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Economic Tour Package Model Using Heuristic

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Abstract. A tour-package is a prearranged tour that includes products and services such as food, activities, accommodation, and transportation, which are sold at a single price. Since the competitiveness within tourism industry is very high, many of the tour agents try to provide attractive tour-packages in order to meet tourist satisfaction as much as possible. Some of the criteria that are considered by the tourist are the number of places to be visited and the cost of the tour-packages. Previous studies indicate that tourists tend to choose economical tour-packages and aiming to visit as many places as they can cover. Thus, this study proposed tour-package model using heuristic approach. The aim is to find economical tour-packages and at the same time to propose as many places as possible to be visited by tourist in a given geographical area particularly in Langkawi Island. The proposed model considers only one starting point where the tour starts and ends at an identified hotel. This study covers 31 most attractive places in Langkawi Island from various categories of tourist attractions. Besides, the allocation of period for lunch and dinner are included in the proposed itineraries where it covers 11 popular restaurants around Langkawi Island. In developing the itinerary, the proposed heuristic approach considers time window for each site (hotel/restaurant/place) so that it represents real world implementation. We present three itineraries with different time constraints (1-day, 2-day and 3-day tour-package). The aim of economic model is to minimize the tour-package cost as much as possible by considering entrance fee of each visited place. We compare the proposed model with our uneconomic model from our previous study. The uneconomic model has no limitation to the cost with the aim to maximize the number of places to be visited. Comparison between the uneconomic and economic itinerary has shown that the proposed model have successfully achieved the objective that minimize the tour cost and cover maximum number of places to be visited.

Keywords: Economic Tour-packages, Heuristic, Tourist Satisfaction, Tourism.
PACS: 02.50.Le, 89.40.-a,

INTRODUCTION

Tourism is an important sector for the development of a country by connecting people around the world. This sector provides various services to people especially through tour packaging. A tour package is a service provided by tour agent and is defined as a single price prearranged tour that provides food, activities, accommodation, and transportation [1]. There are many types of packages offered by the tour agent such as independent and packaged or multi-day and single-day tour packages. The packages can be sold to an individual person or to a group of people depending on tour operators' preference and the preference of the people they are selling their tour to.

This type of tour-packaging problem is referred to as tourist trip design problem (TTDP), where it is an extension of Orienteering Problem (OP) [2]. TTDP is a route-planning problem for tourists interested in visiting multiple attractive places which respect to the tourist constraints and the places attributes. The main objective is to select attractive places that can maximize tourist satisfaction, while taking into account various parameters and constraints such as distances among attractive places, visiting time required for each attractive place, attractive places visiting days/hours, entrance fees, weather conditions and respecting the time available for sightseeing in daily basis. It is known that OP is NP-hard [3] [4]. Hence, exact solutions for OP or specifically for TTDP are only feasible for a small problem.

The TTDP are studied by [5] and [6] where electronic tourist guide was developed using an optimization method. Vansteenwegen et al. [6] employed an effective iterated local search that included an insert and shake steps to escape from local optima. Kantor and Rosenwein [7] proposed two heuristics for solving the OP with time window. The two heuristics are the insertion heuristic, incrementally builds the solution and at each step it selects the node with the highest ratio of profit over insertion cost as the next node to be inserted in the path, and the tree heuristic, is employed when the time windows constraints are tight and the input graph nodes are relatively few.

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There are a number of studies appear in the literature discussing on tour package services in maximizing tourist total satisfaction. For example, the trend of service customization for the package-tour services are showed in [8] and [9] that allows consumer to specify the product or service characteristics that they desire. Popularity of sites to be visited is also contributes to the factor of tourist total satisfaction. This factor was discussed in [10], [11], [12], [13] and [14]. Studies by [10] and [11] were aimed to maximize tourist satisfaction degree whilst respecting time windows restrictions using LP-based heuristic for solving a time constrained routing problem. The problem was solved by scheduling the visit of a tourist in an ordering to a given geographical area. On the other hand, studies by [12] and [13] consider the problem as one-period bus touring problem (BTP). The objective of their studies was to maximize the total attractiveness of the tour by selecting a subset of sites to be visited and scenic routes to be travelled. In other study, Ladany and Deitch [14] employed the BTP with time windows (BTPTW) to maximize the total attractiveness of the tour. The selection of a subset of sites to be visited and scenic routes to be travelled was based on the time windows associated to each of the network items (tourist sites and scenic road segments). In our previous study, Benjamin et al. [15] focused on maximizing tourist satisfaction by considering the number of places being visited with limited and unlimited cost constraint.

The most frequently cited reasons for travellers purchasing a package tour are based on the overall convenience and tour economies [16]. Tourists are mostly assumed that the best method of seeing as much as possible interesting places combined with comfort, scenery and experienced tour guides is through tour packaging [17]. It is shown by [18] that a package tour is a rational and effective way for tourists to visit the largest number of sites on a trip in a given period, to travel in a relatively safe way to faraway countries. Some of the criteria that are considered by the tourist are the number of places to be visited and the cost of the tour-packages. As shown in the literatures, tourists tend to choose economical tour-packages and aiming to visit as many places as they can cover. Thus, this study proposed tour-package model using heuristic approach. The aim is to find economical tour-packages and at the same time to propose as many places as possible to be visited by tourist in a given geographical area particularly in Langkawi Island.

A description on the heuristic approach for constructing economic and uneconomic tour-packages is presented in Section 2. Section 3 discusses the experiments and results of the proposed model. Finally, the conclusion is provided in Section 4 with some future direction.

METHODOLOGY

Heuristic Algorithms

This study employed heuristic approach for solving the TTDP. The implementation of our heuristic algorithm for the tour package development is illustrated in Figure 1. As the solution search is started, the algorithm first checks the feasibility of the tour package such that if there is still itinerary to be developed and there are still places that could be visited by the tourist. Once the feasibility is satisfied, then the tour route will start.

In the next step, the algorithm checks the feasibility of the lunch and dinner period i.e. whether it is time for lunch or dinner or not. If the current time meets the lunch or dinner time windows, then the algorithm starts to find a suitable eating places or restaurant for having lunch or dinner. If it does not meet the lunch or dinner time window, then the algorithm proceed to the next step by finding next feasible places to be visited.

The process is followed by Step 3 where it is represented by Algorithms 1 and 2. Two types of tour package models are presented in this paper; economic and uneconomic. The process of finding places to be visited for the economic model is shown in Algorithm 1. The aim of this model is to produce an economic tour where the main criterion in finding candidate solutions is the one that has lowest entrance fee. On the other hand, the Algorithm 2 is based on the steps in our previous study [15]. The Algorithm 2 shows the process of finding places to be visited for the uneconomic model. This model aims to maximize the number of places to be visited where the main criteria of choosing a place is based on the shortest distance. Subsequently, the chosen place is updated in the itinerary. The itinerary completes whenever the current time meets the time windows of the day and finally the tour returns to the hotel. The process of developing itineraries will stop when the defined number of itineraries has been reached.

ALGORITHM 1. The process of finding places to be visited for the economic model.

```
Choose a place with the lowest entrance fee to be visited from the list of feasible places
IF more than one places in the list
        THEN Choose the nearest place to the current location
        IF more than one places in the list
                THEN Choose a place with the lowest time spent
        ENDIF
ENDIF
```

ALGORITHM 2. The process of finding places to be visited for the uneconomic model.

```
Choose the nearest place to be visited from the list of feasible places
IF more than one places in the list
        THEN Choose the place with the lowest time spent
        IF more than one places that has same lowest spent time
                THEN Choose a place with the lowest entrance fee
        ENDIF
ENDIF
```

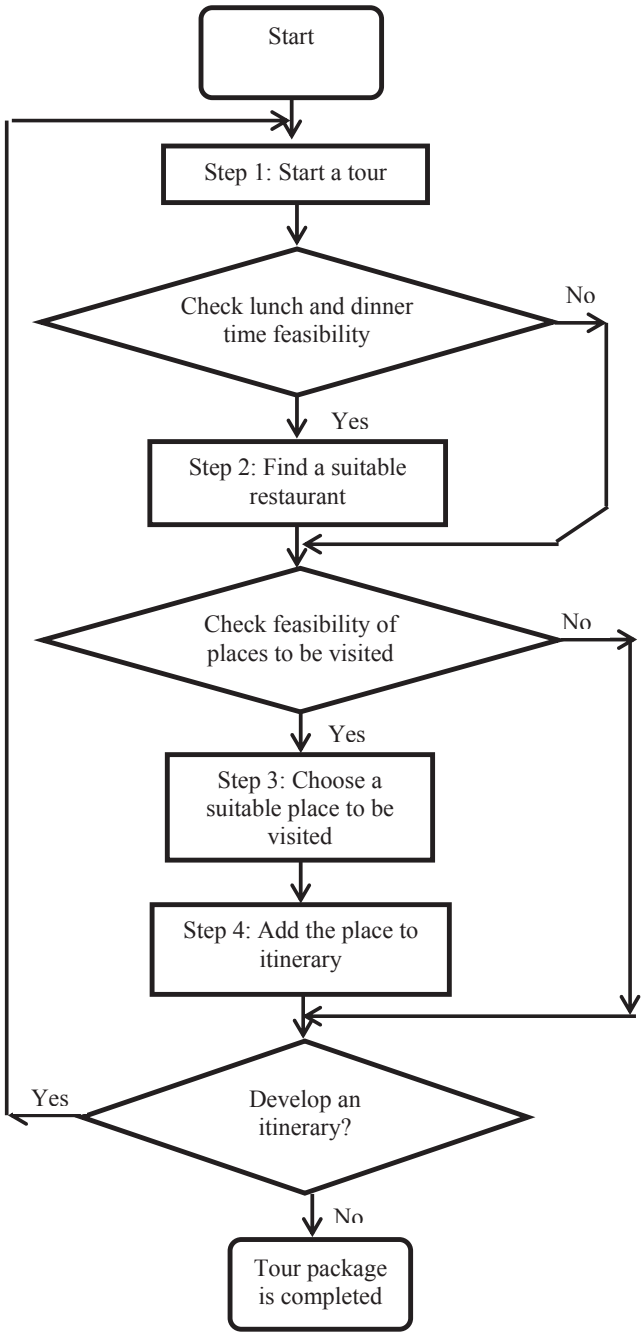

FIGURE 1. Flowchart of the proposed heuristic algorithm

EXPERIMENTS AND RESULTS

Experiments

The experiments in this study are performed using the data collected from the Langkawi Island. As one of the Malaysia best worldwide tourist attraction, Langkawi Island has many categories of attractions such as forests, beaches, history and culture and tax-free shopping which make it suitable for implementing this study. The aim of this study is to generate tour packages for a group of tourist. Due to that, the cost of transportation and tour guide are considered as a fixed cost and are included in the overall cost. It is assumed that each place has a reasonable spending time. For example, time spent for a day cruise is half of a day due to a fix departing and arriving time scheduled by the cruise company. On the other hand, spending time at a certain museum is last for an hour. It is also assumed that the spending time for lunch and dinner is set to one hour each. In this study, the tour starts and ends at the same place. In this case, this study considered a certain hotel in the city area as the starting and ending place.

Results and Analysis

The itineraries of the economic and uneconomic models are presented in Table 1 with three different numbers of days, K = {1, 2, 3}. The values given for each column are the ID number of the places to be visited including the starting and ending point and the eating place(s). The 0 ID value is the starting and ending point of the tour where for this study, the tour is started and ended at an identified hotel. The values starting from 1 to 11 are the eating places. In each itinerary, it is not necessarily to have two eating places. This is due to that some of the activities that have been included in the itinerary are already provide lunch or dinner. Meanwhile, the values from 12 to 48 are the attractive places in Langkawi Island such as forests, beaches, museum and shopping places. It is assumed that the places have equal popularity in order to avoid biasness in selecting the places to be included in the proposed itineraries. The total cost given in the table is the total cost per person in a group of tourists where it includes transportation cost, tour guide and the entrance fee of the visited places.

TABLE (1). The comparison of economic and uneconomic itinerary for K = {1, 2, 3} day(s) (Econ. = economic tour; Unecon. = uneconomic tour).

	K=1		**K=2**				**K=3**					
	Econ.	**Unecon.**	**Econ.**		**Unecon.**		**Econ.**			**Unecon.**		
Day	1	1	1	2	1	2	1	2	3	1	2	3
	0	0	0	0	0	0	0	0	0	0	0	0
	20	46	20	27	46	35	20	27	46	46	35	20
	36	36	36	24	36	26	36	24	39	36	26	22
	45	45	45	26	45	25	45	26	4	45	25	42
	1	43	1	5	43	5	1	5	41	43	5	4
	29	6	29	23	6	23	29	23	37	6	23	31
	33	29	33	21	29	21	33	21	1	29	21	30
	28	33	28	25	33	24	28	25	0	33	24	27
	18	32	18	22	32	44	18	22		32	44	19
	19	28	19	4	28	7	19	4		28	7	8
	8	18	8	0	18	0	8	0		18	0	0
	0	8	0		8		0			8		
		0			0					0		
Total cost	25.00	50.3	50.00		143.5		82.7			223.5		
Total number of places visited	8	9	15		16		19			23		

The overall representation of this Table 1 shows that the objective of economic model is successfully being achieved with at a very minimum cost but with many places can be visited by the tourists. Since the economic model aimed to minimize the cost, most of the proposed places to be visited are the one that requires a very minimum cost or no cost at all such as visiting museums, beaches and shopping complex. As can be seen in the table, the

uneconomic model produces more number of places to be visited but the difference between the economic model is not very significant. This is may be due to that some places that has lowest entrance fees in the economic model has possibilities to have higher time spent compared with the places proposed by the uneconomic model.

CONCLUSIONS

This study proposed an economic tour package model using heuristic. The main criterion of the proposed economic tour model is the one that considered the places that have lowest entrance fees to be included in the itineraries. Experimental results of the proposed model models are compared with a previous study with three different time constraints (K=1, 2, and 3). The results show both models have successfully achieved their objectives. The economic model produced itineraries that have economic cost. The places that have been proposed by the economic model are mostly the places that have minimum entrance fees or no fees at all. On the other hand, the uneconomic produced more places to be visited without considering cost constraint as the main criterion. It is suggested that the proposed heuristic approach could be implemented to a wider area such as the Northern area of Malaysia and of course it would be more challenging in terms of the size of the problem and more criteria need to be considered. This algorithm also can be improved by taking into consideration the tourist preferences in developing itineraries.

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