptional>

<FieldExpression>regex:(.)\*/(?&amp;lt;Losing\_Pitcher\_First\_Name&amp;gt;(.|\\n|\\r)\*?)-(?&amp;lt;Losing\_Pitcher\_Last\_Name&amp;gt;(.|\\n|\\r)\*?)&amp;quot;</FieldExpression>

<FieldExpression>%Losing Pitcher First Name% %Losing Pitcher Last Name%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

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</Action>

<Action>

<ActionID>Action-70</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>2</Page>

<IsOptional>True</IsOptional>

<FieldExpression>regex:(.)\*/(?&amp;lt;Pitcher\_Save\_First\_Name&amp;gt;(.|\\n|\\r)\*?)-(?&amp;lt;Pitcher\_Save\_Last\_Name&amp;gt;(.|\\n|\\r)\*?)&amp;quot;</FieldExpression>

<FieldExpression>%Pitcher Save First Name% %Pitcher Save Last Name%</FieldExpression>

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<ActionID>Action-71</ActionID>

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<Page>2</Page>

<DestinationPage>3</DestinationPage>

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<TopLevelNavCount>1</TopLevelNavCount>

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</Action>

<Action>

<ActionID>Action-72</ActionID>

<ActionType>EndList</ActionType>

<Page>2</Page>

<ListName>GameList1</ListName>

</Action>

<!-- Page 3 -->

<Action>

<ActionID>Action-6</ActionID>

<ActionType>PagePlaceHolder</ActionType>

<Page>3</Page>

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<BaseUrl>http://espn.go.com/mlb/boxscore</BaseUrl>

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</Action>

<Action>

<ActionID>Action-7</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

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<ItemXPath>//div[@class='team away']/div[2]/h3[1]/a</ItemXPath>

</Action>

<Action>

<ActionID>Action-8</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%Home Team%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>//div[@class='team home']/div[2]/h3[1]/a</ItemXPath>

</Action>

<Action>

<ActionID>Action-9</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%Away Team Score%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>//div[@class='team away']/div[2]/h3[1]/span</ItemXPath>

<ID>matchup-mlb-340522127-awayScore</ID>

</Action>

<Action>

<ActionID>Action-10</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%HomeTeam Score%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>//div[@class='team home']/div[2]/h3[1]/span</ItemXPath>

<ID>matchup-mlb-340522127-homeScore</ID>

</Action>

<Action>

<ActionID>Action-11</ActionID>

<ActionType>BeginAnchorList</ActionType>

<Page>3</Page>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>//\*[@id=&amp;quot;my-players-table&amp;quot;]/div/div[1]/div[1]/table[1]/tbody[1]/tr/td[1]/a[1]</ItemXPath>

<ItemXPath>//\*[@id=&amp;quot;my-players-table&amp;quot;]/div/div[1]/div[1]/table[1]/tbody[1]/tr/td[1]/div[1]/a[1]</ItemXPath>

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<ListName>PlayersList</ListName>

</Action>

<Action>

<ActionID>Action-15</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%Team%ABRHRBI</FieldExpression>

<FieldExpression>%Team%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>../../../../thead/tr/th</ItemXPath>

<ItemXPath>//\*[@id=&amp;quot;my-players-table&amp;quot;]//thead[1]/tr[1]/th[1]</ItemXPath>

</Action>

<Action>

<ActionID>Action-49</ActionID>

<ActionType>GetElementValue</ActionType>

<Description>Captures the text of the list item</Description>

<Page>3</Page>

<FieldExpression>%Player%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>.</ItemXPath>

</Action>

<Action>

<ActionID>Action-13</ActionID>

<ActionType>GetElementValue</ActionType>

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<Page>3</Page>

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<ItemXPath>.</ItemXPath>

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<Action>

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<Description>Captures the text of the list item</Description>

<Page>3</Page>

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</Action>

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<Replacement>

<Type>Regex</Type>

<From>(.\*) </From>

</Replacement>

</Action>

<Action>

<ActionID>Action-16</ActionID>

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<Page>3</Page>

<FieldExpression>%AB%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

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<ItemXPath>../../following-sibling::td[1]</ItemXPath>

</Action>

<Action>

<ActionID>Action-17</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%R%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

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<ItemXPath>../../following-sibling::td[2]</ItemXPath>

</Action>

<Action>

<ActionID>Action-18</ActionID>

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<Page>3</Page>

<FieldExpression>%H%</FieldExpression>

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</Action>

<Action>

<ActionID>Action-19</ActionID>

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<Page>3</Page>

<FieldExpression>%RBI%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>../following-sibling::td[4]</ItemXPath>

<ItemXPath>../../following-sibling::td[4]</ItemXPath>

</Action>

<Action>

<ActionID>Action-20</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%BB%</FieldExpression>

<ItemType>PlaceHolder</ItemType>

<ItemXPath>../following-sibling::td[5]</ItemXPath>

<ItemXPath>../../following-sibling::td[5]</ItemXPath>

</Action>

<Action>

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<Page>3</Page>

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<Page>3</Page>

<FieldExpression>%Pitcher H%</FieldExpression>

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<ActionID>Action-32</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%Pitcher R%</FieldExpression>

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<ActionID>Action-33</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%Pitcher ER%</FieldExpression>

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<Action>

<ActionID>Action-34</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%Pitcher BB%</FieldExpression>

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<FieldExpression>%Pitcher SO%</FieldExpression>

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<Action>

<ActionID>Action-36</ActionID>

<ActionType>GetElementValue</ActionType>

<Page>3</Page>

<FieldExpression>%Pitcher HR%</FieldExpression>

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</Action>

<Action>

<ActionID>Action-37</ActionID>

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<Page>3</Page>

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<Action>

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<ActionType>GetElementValue</ActionType>

<Page>3</Page>

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<Page>3</Page>

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<ListName>PitchersList</ListName>

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<Page>3</Page>

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<Page>4</Page>

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<Page>4</Page>

<FieldExpression>%PBP Opp Pitcher% pitching for %PBP Opp Team%</FieldExpression>

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<Page>4</Page>

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<FieldExpression>regex:(.)\*\\,(?&amp;lt;Hit\_By\_Pitch&amp;gt;(.|\\n|\\r)\*)hit by pitch</FieldExpression>

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<FieldExpression>regex:(.)\*\\,(?&amp;lt;Caught\_Stealing&amp;gt;(.|\\n|\\r)\*)caught stealing</FieldExpression>

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