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COMP 567 Discrete Optimization 2

Project Proposal: SEVANNETTE TOURS

*Problem:* Maximize the number of tourists satisfied per day, where a tourist is satisfied if four out of his/her five requested tour locations are actually visited.

We are a tour guide company that services 4 hotels in and around Montreal. We have 2 stations where we park the tour vehicles when they're not in use. The centers are at a fixed (not relatively short) distance from the different hotels.

Currently, we own 8 vans that can each carry up to 8 passengers, 5 mini-buses that can each hold up to 20 passengers, and 3 buses that can each carry 30 passengers. These are distributed among the stations. As per company policy, a van must have at least 6 passengers, a mini-bus at least 14, and a bus at least 24 passengers. Also, for every 10 passengers, an additional tour guide is required.

Tour guides are paid for their services at an hourly rate. Guides who will also be driving the tour vehicles are paid $22 per hour, while guides who will not be driving the passengers around are paid $13 per hour. By Quebec law, at least one guide per vehicle has to be a Francophone. The catch is that tour guides are unilingual, and that the Francophone guides we employ are unfortunately not licensed to drive such vehicles. We have 10 Francophone guides, and 15 Anglophone guides, and from these, only 11 have a driver's license. (We do not employ just drivers.) Because of these constraints, we try to take as many people as we can in mini-buses or buses. For instance, if we had to use 3 vans, we would have to pay $(22*3 + 13*3) = $105 per hour, whereas if we managed to satisfy all tourists by taking them in one big bus, we would have to pay $(22*1 + 13*2) = $48 per hour.

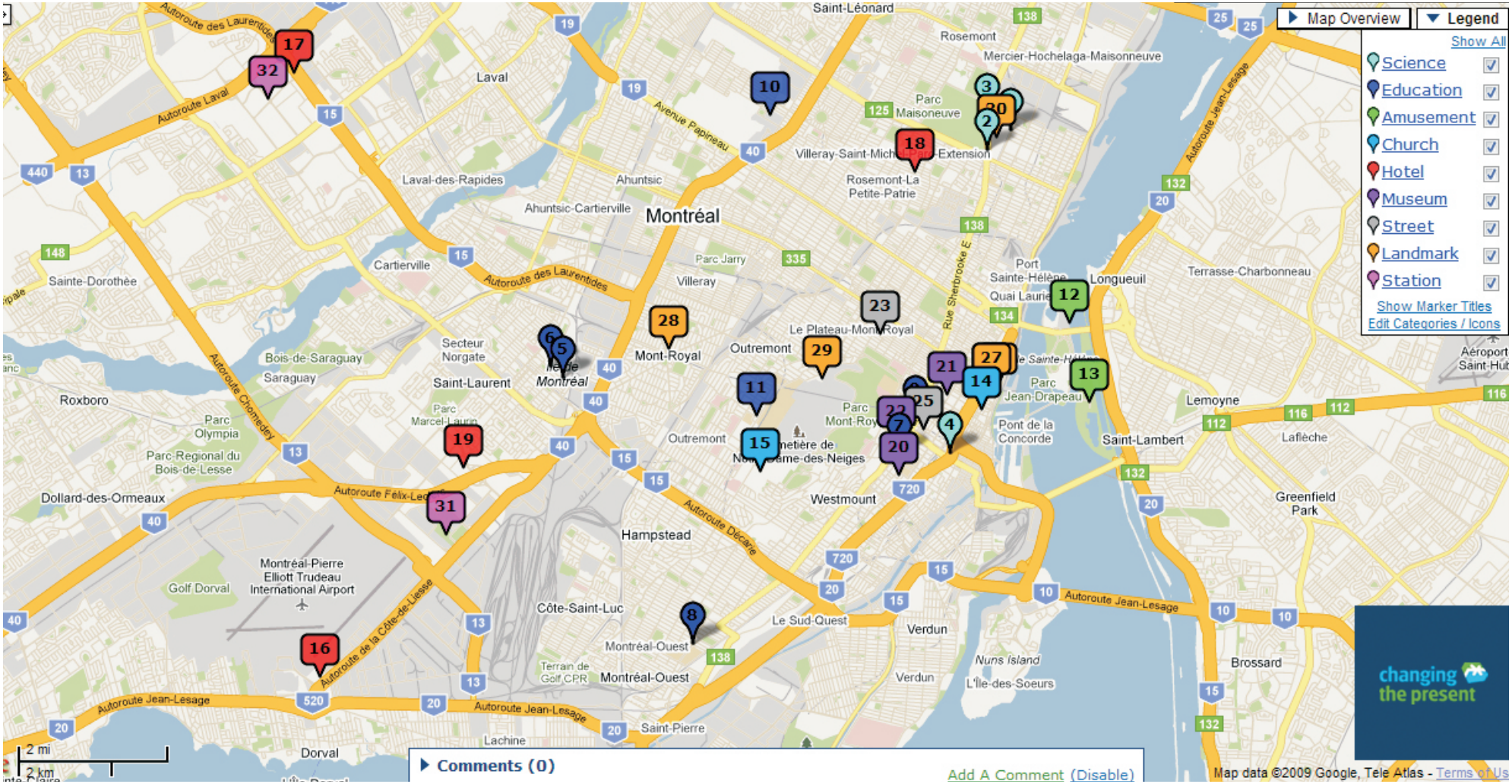
However, fuel costs per tour for a bus are approximately $200, for a mini-bus approximately $130, and for a van, approximately $80. As for parking, while most tourist areas have free parking, a few are paid. Parking costs in such locations for a bus are $25 per hour, a mini-bus, $15 per hour, and a van, $12 per hour.

We must make at least $400 profit per day. It costs tourists $45 for day tours, and $35 for night tours. No vans can be used for night tours. We must drive to at least 2 different touristic regions per tour. We have 27 touristic locations available. These locations are grouped into 18 different regions, according to distance between locations. Some regions have paid parking while others don't. Our company has agreements with some restaurants in Montreal as well. Some regions

include a restaurant while others don't. Tours last approximately 4 hours, and include lunch or dinner. Therefore at least one of the areas per tour has to have a restaurant for the tourists to dine. Also, the estimated time needed to visit a location depends on the type of location. For instance, visiting a museum would take about 45 minutes.

Each tourist gets a checklist of locations and is asked to choose five locations he/ she would like to visit. A tourist will be satisfied with the service offered if and only if he/ she visits at least 4 out of the 5 choices. For instance, if 6 tourists wanted to visit the Planetarium, the Biodome, the Botanical Gardens, the Insectarium and the Olympic Stadium, which would take over 3 hours in total, and these tourists were on a 20-passenger bus, they would not be able to visit them all due to timing constraints and lunch requirements. They would not be satisfied with the service. However, if we grouped them into a van instead, assuming this is allowed after taking the total cost constraints into consideration, that would make 6 more tourists satisfied.

Our aim is to make the maximum number of tourists ( = integers ) satisfied per day, while taking into account cost and time constraints.


Map Overview
Legend
Show All
Science
Education
Amusement
Church
Hotel
Museum
Street
Landmark
Station
Show Marker Titles
Edit Categories / Icons
Montréal
Laval
Saint-Léonard
Rosemont
Mercier-Hochelaga-Maisonneuve
Parc Maisoneuve
Villeray-Saint-Michel-Parc-Extension
Rosemont-La Petite-Patrie
Ahuntsic
Ahuntsic-Cartierville
Laval-des-Rapides
Cartierville
Sainte-Dorothée
Parc Jarry
Villeray
Mont-Royal
Outremont
Le Plateau-Mont-Royal
Secteur Norgate
Saint-Laurent
Bois-de-Saraguay
Saraguay
Roxboro
Parc Olympia
Parc Marcel-Laurin
Parc Regional du Bois-de-Lesse
Dollard-des-Ormeaux
Montréal-Pierre Elliott Trudeau International Airport
Golf Dorval
Hampstead
Westmount
Côte-Saint-Luc
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Verdun
Nuns Island
L'Île-des-Soeurs
Lachine
Saint-Pierre
Dorval
Port Sainte-Hélène
Quai Laurier
Longueuil
Terrasse-Charbonneau
Parc Jean-Drapeau
Pont de la Concorde
Saint-Lambert
Lemoyne
Laflèche
Greenfield Park
Brossard
Aéroport Saint-Hubert
Autoroute des Laurentides
Autoroute Laval
Autoroute Chomedey
Autoroute Félix-Leclerc
Autoroute de la Côte-de-Liesse
Autoroute Décarie
Autoroute Jean-Lesage
Avenue Papineau
Rue Sherbrooke E
2 mi
2 km
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| Location | Type | Day Trip | Night Trip | Time Needed | Restaurant | Parking | Region | Map |
|---|---|---|---|---|---|---|---|---|
| CEGEP Saint Laurent | Education-1 | Yes | No | 20 mins | No | Yes | 1 | 5 |
| CEGEP Vanier | Education-1 | Yes | No | 20 mins | No | Yes | 1 | 6 |
| Concordia University | Education -2 | Yes | No | 15 mins | No | No | 2 | 7 |
| Museum of Fine Arts | Museum | Yes | No | 45 mins | No | No | 2 | 22 |
| Sainte Catherine Street | Street | Yes | No | 60 mins | Yes | No | 2 | 25 |
| McGill University | Education-2 | Yes | No | 45 mins | No | No | 3 | 9 |
| Museum of Contemporary Art | Museum | Yes | No | 45 mins | No | No | 4 | 21 |
| Notre Dame Basilica | Church | Yes | No | 40 mins | No | No | 5 | 14 |
| Old Montreal | Street | Yes | Yes | 60 mins | Yes | No | 6 | 24 |
| City Hall | Landmark | Yes | Yes | 15 mins | No | No | 6 | 27 |
| Bonsecours Market | Landmark | Yes | No | 30 mins | No | No | 6 | 26 |
| Planetarium | Science | Yes | No | 40 mins | No | Yes | 7 | 4 |
| Biodome | Science | Yes | No | 40 mins | No | Yes | 8 | 1 |
| Botanical Gardens | Science | Yes | No | 40 mins | No | Yes | 8 | 2 |
| Insectarium | Science | Yes | No | 40 mins | No | Yes | 8 | 3 |
| Olympic Stadium | Landmark | Yes | No | 40 mins | No | Yes | 8 | 30 |
| Concordia - Loyola Campus | Education-2 | Yes | No | 30 mins | No | Yes | 9 | 8 |
| National Circus School | Education-2 | Yes | No | 45 mins | No | Yes | 10 | 10 |
| Universite De Montreal | Education-2 | Yes | No | 45 mins | No | Yes | 11 | 11 |
| Canadian Center for Architecture | Museum | Yes | No | 45 mins | No | No | 12 | 20 |
| Boulevard Saint Laurent | Street | Yes | Yes | 60 mins | Yes | No | 13 | 23 |
| Mount Royal | Landmark | Yes | Yes | 60 mins | No | Yes | 14 | 28 |
| Mount Royal Cemetery | Landmark | No | Yes | 20 mins | No | No | 15 | 29 |
| Montreal Casino | Amusement | No | Yes | 150 mins | Yes | Yes | 16 | 13 |
| La Ronde | Amusement | Yes | No | 150 mins | Yes | Yes | 17 | 12 |
| Oratory | Church | Yes | No | 40 mins | No | Yes | 18 | 15 |