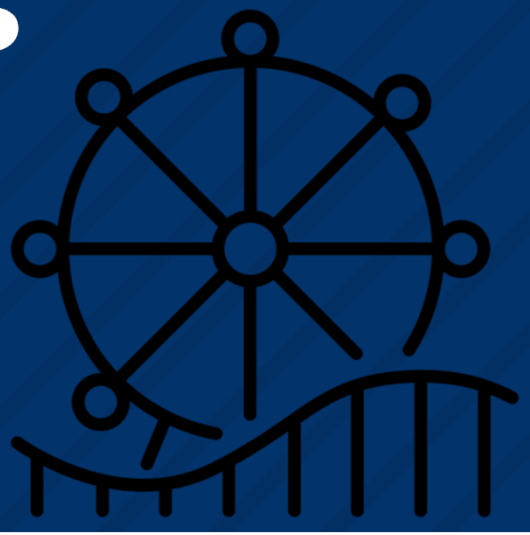
IIE/RA Contest
Problem 6

SM Theme Parks



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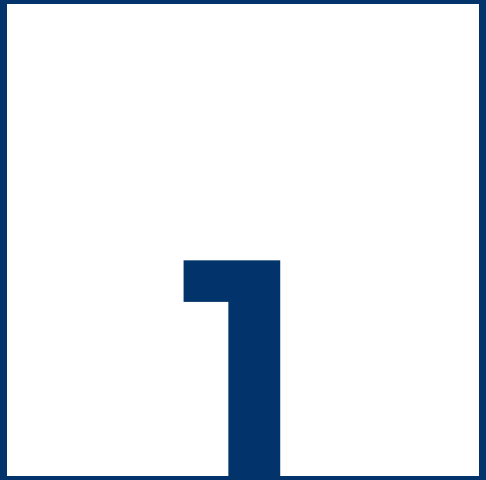

CASE STUDY

What are our problems and the objectives of our case study?

Bayou Adventure World

Frog Pond

Racoon Corner

Skunk Hollow

Gator Island

Problems

The system still needs to be sized to meet the needs of Bayou Adventure World !

- This system can accommodate up to eight trains. Each car having a capacity of **approximately 25 people (+/-)**
- There are two possible modes to consider for customer **loading and unloading** (one side/ both sides)
- Depart only **if full** (almost full) or **fixed period** of time?
- Not look at the amount of time that a customer has to wait for a people-mover, but to look at the **proportion of time** that a people-mover leaves a station when people are unable to board.

Objectives

Minimize 2 & 3, if possible, avoid state 4 with minimal cost !

States:

1. Train leaves a stop with no people waiting to board
2. Train leaves with 1 to 24 people still waiting
3. Train leaves with 25 to 49 people still waiting
4. Train leaves with 50 or more people still waiting

Objectives

Setup

→ what configuration?

Customer acceptance

→ achieving high customer satisfaction

Monetary

→ most cost-effective solution

SIMULATION

Terminating Simulation

- Open between 10 AM and 10 PM daily (600 minutes)
- Start the trains a few minutes before we open the gates each day so that the system is fully functional when the first customers arrive
- The trains will also continue to run after the closing time for approximately one-half hour, or until all customers have departed the park.

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DATA

An overview

DATA 1

Table 1: Travel times

Route	Time	Unit
Frog Pond - Skunk Hollow	5	[minutes]
Skunk Hollow - Gator Island	8	[minutes]
Gator Island - Raccoon Corner	7	[minutes]
Raccoon Corner - Frog Pond	6	[minutes]
Sum:	26	[minutes]

Assumption:
-Travel times are constant

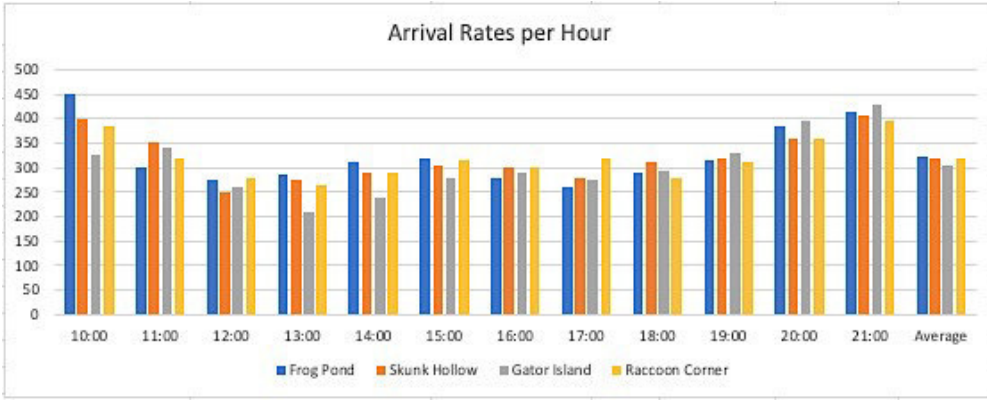
DATA 2

Table 2: Expected customers per hour

Time	Frog Pond	Skunk Hollow	Gator Island	Raccoon Corner	Unit
10:00	450	400	325	385	[rate/hour]
11:00	300	350	340	320	[rate/hour]
12:00	275	250	260	280	[rate/hour]
13:00	285	275	210	265	[rate/hour]
14:00	310	290	240	290	[rate/hour]
15:00	320	305	280	315	[rate/hour]
16:00	280	300	290	300	[rate/hour]
17:00	260	280	275	320	[rate/hour]
18:00	290	310	295	280	[rate/hour]
19:00	315	320	330	310	[rate/hour]
20:00	385	360	395	360	[rate/hour]
21:00	415	405	430	395	[rate/hour]
Average:	323,75	320,42	305,83	318,33	[rate/hour]

Assumption:
- Arrival rates follow an exponential distribution

Observations:
- Peaks when opening and closing the park
- Averages of the stations very similar

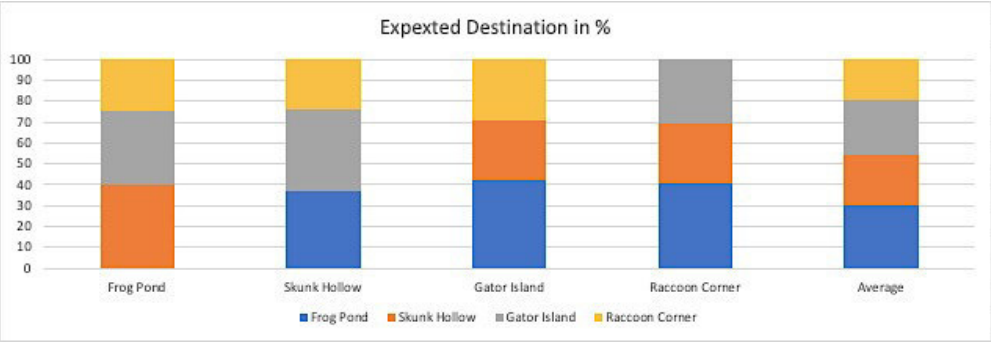


DATA 3

Table 3: Expected Destination

From	Frog Pond	Skunk Hollow	Gator Island	Raccoon Corner	Unit
Frog Pond	-	40	35	25	[%]
Skunk Hollow	37	-	39	24	[%]
Gator Island	42	29	-	29	[%]
Raccoon Corner	41	28	31	-	[%]
Average	30	24,25	26,25	19,5	[%]

Observations:
- Average → not evenly visited
- Used capacity of the cars, will be high, because customers tend to use the peoplemover 2 or 3 Stations long



COSTS

- Cost for the first car of each train is $800 per day.
- The cost for additional cars is $500 per day per car
- The trains are computer-controlled and fully automatic → no labour costs

Other costs depent on which variation of station design we are looking at!

STATION DESIGNS

→ **4 different options:**

Assumption:
binomial distribution

Layout **A**

Action	Value	Unit
to unload	30	[seconds]
to board	45	[seconds]
cost per car	20	[USD]
bounded possible positve deviation	10	[seconds]

Layout **B**

Action	Value	Unit
to unload and load	120	[seconds]
bounded possible positve deviation	10	[seconds]

KAIZEN

Action	Value	Unit
to unload and load	either A or B	[seconds]
bounded possible positve deviation	10	[seconds]
leave station	if next train arrives	
leave station	if close to full	

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IMPLEMENTATION

How we plan to implement our system in AnyLogic.

AGENTS

PEOPLE MOVERS

Have a static individual number of cars

Are created once and never leave the system

Fixed number, created at the start the model

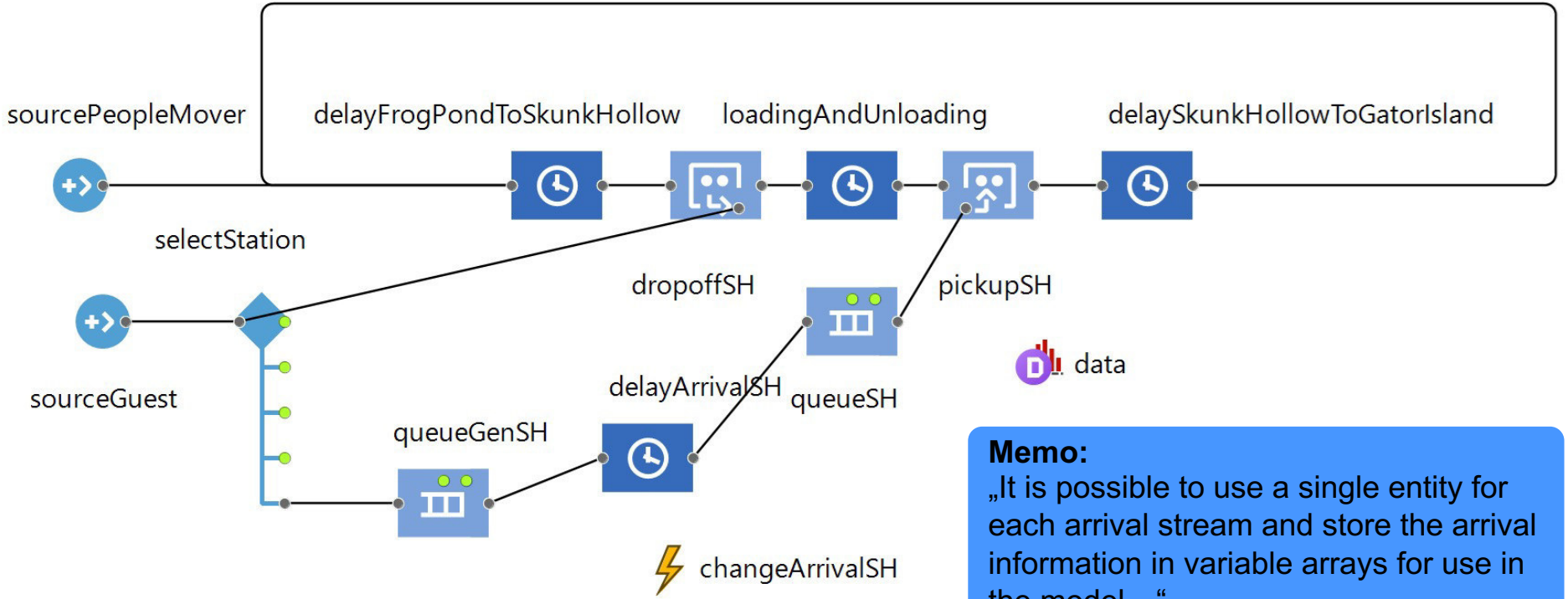
GUESTS

Get assigned a destination when entering a station's queue

Are created once and are reused after each train ride

Fixed number, created at the start the model

SINGLE STATION MOCKUP



Memo:
„It is possible to use a single entity for each arrival stream and store the arrival information in variable arrays for use in the model…“

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PROJECT SCOPE & GOALS

POTENTIAL ISSUES

!

No single objective function and no weighting of individual objectives

!

Massive number of possible combinations of trains and cars for each of the 4 variants

GOALS AND DELIVERABLES

Decision support: Not a single solution but a menu of choices

If requested by client: Neighborhood search near chosen combination

Presentation of each combination is not feasible:

Matrix of the KPIs for numbers of trains and cars in each run

Beyond the scope: differing number of cars per train in individual runs

THANK **YOU**

Any Questions **?**