

Travelling Salesman Problem: THEME PARK Question Worksheet

TASK

You are helping to organise a school trip to Hamilton's Adventure Park in October.

Your teacher is arranging the transport. A coach will drop you off at the Park gates at 10am, but they need to know what time you will be leaving. The coach will be staying at the Park until you are ready to leave and will be charging an hourly rate during this time. The school is funding the trip, although they only have a limited budget and they want to make it as cheap as possible.

Therefore, in order to keep the transport costs as low as possible, it is up to you to plan the quickest route around Hamilton's Adventure Park. As you will have standard tickets, you need to allocate time to queue for entry to the Park. You will also need to allow time for you and your friends to visit each main attraction once before returning to the Park gates, and include a 30 minute lunch break.

INFORMATION GATHERING

1. What information do you need to consider for this task?

.....

.....

.....

.....

.....

.....

2. Complete the table below to complete the network and show the quickest routes between all attractions

	Park Gates	Animal Kingdom	Carnival Land	Corkscrew	Log Flume	Wonder Wheel	The Hole	Roller Coaster
Park Gates	-	8m	12m			14m		
Animal Kingdom	8m	-		3m	6m30s			
Carnival Land	12m		-			6m30s		10m30s
Corkscrew		3m		-	6m30s			
Log Flume		6m30s		6m30s	-	13m30s	11m	
Wonder Wheel	14m		6m30s		13m30s	-	9m	9m30s
The Hole					11m	9m	-	10m30s
Roller Coaster			10m30s			9m30s	10m30s	-

UPPER AND LOWER BOUNDS

Lowest Upper Bound - Nearest Neighbour Algorithm

1. Pick any starting vertex
2. Consider the edges that join the starting vertex to other vertices. Pick the edge with the minimum weight and add this to the cycle
3. Repeat step 2 until all vertices have been chosen
4. Add the edge that joins the last vertex to the first vertex to complete the cycle

Highest Lowest Bound - Minimum Spanning Tree / Prim's Algorithm

1. Pick any vertex. Remove the two connecting edges with least weight
2. Find the minimum spanning tree for the other vertices using Prim's Algorithm:
 - a. From any start vertex, draw the lowest valued edge to start your tree

- b. From any vertex on your tree, add the edge with the lowest value
 - c. If there are $n-1$ edges in your tree, you have finished. If not, repeat step b
3. Add back in the two edges previously removed
4. The weight of the resulting graph (which may not be a cycle) is a lower bound
5. Repeat steps 1-4 for each vertex. The largest result is the overall lower bound

3. Applying the Nearest Neighbour Algorithm, complete the Table below:

Starting vertex	Tour using Nearest Neighbour Algorithm	Weight of tour
Park Gates		
Animal Kingdom		
Carnival Land		
Corkscrew		
Log Flume		
Wonder Wheel		
The Hole		
Roller Coaster		

4. What is the Lowest Upper Bound?

.....

5. Applying the Minimum Spanning Tree/Prim's Algorithm, complete the Table below:

Vertex deleted	Total weight of Minimum Spanning Tree	Total weight of two shortest edges connected to deleted vertex	Lower Bound
Park Gates			
Animal Kingdom			
Carnival Land			
Corkscrew			
Log Flume			
Wonder Wheel			
The Hole			
Roller Coaster			

6. What is the Highest Lower Bound?

.....

7. Solution

a. What is the most reasonable tour time and route of Hamilton's Adventure Park?

.....
.....
.....
.....
.....
.....
.....
.....

b. Using the tour time from Question 7a. and the information from Question 1, use the space below to outline how long you will be in the Park altogether and what time you will need the coach to collect you from the Park Gates.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....