

A magical night scene of a Disney castle, likely Cinderella Castle, illuminated with warm lights. A vibrant rainbow arches over the castle against a deep blue twilight sky. In the foreground, a body of water reflects the castle and the sky. The bottom of the image is filled with numerous bright, sparkling light effects, resembling fireworks or magical sparks.

Optimizing New Disneyland

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Background

- Disneyland is a famous amusement park in the world. Now, there are in 5 countries; US(2), Japan(1), China Mainland(1)+Hongkong(1), France(1)
- So, as they try to reach out all regions to expand their customer base, they plan to locate 3 new Disneyland



Idea

Create an optimization program that automatically select 3 locations maximize profit within the budget

The factor could include GDP, population, weather score and country location etc.



Optimization Model

Key Objective: Maximize 20-year profit from New Disneyland base on revenue and cost that can be vary on number of attendance

Maximize : Net present value of profit from

Sum(Revenue from average ticket fee + souvenir & food*attendances) for 20 years

- (Cost from fixed cost + variable cost * attendances) for 20 years

- set up cost at the fist year

How to solve? : Allocation method by setting binary decision variables in each country (build or not) and use LP solver to maximize profit

Assumption:

1. Number of attendances (generate by number of population in each country and divide by score that convert from GDP, population, Disney consumer base, weather)
2. Every year, number of attendance grows up 1%
3. Set up cost charge only in the 1st year
4. Fixed cost charge in each year (1 billions), and growth 1% per year
5. Ticket price increases 5% in every year (1st year = \$200)
6. Souvenir&food revenue average \$200 per attendance
7. Variable cost charge \$50 per attendance on average
8. Discount rate = 5%

Constraints:

1. Select top3 country that can maximize profit within budget (\$10 billion)
2. For new location, there are no more than 1 park in the same subregion and 2 parks in the same region
3. Cannot build in the same country to prevent from cannibalize demand

Remark:

1. We drop some country that does not have GDP and weather data
2. And we drop some country that has small area than 1000 km² and low GDP than 2500 billions. Because it is not a proper location to build amusement park.

Programming screenshot:

Link of coding file



Adobe Acrobat
Document

Constraints:

```
#Constraint1: Total set-up costs should be less or equal than our budget.
model.Bud = ConstraintList()
model.Bud.add(expr = sum(setup_cost[i] * model.x[i] for i in range(len(country))) <= budget)

#Constraint2: We want 3 new Disneylands.
model.DisneyNumb = ConstraintList()
model.DisneyNumb.add(expr = sum(model.x[i] for i in range(len(country))) == 3)

#Constraint3: We don't want another Disneyland in the country that already has one.
model.NotSameLoc = ConstraintList()
for i in range(len(country)):
    model.NotSameLoc.add(expr = model.x[i] + exist[i] <= 1 )

#Constraint4: For each region, we want less or equal than 2 new Disneylands.
model.Region = ConstraintList()
for j in range(len(region_dummy.columns)):
    model.Region.add(expr = sum(model.x[i]*region_dummy.iloc[i,j] for i in range(len(country))) <= 2)

#Constraint5: For each subregion, we want less or equal than 1 new Disneylands.
model.SubRegion = ConstraintList()
for k in range(len(subregion_dummy.columns)):
    model.SubRegion.add(expr = sum(model.x[i]*subregion_dummy.iloc[i,j] for i in range(len(country))) <= 1)
```

Result:

The top 3 locations for our new Disneyland would be:
Indonesia with total revenue at: 19.918 billion dollars.
Brazil with total revenue at: 10.772 billion dollars.
Germany with total revenue at: 9.218 billion dollars.
Our total revenue from 3 new Disneylands would be: 39.907 billion dollars.

Data example

rank	country	area (km2)	region	subregion	pop2021	Disney park
1	China	9,706,961	Asia	Eastern Asia	1,444,216,107	2
2	India	3,287,590	Asia	Southern Asia	1,393,409,038	0
3	United States	9,372,610	Americas	Northern America	332,915,073	2
4	Indonesia	1,904,569	Asia	South-Eastern Asia	276,361,783	0
5	Pakistan	881,912	Asia	Southern Asia	225,199,937	0
6	Brazil	8,515,767	Americas	South America	213,993,437	0
7	Nigeria	923,768	Africa	Western Africa	211,400,708	0
8	Bangladesh	147,570	Asia	Southern Asia	166,303,498	0
9	Russia	17,098,242	Europe	Eastern Europe	145,912,025	0
10	Mexico	1,964,375	Americas	Central America	130,262,216	0
11	Japan	377,930	Asia	Eastern Asia	126,050,804	1
12	Ethiopia	1,104,300	Africa	Eastern Africa	117,876,227	0
13	Philippines	342,353	Asia	South-Eastern Asia	111,046,913	0
14	Egypt	1,002,450	Africa	Northern Africa	104,258,327	0
15	Vietnam	331,212	Asia	South-Eastern Asia	98,168,833	0
16	DR Congo	2,344,858	Africa	Middle Africa	92,377,993	0
17	Turkey	783,562	Asia	Western Asia	85,042,738	0
18	Iran	1,648,195	Asia	Southern Asia	85,028,759	0
19	Germany	357,114	Europe	Western Europe	83,900,473	0
20	Thailand	513,120	Asia	South-Eastern Asia	69,950,850	0
21	United Kingdom	242,900	Europe	Northern Europe	68,207,116	0
22	France	551,695	Europe	Western Europe	65,426,179	1
23	Tanzania	945,087	Africa	Eastern Africa	61,498,437	0



Link of data file



Microsoft Excel
Worksheet

Hypothetical Client(s)

- Disney company, or any company that want to set up new location.
- Hence company can select new location which maximize their profit so that breakeven within 20 years

Next step

Company can include more other factors for calculation.

Since we have a limitation about the accessible of internal data; number of customer base in each country, number of visitors in each existing Disneyland. If we know that, we can estimate more accurate outcome.

Limitation

At first, we try to project the number of attendances by doing regression with the actual number visitors from existing parks data, however, the result is not reasonable. Therefore, we change the way to input it as score indicators.

It could have some significant several factors that impact Macro economy in specific country; force majeure, pandemic, recession. Therefore, our optimization cannot project the profit with 100% accuracy.

Contribution

We work together all processes. We select the Disney problem because we are obsessed with it and try to find what company should question about and relate to the coursework we learn. Moreover, since we know much about this company, it is easier for us to consider the objective, variables, and constraints they would have. Then we search for the information and data together and support each other for programming and presentation part.

Sources

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