University of Glasgow | School of Computing Science

Algorithms for Sports Elimination

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Abstract

Abstract goes here.

Acknowledgements

We would like to thank our project supervisor, Dr. David Manlove, for his extensive guidance, knowledge, and support throughout the project. We would also like to thank all of the participants of our user evaluation during the evaluation stage of our project.

Education Use Consent

We hereby give our permission for this project to be shown to other University of Glasgow students and to be distributed in an electronic format. **Please note that you are under no obligation to sign this declaration, but doing so would help future students.**

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Chapter 2

Preliminaries

2.1 Terminology

The web application design and implementation section discusses many web technologies along with their acronyms. The acronyms will be described with a brief overview of the technology.

- HTML: Hyper Text Markup Language. HTML is the basis of every web page structure. It is a structured document with tags denoted by angle brackets (such as <html>). These tags form a nested, tree-like structure that is read by the browser to create the page layout of the website.
- CSS: Cascading Style Sheets. CSS provides the style information for the HTML document. CSS enables the separation of the HTML document content from the document's presentation and defines a consistent approach for specifying the style of an HTML document.
- JS: JavaScript. JS is an interpreted computer programming language used by browsers to provide dynamic, interactive web page content without requiring communication with the web server. JS is bundled alongside an HTML document.
- jQuery and jQuery UI: These are libraries (bundles) of JavaScript code to simplify the development of JavaScript.
- PHP: PHP Hypertext Preprocessor. PHP is a server-side computer programming language used to generate dynamic web pages prior to sending the web page on to the browser in the form of HTML. PHP may interact with databases and other external data sources during the creation of the web page.
- SQL: Structured Query Language. A high-level language for expressing what a user wants from a database.
- MySQL. The relational database management system that manages some data set represented by tables. MySQL also accepts SQL queries and will return data that matches what the SQL query requests.

This report discusses graph theory and network flow relating to the Ford-Fulkerson algorithm in significant depth. This is discussed in a separate section, section 2.2.

2.2 Graph Theory and Network Flow

Graphs are made up of two components: vertices and edges. Vertices can be thought of as cities, with edges being roads between cities. A road between two cities can have a maximum number of cars on it at one time. This is known as the edges capacity. The road has a number of cars on it at present time, known as the edges flow. The flow of traffic can never exceed the capacity of the road.

The road from city A to city B is separate from city B to city A and the existence of one road does not imply the existence of the other.

Network Flow is the study of working out how to have as much traffic move from a start city (the source) to an end city (the sink) by passing through intermediate cities. By using this concept, it is possible to determine the elimination of teams in a sports league. This application of graph theory and network flow will be discussed in detail in section 3.2 on the Ford-Fulkerson algorithm.

Chapter 3

Design and Implementation

3.1 Desktop User Interface

3.1.1 Design

3.1.2 Implementation

3.2 Ford-Fulkerson Algorithm

3.2.1 Design

Wayne paper [1]

3.2.2 Implementation

3.3 Parser

3.3.1 Design

3.3.2 Implementation

3.4 Web Application

3.4.1 Design

Introduction

This section discusses the design of the web-based version of the application. The design of the application was constructed with only the most important functional and non-functional requirements in mind. The web-based version was classed as the least important part of the project, with preliminary effort directed solely towards the desktop application.

System architecture

The web application is a standard multi-tier architecture with the presentation, logic, and data separated from each other.

The presentation tier is the client/browser who has Hyper Text Mark-up Language (HTML) and Cascading Style Sheets (CSS) for the static presentation of content. In addition there is JavaScript supported by JQuery JQueryUI for the dynamic user interface elements.

The logic tier runs on a web server called Lighttpd (pronounced lighty) that is supported by PHP: Hypertext Preprocessor (PHP). The logic tier has two data sources that make up the data tier, a MySQL database containing the latest data and a Java jar for looking back at older data.

The N-Tier Architecture diagram is available from appendix D.

User interface

The user interface of the web application was intended on being as close to the desktop interface as viable within the constraints of a web browser and within the realms of what is typical layout of a web page.

A wireframe for the web application is shown in figure C.

The web application has a single page containing the six available divisions. Each division is a table and only one is available for viewing. The reasoning behind this is to keep as much information 'about the fold' (above the lower page boundary on a browser's window).

There are links at the top of each page that will allow the user to traverse the entire date range for the season allowing them to view the scoreboard and elimination status at any point in time.

3.4.2 Implementation

Introduction

This section discusses the implementation of the web-based version of the application. The implementation discussion will be split up into the three main sections as shown in figure D.

Presentation - Client/Browser

The website uses three of the most common web technologies in use: HTML, CSS, and JavaScript (supported by jQuery and jQuery UI).

Logic - Web Server/PHP Processor

The website is dynamically created by using PHP. PHP interfaces with data one of the data layer sections and, from the results obtained from the data layer, produces the division tables and pushes the generated HTML along with the attached CSS and JavaScript.

Data - MySQL Database/Java JAR

The web application has two primary sources of data: a MySQL database and a Java JAR file. The MySQL database contains the recent information available on the sports divisions whereas the Java JAR contains a text file of the entire result set allowing the user to request to see the state of a division at any point in the league.

Chapter 4

Evaluation

4.1 Correctness Testing

4.2 User Evaluation

Chapter 5

Conclusion

5.1 Summary

5.2 Future Work

5.3 Lessons Learned

Chapter 6

Contributions

6.1 Gordon Reid

- Team leader
- Ford-Fulkerson algorithm
- Second user interface iteration
- Second parser iteration (in use)
- Post-second user interface iteration file opening.
- Web application user interface
- Web application back-end

6.2 Ryan Wells

6.3 Kris Stewart

6.4 David Selkirk

6.5 James Gallagher

Appendix A

Installation and Running of Application

A.1 Desktop Application

A.1.1 Installation

The desktop application requires the Java Runtime Environment (JRE) available from http://www.java.com/en/download/index.jsp. The application has been tested on JRE 6 and JRE 7 without issue.

The print functionality requires a LaTeX distribution that includes the executable ‘pdflatex’. The installation procedure varies for each operating system and instructions are available from http://latex-project.org/ftp.html.

A.1.2 Running

After the Java Runtime Environment (JRE) is installed, running the application only requires double clicking the supplied JAR file.

The print functionality is executed within the Java application and thus is transparent to the user. In the event that the command ‘pdflatex’ cannot be found, the application will fail to print however will not crash. Print functionality is known to work on standard installations of the distribution on Linux/GNU-based and Mac OS operating system.

A.2 Web Application

A.2.1 Installation

Installation of the web application is not required as a remote host is running the required software. This can be accessed via http://www.gordonrenfrewshire.com/teamw. For purposes of completeness and satisfying the potential desires of the reader, an installation procedure is supplied.

In the event that the supplied URL fails to work, please contact Gordon Reid via any of the following methods:

Student email: 1002536r@student.gla.ac.uk

Personal email: gordon.reid1992@hotmail.co.uk

Mobile phone: 07706 477 672

The web server has numerous standard applications running to service the web application. Each one is required for full functionality:

1. A web server (such as Lighttpd or Apache)
2. PHP (known to work on PHP 5.x)
3. Java Runtime Environment (version 6 or 7)
4. MySQL (version 5.x)

Installation of packages

The installation procedure assumes you have super user access on a Debian-based distribution. The official procedure for installation of a 'LAMP' (Linux Apache, MySQL, PHP) server is available from the Debian Wiki at http://wiki.debian.org/LaMp

Set up of database

COMMAND FOR DB CREATION HERE

SQL FOR CREATION OF TABLE HERE

In the folder 'website/content/php/includes/functions.php' there are a number of variables at the top of the page indicating the values for the server, user, password, and database. These can be modified to suit your requirements however the default are highly recommended.

A word of warning, the variable scope is very insecure and however was designed as such for simplicity of installation and testing. Please do not run the server code on a public or production server.

A.2.2 Running

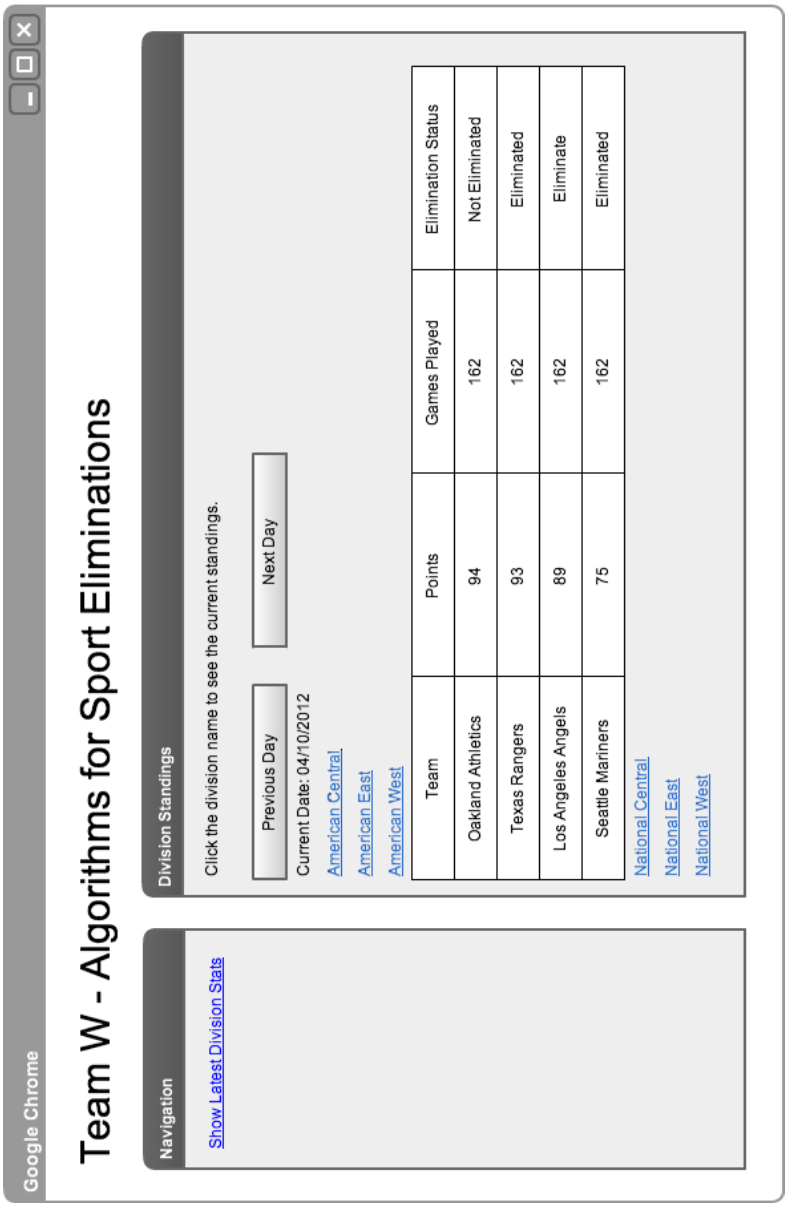
As stated in the installation section, the web application is available for viewing at http://www.gordonrenfrewshire.com/teamw. If a personal installation has been executed then running the application will be dependent on your own set up.

Appendix B

User Manual

Appendix C

Web Application Wireframe



Team W - Algorithms for Sport Eliminations

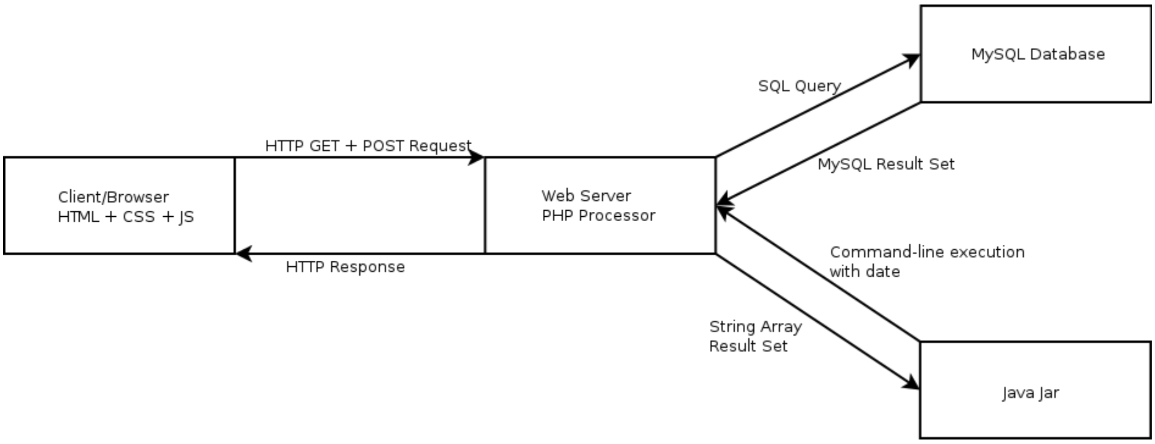
Click the division name to see the current standings.

Current Date: 04/10/2012

Team	Points	Games Played	Elimination Status
Oakland Athletics	94	162	Not Eliminated
Texas Rangers	93	162	Eliminated
Los Angeles Angels	89	162	Eliminate
Seattle Mariners	75	162	Eliminated

Appendix D

Web Application N-Tier Architecture Diagram



Bibliography

[1] Kevin D. Wayne. A new property and a faster algorithm for baseball elimination. 14(2):223–229, 2001.