Volume 4
Issue 2 *Spring 2018*

Article 4

February 2018

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Danica Dvorachek
Liberty University, ddvorachek@liberty.edu

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With over 52 million visitors annually, the Walt Disney World theme park is one of the busiest places on earth (US City Traveler, 2015). While some of these visitors are regular attendees, most are creating new memories in unfamiliar territory. To assist these novice theme park visitors, a plethora of reference books, blogs, tour guides and other resources exist. These recommend which attractions to visit and their popularity. What these resources do not provide, however, is the optimal order that these attractions should be visited.

This paper suggests that a decision support system (DSS) could be created that would receive user inputs in order to compute the optimal route that a guest should take to accomplish their attraction-visiting goals. By implementing a DSS of this nature into its mobile application and theme parks, the author makes the case that the Walt Disney Company could increase its guest satisfaction and theme park profits.

An Introduction to Decision Support Systems

Decision support systems (DSS) are used globally, across all lines of business, to assist humans in their decision-making processes. On a basic level, DSS take into account all types of inputs, utilizing forecasting techniques and algorithms, to output a best decision. In other words, DSS "are systems designed to ensure more precise decision-making by effectively using timely and appropriate data, information, and knowledge management for convergence industry" (Chung, Boutaba, & Hariri, 2016).

There are many ways that DSS can be employed; these are generally categorized into five types. The first type is the communication DSS, used mostly for internal teams. Examples of communication DSS include instant messaging software and online collaboration spaces. The second type is data-driven DSS, which answers specific user questions. This is most often seen in a querying system, such as a nurse searching for a patient's records. Next, the document DSS has the purpose of finding documents based on specific keywords or tags. Examples include everyday search engines such as Google or Bing. Knowledge DSS are the fourth category, covering a clear majority of DSS. These are used to help provide advice or assist in choosing a product. Finally, model DSS are arguably the most complex systems, helping with company analysis. These are often used for scheduling and simulation (Power, 2016).

For the purposes of this paper, the DSS being discussed would fall under the category of modeling DSS due to its scheduling and visualization components. These attributes will be further discussed in the Graphical User Interface portion of the paper.

Theme Park Routing

The inspiration for this paper and corresponding project is a journal article by C. Y. Tsai and S. H. Chung. The paper was published January 2012 in the Journal of Decision Support Systems. Its topic: a personalized route recommendation service for theme parks using RFID information and tourist behavior. The basic premise is that a theme park can collect data from each of its park visitors that are wearing RFID bracelets. This data could then be used alongside the data from the theme park's attractions to create routes for individuals as they come into the theme park.

Tsai and Chung's paper is not the only journal article to explore the topic of theme park routing. Similar articles discuss how crowding and congestion is often worse than it needs to be in theme parks because visitors bunch into groups, distributing themselves unevenly around the area (Brown, Kappes, & Marks, 2013; Zheng, Jin, & Ren, 2014). Other travel route articles discuss using geotagged photos instead of RFID readers (Kurashima, Iwata, Irie, & Fujimura, 2013). While the methodologies of these papers may differ, they all agree that the visitor's experience could be greatly improved by utilizing routing methods.

Walt Disney World has four theme parks, two water parks, twenty-seven resorts, and the main shopping center, Disney Springs. For the corresponding project about which this paper is written, routes can be determined within each of the four theme parks: Magic Kingdom, Epcot, Hollywood Studios, and Animal Kingdom.

DSS Benefits

Visitor

The biggest advantage that a DSS brings to a theme park visitor is an optimized experience. The guest is able to wait a minimum amount of time in lines while having the opportunity to experience as many rides and attractions as possible.

Additionally, a DSS can take a level of stress off the shoulders of visitors. Instead of worrying about where to go and when, the visitors can simply rely on the advice of the DSS. Because the DSS is able to predict the busiest times of day, it can make suggestions to visitors to more evenly disperse the crowds. This creates a better experience for visitors as well.

Company

By utilizing a DSS, a company can receive many benefits. Generally speaking, some of the advantages may include "improved internal control, better management awareness, faster response to changes in business environment, and recorded experiences" (Louw, 2002). From the perspective of this paper, by having a theme park routing DSS, there are more specific advantages as well.

The first of these is increased revenue. The more satisfied its guests are, the more money Disney receives. This revenue increase is due to longer park visits, returning and repeat guests, and increased brand loyalty. When guests are in the park for longer periods of time, they are more likely to spend extra money on merchandise and dining. If the guests are happy with their experience, they are more likely to come back a second or third time, increasing park profits. With increased brand loyalty, guests are willing to spend more money for Disney-branded items and more likely to consume other Disney-related products (Touzani & Temessek, 2009).

The second advantage is the ability to identify workforce needs more accurately, potentially lowering labor costs. The company is able to collect data on all of the routes being provided to its guests. By doing so, the company is able to identify bottlenecks and determine which areas of the parks will be the busiest at which times in the day. With this information, the company can create a more optimized workload, placing more workers in busier sections of the parks. By increasing the accuracy of its staffing and workload models, the park can reduce its unnecessary workload costs.

The final advantage is having a consumer product that other entertainment competitors do not possess. This allows a theme park to survive in the rapidly changing environment of the entertainment industry. Again, this advantage brings in revenue because guests visit the Disney theme park rather than a competitor.

Data Collection Process

In order for a DSS to be successful, there must be a thorough collection of data to support its decisions. Decision systems, after all, “are only as good as the underlying database supporting it” (Louw, 2002). In the ideal system, data would be collected through RFID bracelets that many of Disney’s guests wear today. These are referred to by the company as Magic Bands (Figure 1), and are used for holding tickets, fastpasses, room keys, and credit cards. Because of their RFID capabilities, they could also be used to monitor the time duration of guests’ activities. RFID scanners are located at the entrance and exit of each attraction, so data can be collected for the time each guest spends waiting in line and riding each attraction.

For the adjacent project to this paper, two methods were used for data collection. The first was from the MyDisneyExperience mobile application. Walt Disney World has an app, MyDisneyExperience, that allows guests to see the current wait times of attractions, among other features. Multiple times each day, data was collected from this app regarding the current wait times of park attractions.

The second method for data collection was to use www.touringplans.com. This webpage has the predicted wait times, actual wait times, and average wait times for Walt Disney World attractions through the 2017 year. Actual wait times were collected for the purpose of the project. The mobile application for Walt Disney World does not keep a record of past wait times, so the Touring Plans website was used for historical data.

Data Categorization

Theme park wait times are affected by multiple variables; however, the main inputs for this project included time of day, time of year, and whether or not it was a weekend. These inputs were chosen because of their impact on theme park attendance and level of activity. Four times of day were chosen, labeled in the database as 1, 2, 3, or 4. The first was from park opening, 8:00am, to 11:00am. The second time period, the lunch rush, covered 11:01 am to 3:00pm. The third time period included times between 3:01pm and 7:59pm. The final time period was during and after fireworks, from 8pm until midnight.

The dates of the year were broken into four categories, labeled in the database as 1, 2, 3, or 4. The first time of year was labeled as the “slow” time; this included most of January, February, and September. The second time period, the “normal” level of busyness, included most of March, April, May, and October. The third time period, or “summer peak” included June, July, August. Finally, the holiday peak, or fourth period, encapsulated November and December.

Weekends are generally busier days than weekdays at theme parks. Thus, days were categorized as weekends or not. Fridays were considered weekends in the data.

Database

For a DSS, there are multiple types from which a database can be chosen. Some of the common databases are based in spreadsheets, C#, Java, C++, Matlab, or R. For this project and paper, a spreadsheet database was chosen. Microsoft Excel was chosen for its functions, common use, and VBA coding. To categorize all of the data, hidden index sheets were used, and index-match functions were used to call upon those index sheets. VBA enabled the graphical user interface (GUI) and the majority of the calculations.

Graphical User Interface

When a user opens the Excel file containing the DSS, they are prompted to go through different sheets and user forms. Below are the explanations of each.

Welcome

The first sheet the user interacts with is the Welcome sheet (Figure 6). Displayed is the company logo, a picture of Mickey Mouse, a description of the DSS, and a start button. Once the start button is selected, the first user form is displayed. Upon opening the excel file, the only sheet visible is the welcome sheet; thus, it is the only screen with which the user is currently able to interact.

User Forms

The first user form asks the user about the park they wish to visit, the date of the visit, and the times they will enter and leave the park. Error checking has been fully integrated into the user form (Figure 2). For example, if the user chooses the month of February, only days from 1 to 29 will appear. If the user chooses to enter the park at 1, it must be PM, not AM. If a user submits the form without entering required information, an error message will appear prompting them to fix the error (Figure 3).

The second user form appears once the first user form has been completely filled out and submitted. It asks the user to choose their top three attractions that they wish to visit (Figure 4). Only attractions within the park that they chose on user form 1 will be displayed as options on user form 2. If the user chooses the same attraction multiple times, a message box displays asking them to change their selections.

The third user form changes depending on which theme park was chosen on user form 1 (Figures 5). Each variation displays the appropriate park logo and the list of attractions there. The attractions that have already been listed as priorities on user form 2 are disabled, so that they cannot be chosen a second time. This user form allows the user to select any other attractions they may want to see if there is extra time. For each of the user forms, the user may go back to the previous form(s), go forward to the next step, or exit the inputs completely.

Output

Once the inputs have been collected from the user, the DSS gives the user two outputs: a schedule and a map visualization. Depending on which park is chosen, the appropriate map is displayed, with numbers correlating to which attractions should be visited in order.

Schedule

The schedule starts from the time the user enters the park, increasing by 15-minute increments, until the user exits the park (Figure 7). In each interval, an attraction is listed. At this point in the day, the user should be involved in this attraction, whether that be standing in queue or riding the attraction. A fifteen minute time frame is given in between each ride for travel time. This is shown on the schedule as the first time slot for the next attraction.

Map Visualization

The DSS displays a park map with all the attractions. For each attraction that the schedule lists, a bright yellow number is shown. The number corresponds to the order in which the user should visit the attractions. Thus, if Animal Kingdom's Na'vi River Journey attraction is the second attraction listed in the schedule, a bright yellow 2 would be shown on top of the Na'vi River Journey on the park map.

Optimization Technology

DSS can use many different types of optimization technology. Because this DSS was hosted in Excel, many formulas and functions were utilized to assist the DSS optimization. The first of these was the index-match function, used to categorize dates and times. This function also made it possible to find the attraction time length. In addition, a selection algorithm was created with VBA to find the minimum of the averages for each attraction in question.

Selection Algorithm

A selection algorithm, also known as selection sort, repeatedly selects the next element and places it into the next open slot (Khan Academy, 2016). This is often an inefficient algorithm, but it is quite simple and often finds a correct solution. In Excel, this process was accommodated to be much faster by using Excel functions to find the averages for each attraction by day and time.

The first priority attraction that the user chooses is given a variable, x1. The second attraction is called x2 and the third attraction is called x3. The code finds the average wait time for each of these attractions during all four times of the day. It identifies the minimum average wait time for x1. It then places x1 into the corresponding time slots. It then identifies the minimum average wait time for x2 and places it into the schedule. It does the same for x3. The algorithm then moves onto the attractions that were listed by the user as not priorities, but would like to visit if time. For each of these attractions, an available time slot in the schedule is found. The algorithm finds the first attraction with a wait time that will fit into the available time slot. It then moves onto the next time slot until no more time in the schedule is left.

Areas of Improvement

Similar to the paper from which this one was inspired, this DSS has a redundancy check procedure so that an attraction will only be selected once for a user. Also, both papers suggest using RFID for data collection. One of the differences, though, is that the Tsai & Chung paper discussed including a travel time based on the distance between attractions. They suggested that RFID points around the park could track how long it takes an average guest to traverse the path between attractions. This paper simply decided to set a baseline of fifteen minutes between rides, though specific travel times make more sense.

Another area of improvement to consider: many guests like to travel to multiple theme parks in one day. While a guest could use this DSS for each park, taking into consideration their own travel time, this DSS could be improved to allow for this park-hopping behavior.

Conclusion

In conclusion, this theme park DSS has the ability to help visitors and the company while improving the guests' experience. By using user inputs regarding theme park, date, and attraction choices, the DSS can create an optimized route for the theme park guest. RFID collected data, an Excel database, a VBA selection algorithm, and GUI all make this DSS possible. In the future, additional features such as park hopping and improved travel times should be included.

Appendix

Figure 1: Magic Band

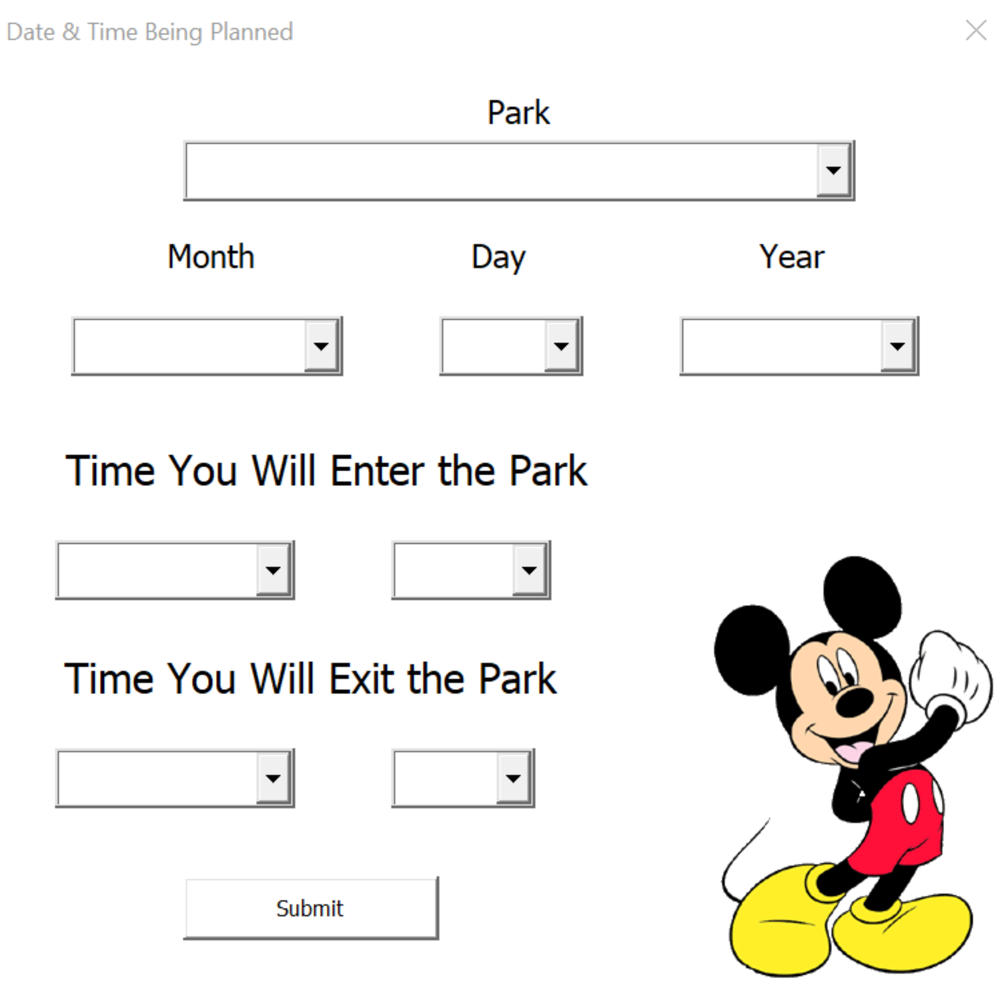

Figure 2: User Form 1

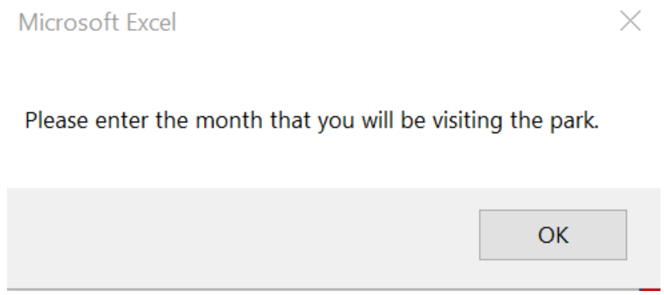

Figure 3: Error Message

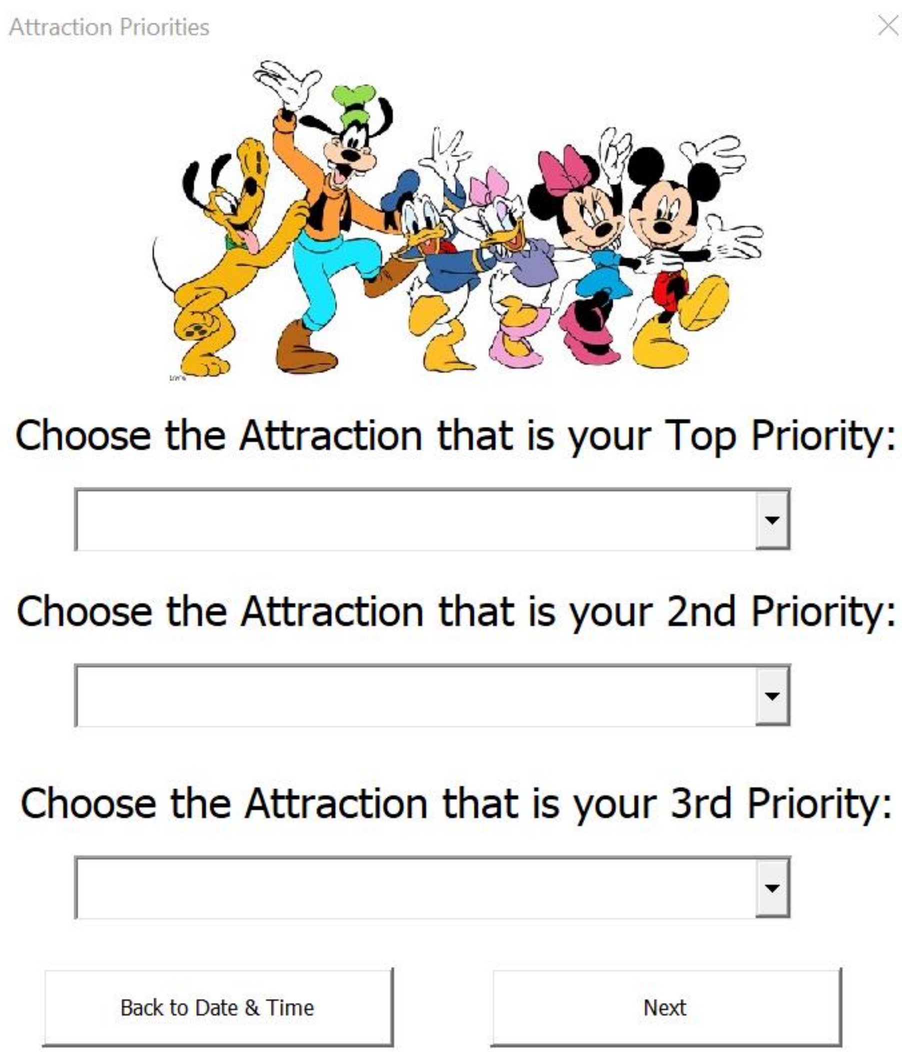

Figure 4: User Form 2

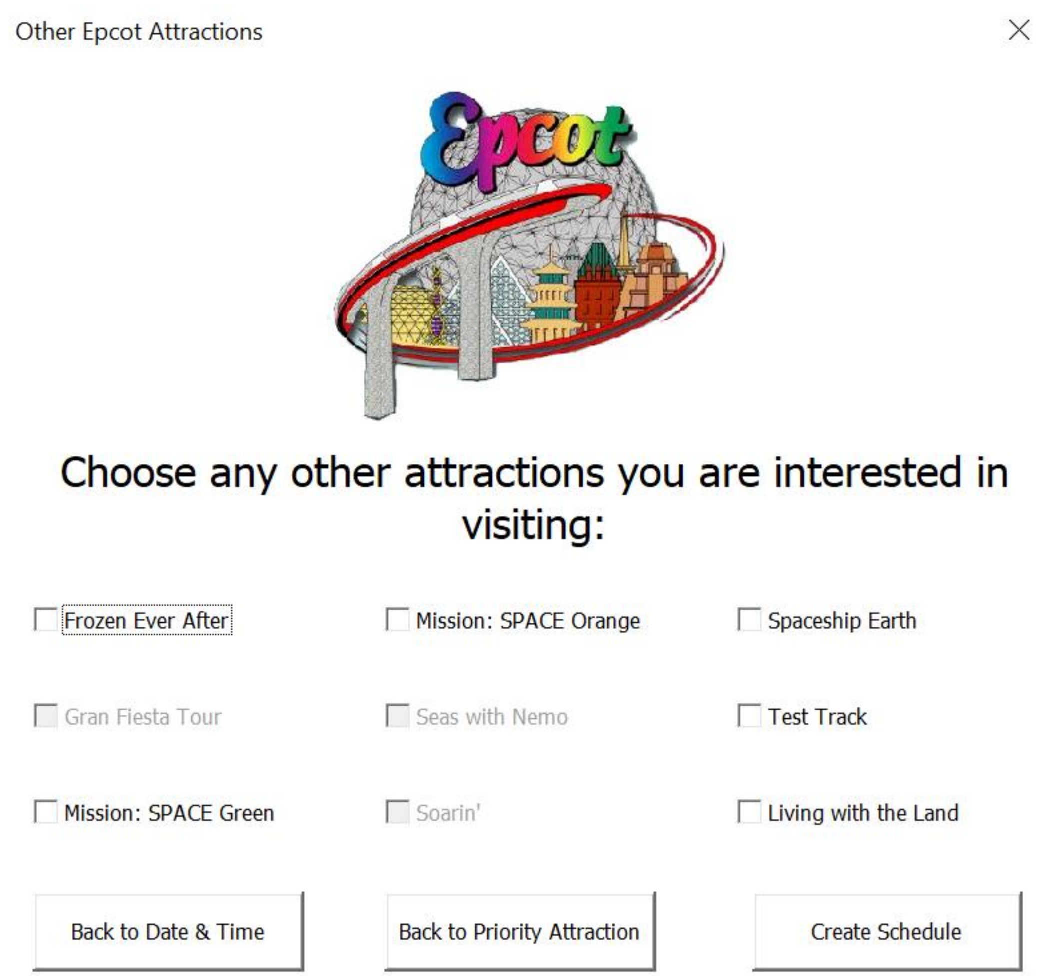

Figure 5: User Form 3 (Epcot)

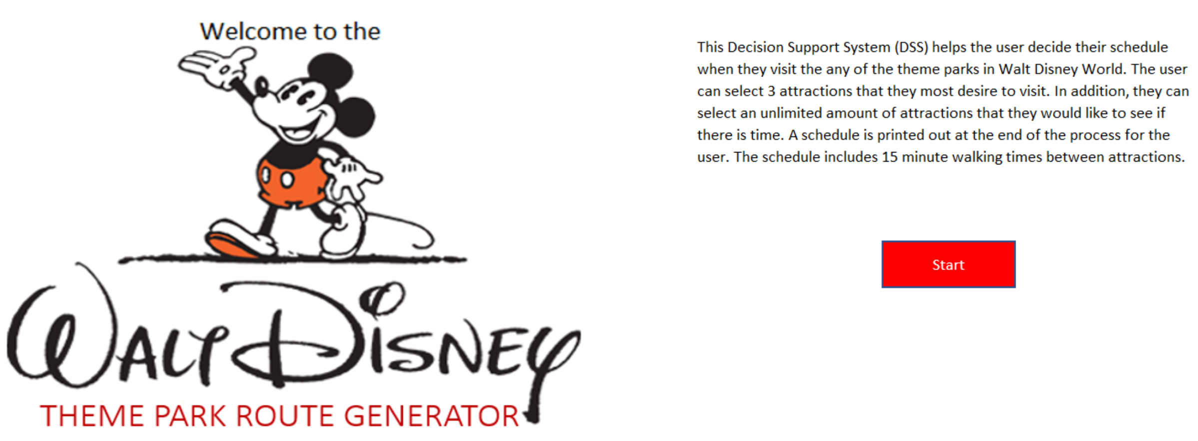

Figure 6: Welcome Screen

Schedule For

February 2 2018

Time Period	Time	Attraction
3	3:00 PM	Primeval Whirl
3	3:15 PM	Primeval Whirl
3	3:30 PM	Primeval Whirl
3	3:45 PM	Na'vi River
3	4:00 PM	Na'vi River
3	4:15 PM	Na'vi River
3	4:30 PM	Na'vi River
3	4:45 PM	Na'vi River
3	5:00 PM	Na'vi River
3	5:15 PM	Na'vi River
3	5:30 PM	Na'vi River
3	5:45 PM	Na'vi River
3	6:00 PM	TriceraTop Spin
3	6:15 PM	TriceraTop Spin
3	6:30 PM	TriceraTop Spin
3	6:45 PM	Kilimanjaro Safari
3	7:00 PM	Kilimanjaro Safari
3	7:15 PM	Kilimanjaro Safari
3	7:30 PM	Kilimanjaro Safari
3	7:45 PM	Kilimanjaro Safari
4	8:00 PM	Dinosaur
4	8:15 PM	Dinosaur
4	8:30 PM	Dinosaur
4	8:45 PM	
4	9:00 PM	

Figure 7: Schedule Sheet

References

Brown, A., Kappes, J., & Marks, J. (2013). Mitigating theme park crowding with incentives and information on mobile devices. *Journal of Travel Research, 54* (4), 426 – 436.

Chung, K., Boutaba, R., & Hariri, S. (2016). Knowledge based decision support system. *Journal of Information Technology and Management*, *17*(1), 1-3.

Khan Academy. (2016). Selection sort pseudocode. *Khan Academy.* Retrieved from: https://www.khanacademy.org/computing/computer-science/algorithms/sorting-algorithms/a/selection-sort-pseudocode

Kurashima, T., Iwata, T., Irie, G., & Fujimura K. (2013). Travel route recommendation using geotagged photos. *Journal of Knowledge and Information Systems, 37*(1), 37 – 60.

Louw, R. E. (2002). Decision support systems. *University of Missouri St. Louis: Information system analysis 488.* Retrieved from: www.umsl.edu/~sauterv/analysis/488_f02_papers/dss.html

Power, D. (2016). Types of decision support systems (DSS). *The Global Development Research Center.* Retrieved from: https://www.gdrc.org/decision/dss-types.html

Touzani, M., & Temessek, A. (2009). Brand loyalty: Impact of cognitive and affective variables. *Journal of Economics and Applied Informatics.*, 227 – 242.

Tsai, C.Y. & Chung, S.H. (2012). A personalized route recommendation service for theme parks using RFID information and tourist behavior. *Journal of Decision Support Systems, 52*(2), 514 – 527.

US City Traveler (2015). 10 most popular theme parks in the world. *US City Traveler.* Retrieved from: http://www.uscitytraveler.com/10-most-popular-theme-parks-in-the-world/

Zheng, W.M., Jin, M.Z., & Ren, P.Y. (2014). The impact of information sharing on congestion using agent-based simulation. *International Journal of Simulation Modelling*, *13*(2), 183 – 194.