

# CASE STUDIES AND GUESSTIMATE

**DATA SCIENCE  
BUSINESS ANALYST  
MBA**

BY

THE DATA MONK



## **Case Study and Guesstimates for Data Science, Business Analyst and MBA candidates**

Ability to solve a problem is the key to success in most of the private domain, but it gains a lot of importance when it comes to Data Science, Business Analyst, and MBA candidates. We have a pool of more than 30 Data Scientists, B.A.s and MBAs and we have seen people struggling in solving basic case studies. But this condition of theirs is not due to lack of knowledge but because of less practice material.

Here we present the top hand picked case studies and guesstimates which will surely help in solving real time as well as interview questions.

In case you need guidance to make a career in Data Science then do write it to us at [contact@thedatamonk.com](mailto:contact@thedatamonk.com) or visit [www.thedatamonk.com](http://www.thedatamonk.com)

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# Guesstimates

## Approach

Firstly, let us list down what stuff might be relevant for the interviewer to give you a good evaluation, in decreasing order of priority.

1. A Structured approach
2. What general numbers should I remember?
3. Math: Numbers galore
4. Handy Formulae
5. Miscellaneous

### 1. A Structured approach

So, the torture has started. You have been asked a question which doesn't seem to have any relevance in ANY Universe. What do you think should ensue? Chaos, Panic ! Tears roll down your eyes, piss down your pants. Well, this is exactly what must be avoided. So, some ways to add method to the madness, are as follows:

Clarify, Clarify ..... Clarify !!!! “ The first step to solving a problem is to know it.” So it is essential to have a COMPLETE picture of what you need to estimate

Contraceptive Example:

Curious Interviewer: “What is the number of people using contraception in a night?”

Much more Curious Interviewee: “I have the following clarifying questions” (asks them one by one).

“Which month is this night in?” This matters, since; marriages in India are concentrated in December, due to religious reasons, ultimately leading to an increased number of contraceptive users.

“Is the required number to be calculated for the World or India?” The interviewer might have purposefully left out the fact that the question was India specific.

“What are the different contraceptives?” No matter how sincerely you had taken your sex education class in school, you might want to clarify this point too.

Try having ‘n’ methods to estimate:

So, let’s say, you have started using a particular approach and midway into the discussion you realize that a different approach will give a much better estimate.

What do you do? You are faced with the Sunk Cost Fallacy and hence continue with your inefficient approach.

So, the solution to this is fairly obvious. Have a list of ‘n’ approaches upfront and subsequently choose one which seems most apt.

**Contraceptive Example:** You could estimate this from the Demand side (number of people who WISH to have protected sex) or from the Supply Side (number of people who CAN have protected sex). Now, in rural populations, the Supply<Demand, and in urban populations, Supply=Demand. So, the calculations for urban populations can be done from both the Supply and the Demand side. However, for rural populations the Supply side will give the right estimate.

### **Go Old School:**

Write a formula ! : You want to find a number which is basically a combination of other numbers. So, write the relationship between your required number and the other numbers (basically, write a formula). Now, all that is left is finding the numbers on the RHS independently and Presto! You have your guesstimate.

### **Contraceptive Example:**

Going from the Demand Side. “Number of contraceptives used = Number of couples having sex per night\*Fraction having protected sex\* Number of contraceptives used per couple per night”

**Backward Traceability:** The idea is to write the calculations; the tree diagrams etc. in a chronological manner such that if at any point in time, you want to go back and check your calculations or approach you can do it without any fuss.

## **2. Awareness in General:**

What general numbers should I remember?

The following numbers can be memorized for your country (here India)

\*Only ballpark figures are mentioned

GDP = 1.8 trillion USD

Population = 1.2 billion ~ 1 billion

Land Area = 3 million km<sup>2</sup>

GDP growth rate = 5%

Average size of a family = 3.6 ~ 4

Number of households = 330 million ~ 300 million

Population growth rate = 1.5 % ( World = 1%)

Sex ratio = 1:1

Rural: Urban population = 70:30

Population Distribution by Age:

India has a young population. It has more than 50% of its population below the age of 25.

0-15: 30 %

15-25 : 20 %

25-50 : 30 %

50+ : 20%

Population Distribution by Income:

Upper Middle Class (>32,000 pm): 10%

Middle Class (16,000-32,000 pm): 30%

Lower Middle Class (8000-16,000 pm): 40%

Below poverty line (<8000pm): 20%

Mumbai population = 20 million

Kolkata, Delhi population ( Take Approx same for all metros ) =15 million

### **3. Math: Numbers galore**

Number of Zeros : 1 lakh =  $10^5$ , 1 million =  $10^6$ , 1 crore =  $10^7$ , 1 billion =  $10^9$ , 1 trillion =  $10^{12}$

Percentages: Situations arise when you have to multiply percentages. So it is good to have this well practised. Example: In a population 80% males and 60% females wear watches. Then, assuming a 1:1 sex ratio we get  $80\% * 50\% + 60\% * 50\% = 40\% + 30\% = 70\%$  of the population wears watches.

### **4. Handy Formulae**

Market Size: Estimating the market size would basically mean, how many new products will be required in the next year.

$$\begin{aligned}\text{\# Products required per year} &= \text{\# existing products that get obsolete} + \text{\# new products required} \\ &= Q/n + r*Q\end{aligned}$$

Where, Q= existing number of products in the market

n= average age of the product

r= average growth rate of the product~ GDP growth rate of the country ( 5% for India )

Example: “What is the market size of squash rackets in India?” The average age of a racket (n=1.5 yrs), average growth rate for the racket (r= 5%) and the number of existing rackets in India (Q = 1 million has to be found by guesstimation). Market size = 1 million \* ( 1/1.5 + 0.05 ) = 0.72 million

Occupancy: This is valid for any situation in which there are a particular number of places and a partial number of them are occupied. Thus, like a bus, theatre, stadium etc. have ‘n’ seats and a fraction of them are occupied.

Example : Avg occupancy of a particular bus is 70%, then if there are 100 seats, at any point in time on an average 70 seats will be occupied.

## **5. Miscellaneous**

Example : “Q: What is the market of roses in India?”. Here, you must think that roses are not just sold as a flower but also is a raw material for the production of rose water. Hence, it is important to include this hidden application in your guesstimate.

Example: During the course of investigating any costs for a guesstimate of total costs, you might encounter a situation like, what is the cost of potatoes per Kg and you have no freaking idea. Solution: Estimate the weight of a samosa (30g) and the cost of the cheapest one that you have eaten (say, Rs 5) and assume a % of this samosa’s cost which would come from the potato ( say, 20% : This number is low because oil is an essential component in samsosa making which is definitely expensive) . Thus, the cost of potatoes in Rs per Kg then is =  $(5*20\%)/(0.030) \sim 35$ .

## Examples

### 1. Number of Maggi sold in a day in India

I took a bottom-up approach.

Considering an ordinary, urban household with 4 individuals

Number of Maggi needed per month = 10

Therefore, per head consumption =  $(10/4) = 2.5$  Maggi per person

Population = 1.3 billion

Urban population: 70% of total population

Above poverty line population: 40% of total population

Therefore, net population to consider:  $1300 * 0.7 * 0.4 = 364$  million.



Population distribution: (Age-wise)

0 – 10 (consume less than 2.5 packets per month, say 2 packets): 20% of the population

{which equals to  $(364 \times 0.2 \times 2)$  million packets per month = 145.6 million packets per month}

10 – 60 (consume 3 packets per month): 65% of the population

{which equals to  $(364 \times 0.65 \times 3)$  million kg per month = 709.8 million packets per month}

60+ (consume less than 2.5 packets per month, 2 packets): 15%

{which equals to  $(364 \times 0.15 \times 2)$  million packets per month = 109.2 million packets per month}

Total approximate consumption =  $(145.6 + 709.8 + 109.2)$  million packets/month = 964.6 million packets/month

Assuming a month of 30 days, per day consumption =  $(964.6 / 30)$  million packets per day = 32.15 million packets per day.

## **2. How many t-shirts e-commerce companies selling in India per day?**

We can approach this problem in two ways:

Demand side

Supply side

I am going to solve using demand of t-shirts in the market



Total population of india : 1 bn (approx)

Reach to internet : 40% =400 Mn

Reach of ecommerce companies to deliver products : 3/4th = 300Mn

Let's assume 50% are male and 50% are female

Lets solve for male population first:

Now i have divided males in the four categories on the basis of age because demand of t-shirts for different age groups will be different

0–15 yr = 45 Mn, on an average individual own 4 t shirts ->  $4*45=180$  Mn

16–22 yr = 23 Mn, on an average individual own 4 t shirts ->  $4*23 = 92$  Mn

23–30 yr = 65 Mn, on an average individual own 3 t shirts ->  $3*65 = 195$

Mn

30 - 80 yr = 18 Mn, on an average individual have 2 t shirts ->  $2*18 = 36$  Mn

Total t shirts own by men :  $180 + 92+195+36 = 503$  Mn ~ 500 Mn

Let's solve for female population now:

0–15 yr = 45 Mn, on an average individual own 2 t shirts ->  $2*45=90$  Mn

16–22 yr = 23 Mn, on an average individual own 4 t shirts ->  $4*23 = 92$  Mn

23–30 yr = 15 Mn, on an average individual own 3 t shirts ->  $3*15 = 45$  Mn

30 - 80 yr = 67 Mn -> we can neglect this section. Only few ladies prefer to use t-shirts in this age group.

Total t shirts own by females :  $90+92+45 = 227 \text{ Mn} \sim 230 \text{ Mn}$

Total t shirts own by men + women =  $500+230=730 \text{ Mn}$

Average life of a t shirt = 2 year

Demand per year =  $365 \text{ Mn} \sim 360 \text{ Mn}$

Online portals provide coupons and offers but because of trust factor and fitting issues, people in india still prefer to buy offline, So i am assuming 30% of people buy t shirt from ecommerce portal and 70% are buying from market.

Total number of t-shirts sold through ecommerce platform per year in India=  $.3*360 = 108 \text{ Mn} \sim 100 \text{ Mn}$  per year

Number of t-shirts sold in India per day(From ecommerce portal) =  $100 * 10^6/365 \sim 27,000$

### **3. What is the number of laptops sold in Bangalore on an average routine day?**



Laptop is a costly product. I am assuming that people buy laptop only when they needed. That's why i am going to calculate potential market of laptops in India.

Total population of Bangalore = 18Mn ~ 20Mn

Let's divide population on the basis of age

0–18 Yr - 30% of 20 Mn = 6 Mn -> We can neglect this age group because generally they don't need personal laptop and when needed, they prefer to use others laptop.

19–22 Yr - 10% of 20 Mn = 2Mn ->  $0.6 * 2$  Mn -> 1.2 Mn (This is the college age group. Most of the college students need a laptop. Assumed 60% of them own a laptop)

22–50 Yr = 40% of 20 Mn = 8 Mn. 22-50 age group is the working class of the society. I have divided this class into 3 major categories.



White collar employees (25%)

Blue collar employees (50%)

Small business owners (25%)

Assumed 80% and 30% people in the category of white collar employees and Small business owners respectively own a laptop or PC. We can neglect blue collar employees.

80% white collar own a laptop or PC -> 1.6 Mn

Small business owners own laptops or PC -> 0.6 Mn

50–80 Yr = 20% = 4 Mn -> we can ignore this age group

Total laptop + PC users in Bangalore =  $1.2 + 1.6 + .6 = 2.4$  Mn

Corporate offices/Schools/Computer centers generally have desktop. Lets assume 60% are desktops.

Laptops = 40% -> 0.9 Mn

Average life of a laptop = 5 year ( in India )

Number of sold per day in Bangalore =  $0.9 \text{ Mn} / 365 * 5 \sim 500$  laptops

#### **4. What are the number of smart phones sold in India per year?**

Population of India : 1200 mn

Population above poverty line: 70% 840 mn

Population below 14 years: 30%

Hence, proxy figure: 588 mn

Rural Population (70%) : 410 mn

Rural Households: 82 Mn

Rural Mobile Penetration: Avg 2 per household- 164 Mn



In rural areas assume that a new mobile is bought once in 3 years. Hence, new mobiles bought In current year- 55 Mn

Urban (30%) :176 Mn

Assume Avg No of Mobiles per person : 1.5

Urban Mobile Penetration: 265 Mn

Assuming that a new mobile is bought once in 1.5 years. Hence new mobiles in current year- 176 Mn

Total New Mobiles: 231 mn

Assuming 3 out of 10 new mobiles are smart phones

No. of smart phones sold=70 Mn

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**5. What is the total number of people who get a new job in India in a year?**



**Observations:**

35 million students enroll in India(Undergraduate, graduate, doctorate, diploma)

72% of 35 million graduate every year = 25 million

Students completing 10th grade = 20 million

Students completing 12th grade= 15 million

Unemployed graduates of the previous year= 15 million

(Since 60% of 25 million graduates are unemployed)

GDP growth rate is 7%

Calculations:

40% of 25 million graduates are only employed= 10 million

Assuming 500,000 of the previous year's graduates get a new job

100,000 starts working after 12th grade due to poverty, poor grades etc

An estimate of 50,000 starts working after 10th grade due to poverty,poor grades etc

10,000 people already on workforce end up with a new job

Total= 10 million + 500,000 + 100,000 + 50,000 + 10,000

= 10.66 million (approx)

Note:

Migrants working in India are negligible

Due to urbanization, very few go for work without completing their 10th grade

Increased feminism has a significant effect on the estimates

## **6. How many red colored Swift cars are there in Delhi?**



The approach to such problems follows a MECE approach. MECE expands to Mutually Exclusive Collectively Exhaustive, which trivially means breaking your problem down to Non-overlapping segments which add up together to give your final solution.

Let's solve the guesstimate

Population of Delhi: 20 Mn

**Children or college going** = 20% of 20 Mn -> 4 Mn

Senior citizens = 20% of 20 Mn -> 4 Mn

Working people = 60% of 20 Mn -> 12 Mn

let there are 5 brands of car and each brand have 10 cars which are equally distributed. So in total, we have 50 models of cars running in the streets.

This does not include luxury cars.

Working class people, let's assume half are married and half remain unmarried. So married -> 6 Mn and unmarried -> 6 Mn

**Married couples:-**

Number of married couples =  $6 \text{ Mn}/2 \rightarrow 3 \text{ Mn}$

I am assuming 10% belong to the rich class and prefer luxury cars and 20% cannot afford a car. The rest 70% has one car each.

70% of 3 Mn = 2.1 Mn

There is the equal distribution of above mentioned 50 cars among these 2.1 couples again. So the number of Swift Cars right now is  $2.1 \text{ Mn} / 50 = 0.042 \text{ Mn}$ . I am assuming Swift car comes in 10 colors. Hence number of red swift cars in married couples is  $0.0042 \text{ Mn} \rightarrow 42,000$

**Unmarried couples:-**

Out of 6 Mn unmarried couples, Only 10% can afford mid range non luxury cars. Hence no of cars = 6 lakh. These are again divided into 50 models as above and each model has 10 colors. So number of red colored swift cars among unmarried people =  $6 \text{ lakh} / 500 \rightarrow 12,000$

Senior citizens

Out of 2 Mn families(4 Mn people), 20% i.e. 0.4 Mn families own a car. Again, as above, these cars are divided into 50 models with each model having 10 colors. So  $4 \text{ lakh}/500 \rightarrow 8,000$

Total number of red colored swift cars in Delhi =  $42,000 + 12,000 + 8,000 \rightarrow 62,000$

## 7. How many paan shops are there in India?



We will approach this problem by solving both demand and supply sides  
First i will calculate the demand for the Pans in India

Total population of India = 1.2 bn or 1200 Mn (approx)

Males = 700 Mn

Female = 600 Mn ( 900 women per 1000 men )

Ratio of women consuming pan in India on the regular basis is very small.  
Let's assume 2% of total women population consume pan on the regular basis

Number of pans consumed by females = 2% of total female population =  
 $600 \text{ Mn} * .02 \rightarrow 12 \text{ Mn}$

Let's solve for male population now:

Consumption of pans varies with the age group.

For example, Old person will consume less pans compare to young guys because of health issues. I have divided males on the basis of age group

0–15 -> we can neglect this section. Only few boys below age 15 consume pans

16–22 -> 15% of 700 Mn = 105 Mn -> ~ 5 Mn ( 16-22 is the college age & as per my personal experience in the college, Avg. 5 students consume pan out of the 100)

23–50 -> 35% of 700 Mn = 240 Mn -> 20% people consume pan ->  
0.2\*240 -> 48 Mn

51–80 -> 20% of 700 Mn =140 Mn -> .05\*140 -> 7 Mn (In the older age, because of health issues, few people consume pan. Here assumed 5% will consume pan

Total demand of pans in India per day =  $12 \text{ Mn} + 5 \text{ Mn} + 48 \text{ Mn} + 7 \text{ Mn} = 72 \text{ Mn}$

Let's calculate the supply of pans per day

Time taken to ready 1 pan = 2 mins -> 30 Pans in 1 hour

Let's assume pan shop open for 10 hours per day ->  $30 * 10 = 300$  pans per day

Number of pan shops in india =  $72 \text{ Mn} / 300 = 2,40,000 \sim 2.5 \text{ lakh}$

## **8. What is the maximum number of human beings that can survive on the earth?**



### **Assumptions**

Total usable land for human on earth is the 30% of total area

Average number of persons living in a house = 4

Average house includes 2 rooms, 1 washroom, 1 bathroom and 1 kitchen

Schools / hospitals / Roads / Railway line and other public utilities cover 25% of total land area

Diameter of earth = 13,000 km -> land area = 30% of total area =  $.3 * 3.14 * (13,000/2)^2 = 4 * 10^8 \text{ km}^2$

Total land area =  $4 * 10^8$

Area of 1 room =  $5 * 5 \rightarrow$  Total area of two rooms =  $50 \text{ m}^2$

Area of 1 washroom =  $1 * 1 = 1 \text{ m}^2$

Area of 1 bathroom =  $2 * 2 = 4 \text{ m}^2$

Area of 1 kitchen =  $2 * 2 = 4 \text{ m}^2$

Total area of 1 house =  $60 \text{ m}^2$

Food will be required for the survival, hence each family will need land for raw food material production. Based on the experience,  $300 \text{ m}^2$  is the

sufficient land to grow raw food material like wheat, rice etc for the survival of 4 persons

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Total land required per family (House + food production) = 360 m<sup>2</sup>

25% of total useful land will be used by public utilities like schools / hospitals etc =  $0.25 \times 4 \times 10^8 = 10^8 \text{ km}^2$

Land left =  $3 \times 10^8 \text{ km}^2$

Total number of families those can survive on earth =  $3 \times 10^8 \times 10^6 \text{ m}^2 / 360 \text{ m}^2 = 8.33 \times 10^{11}$

Person per family = 4

Total number of persons those can survive on the earth =  $4 \times 8.33 \times 10^{11} = 3.3 \text{ trillion}$

## 9. How to calculate the number of taxis operating in Mumbai per day?



Here, Taxi means the yellow white one. **Not ola/uber etc.**

Solution is dependent on two things . First is the population i.e. how many person are willing to use taxi per day which will directly give the total trips required per day to satisfy the population and second from the supply side i.e. Number of trips per taxi per day.

Demand of taxis

**Step 1 - Population of Mumbai**

552 MP's for 1.26 Billion people = 2.3 million people/ MP

MP's elected from Mumbai + Thane + Kalyan (your choice of city) = 8

Population of Mumbai =  $8 * 2.3 = 18.4$ million = 1.8 Crore ~ 2 Crore

**Step 2:** No of ways one could commute in Mumbai

- 1) Walk
- 2) Bike/bicycle
- 3) Auto
- 4) Car

- 5) Taxi
- 6) Bus
- 7) Local Train

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### **Step 3 : People preference for each transportation**

Considering population distribution in Mumbai as below:

- 1) Upper Class: 10%
- 2) Middle Class: 70%
- 3) Lower Class: 20%

Preference distribution in each class will depend on affordability, distance to travel and convenience

- 1) Upper Class (10%) = 7% Cars + 2% super bikes + 1% taxi(others)
- 2) Middle Class (70%) = 0.5% Walk + 10% Bike + 6% Car + 8% Taxi + 3.5% Auto + 17% Bus + 25% Local
- 3) Lower Class (20%) = 0.5% Walk + 12% Local + 7% Bus + 0.5% Bike(Others)

### **Preference distribution:**

- 1) Walk : 1%
- 2) Bike/bicycle: 12.5%
- 3) Auto: 3.5%
- 4) Car: 13%
- 5) Taxi: 9%
- 6) Bus: 24%
- 7) Local Train: 37%

Step 4: Population traveling in the taxis

9% of population travels in taxi hence resulting in 18 Lakh people. 18 lakh people can travel alone or in group of 4 at max. Let's assume avg 3 people per trip, we arrive at 6 lakh taxi trips per day.

### **Supply of taxis**

Taxis are normally used for trips which range between 5km - 15 kms of travel. Considering traffic signals, waiting time (at peak hours) and travel time, One on average, one ends up doing 10 trips (pickup and drop) a day.

Therefore, (6lakh trips)/(10trips per taxi) = 60,000 Taxi's



## 10. How to calculate the number of weddings in India per year?



India population ~ 1.2 billion

Rural - 72% and Urban - 28% (Original stats)

### Assumption

Rural areas, the age of marriage (in average) is between 15 - 35 years and in urban areas = 20 - 35 years

India is a young country. 0 - 35 years has around 65% of the total population. Assuming that population is uniformly distributed.

## **Rural population**

So, the percentage of people in rural areas fit for marriage is  $(35-15)/35*65 = 40\%$

Rural population fit for marriage is  $= 0.72 * .40 * 1.2 \text{ billion} = 345.6 \text{ million}$

Assuming the sex ratio as 50% male and 50% female (its close to 49%)

Number of marriages in rural areas  $= 345.6 \text{ mill}/2 = 172.8 \text{ million}$

If only one marriage per women, number is  $172.8/20 = 8.64 \text{ million}$

## **Urban population**

Urban area population fit for marriage  $= 0.28 * .30 * 1.2 \text{ billion} = 100 \text{ million}$

Assuming the sex ratio as 50% male and 50% female (its close to 49%)

Number of marriages in urban areas  $= 100 \text{ mill}/2 = 50 \text{ million}$

If only one marriage per women, number is  $50/15 = 3.3 \text{ million}$

Total number of marriages in India per year  $= 8.64 \text{ Mn} + 3.3 \text{ Mn} \sim 12 \text{ Million}$

As per resources, there are nearly 10 Million marriages happen each year in India. Our answer is close to the actual numbers.

## **11. How many KGs of paint are used in the USA annually?**

The assumption here is we are calculating the paint used to coat buildings.

Population of US= 320 million

Types of Buildings can be classified broadly as:

**1. Homes**

**2. Large offices**

**3. Schools + Universities**

**4. Commercial buildings (restaurants, DMVs etc.)**

Now let us estimate the paint for each category. Once we establish the approach in one category we should be able to replicate it across others.

Some basic metrics & assumptions needed for the calculation :

- A. Population of USA = 320 million
- B. Amount of paint needed per 500 sqft: 1 gallon (we will convert to KG at the end)
- C. The sqft. that needs to be painted for each building will be 4 times the floor-sqft, considering the walls to be painted on 4 sides, inside & out, minus windows. This is an approximation.

Number of buildings of each type:

- 1. Homes = There is one home per every 4 people on an avg i.e. 80 million homes
- 2. Offices = There is one large office building per 500 people on avg = 0.64 million large offices
- 3. Schools + Universities = for every 10000 ppl there are 3 schools (elementary, middle and high) + 1 university i.e. 4 buildings per every 10000 people i.e a total of  $320 \text{ mil} / 10000 = 32000 * 4 = 128000$  buildings
- 4. Similarly, Commercial buildings = 10 buildings for every 10000 ppl on an avg i.e.  $32000 * 10 = 320000$  buildings

Now let us estimate the sqft. to be painted for each category: (review the assumptions & metrics we listed earlier)

1. Homes get painted once in 10 years, so apprx. 8 million homes get painted every year.

10% homes are very large i.e. 0.8 mil = 5000 sqft

10% homes are small i.e. 0.8 mil = 600 sqft

Remaining i.e. 6.4 mil = avg 2000 sqft

Total sqft =  $5000 * 0.8 + 0.8 * 600 + 2000 * 6.4 = 4000 + 480 + 12800$  mil sft  
= 17,280 mil sqft

Walls to be painted =  $4 * 17280$  sqft = 69,120 mil sqft to be painted

2. Offices avg 10000 sqft per building

Offices get painted once in 5 years; so 0.15 mil offices get painted every year

Office wall space = 40000 sqft per building

Walls to be painted =  $40000 * 0.15$  mil sqft = 6000 mil sft to be painted

3. Schools & universities ; assuming same size as office buildings

Schools get painted once in 5 years; so 25600 schools get painted every year

Walls to be painted =  $40000$  sqft \* 25600 buildings = 1024 mil sqft to be painted

4. Commercial buildings ; assuming an average commercial building is of size 5000 sqft

Commercial buildings get painted once in 5 years; so 64000 buildings get painted every year

Total walls to be painted =  $20000 * 64000$  = 1280 mil sqft

Total of all calculations:

Total sqft to be painted = 77424 mil sqft

1 gallon of paint is good for 500 sqft. Hence total gallons needed = 154.8 million gallons or 17.2 million KGs

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## **12. How many street lights are there in India?**



Lets start with the formula we can use to estimate this:

**(Area covered by streets in India) \* (Percentage of street area containing street lights) \* (Avg. number of street light in the area/Km<sup>2</sup>)**

Let's float some numbers now:

Total area of India is: 3.28~3.3 million Km<sup>2</sup>

1. Area covered by streets: .66 million Km<sup>2</sup>  
(Real Estate+Farm Lands+Streets)

Assuming real estate to be most of the area followed by farm land (including barren land), I'll divide the area into 50%, 30% & 20%. So, we have total street area =  $3.3 * 20\% = .66$  million Km<sup>2</sup>.

2. Percentage of street area covered by street lights: 30%

For this I would assume 70%-30% division of people in villages and cities.

Lets take into account 60% in tier 1 (10% of overall cities) cities, 40% in tier 2 (70% of overall cities), 10% in tier 3 (10% of overall cities) and 10% in other small towns (another 10%).

So, we have 6%, 28%, 1%, 1%. Adding them up and rounding them off to lower number owing to poor infrastructure and an increase in assumption of total area in India. We assume total as 30%.

3. Avg. number of street lights per unit area: 2100

Assuming avg Width of street containing 1 fleet of street lights is: 10 m = .010 Km

Number of Street lights per Km = 2 (Factor of two coz number of street lights at one spot)\* [1000 m/ Distance between street lights (50 meters)] = 40.

So, Avg Street lights per unit area:  $20/0.010 = 2000/\text{Km}^2$

I will spike this number up by 5% considering flyovers, Multiple lane expressways making it to be:  $2100/\text{Km}^2$ .

So, Putting it in formula:  $(.66 \text{ million } \text{Km}^2)*(30\%)*(2100/\text{Km}^2) = 415.8 \text{ million}$



# **Business Case Studies**

Sometimes case interviews can become really tricky and leave you dumbfounded. Perhaps the easiest way to crack through them with flying colors is to untie the knots of the problem given to you one by one. The candidate should deal with one matter at a time, solve it and then take up another one. And that is what the interviewers are looking for in the person they would like to hire. The skills that one needs are:

1. Complete awareness about commercial ongoing
2. Witty business skills
3. Dexterity in verbal reasoning and numeric
4. Compact presentation skills
5. Confident communication skills
6. Calmness of mind
7. Tactful business strategy

## **How to ace the Case Interview?**

One thing is forbidden in case interviews, i.e. you cannot panic. The moment your face shows that you are panic stricken or you become sweaty, thinking about where to start from or which direction might be the right one to start untying the knots, you're already out of the scene. You cannot let the man/woman on the other side of the table realize your anxiety.

The questions are hardly ever straightforward, therefore estimate an idea that neither your answers should be so. Make assumptions or ask recurrent logical questions to gather as much information as you can.

### **Ask questions:**

Generally, the questions put forward before you already provide you with a bunch of information. You need to take note of every intricacy related to your case and ignore the extra details that were meant to be obstacles to your thinking process.

After the interviewer is finished, he would ask you whether or not you have any sort of queries. It is witty enough to never say No. Many people are of this idea that saying Yes might have a bad impression before the interviewer. However, that is absolutely not. On the contrary, that is your way to scour more minutia of the case which might prove to be useful.

Also, clarify something if you have even the least of doubts. This would definitely have a positive impact on them that you have listened well enough and did not just sit blank and you would be cleared of any possible misconceptions.

### **Ask questions if you are still not clear:**

This would not only help you in analyzing the problem step by step but also come up with the bigger picture. Where most people go wrong is to circulate around the question, trying to figure out the correct answer and neglect the details altogether. That way the candidate would only end up getting more bound by the trivialities.

Interviewers are more impressed when you actually question them back thus making it obvious that you just do not aim at getting through the interview but actually resolve the case before leaving the room

### **Indulge the interviewer into a conversation:**

When you ask questions in a fearless manner in an interview, the interviewer can actually be quite helpful in guiding you properly and have a better perspective of the problem. Therefore, engage him/her in a constant conversation.

Try not making it look like a test which you need to pass through, consider it as an interactive session. When you gradually start solving the issues, keep on explaining them to him. Make it a two-way conversation. So that even if you are wrong at some point, he might drop some clues before you in a slyly. However, you need to be witty enough to catch and utilize it. Besides, this helps in developing a better rapport with the interviewer. However, one thing to keep in mind is – do not interrupt him/her in between while telling you about the case.

### **Arrange the case into a sequence:**

To have a definite idea about the problem, you need to put the squares into the right boxes. And for that, start arranging the details into a sequence from the very beginning into a logical structure. What the interviewer wants to know is how you proceed with your thought, what you do with them and how you make up an assumption out of just mere ambiguous details provided to you. Split the details into several parts like “decreasing market price”, “increasing variable cost”, “selling of new products” etc.

### **Recognizing the case “type”**

Cases upon which general questions asked are – pricing strategies, entering a new market, investing in a new company, launching a new product, plans for progress in the business etc. Once you have figured out the problem type after getting a proper structure, you have a framework to start working on.

### **Have an idea about the market:**

Just being a bookworm won't help you get through management job interviews. You need to have a fair knowledge about the market, industry, business trends etc. Reading any business newspaper like "The Economist" daily can be a lot of help in this.

### **Practice cases beforehand:**

There are many case interviewers who give tests online, which you can always try for getting better at this. It is alike mathematics, the more you practice, the better you get at it.

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**1. Ghana is a nation in West Africa with a population of approximately 24 million. As per the records of 2012, its largest country Accra alone has a population of about 2.3 million. World Bank has ranked its economy as the lower-middle class economy. There are almost over 500 internet cafes in Ghana, and the client of our company is owning the largest internet café in Accra – Busy Internet. Since the company has been facing a consecutive decline in its profit line, the Managing Director has hired your company to find out the possible problem as well as recommend plans for improvement. What do you think would be your answer?**

**Possible answer:**

The candidate would be at an obvious advantage if he has any knowledge about the Ghanaian economy. However, if one has not, then at once start arranging the details into a structure to have a framework of the position of the nontraditional business market in Ghana. The fact that the economy has not progressed very well is evident from the declaration by World Bank. Therefore, the possible suggestion can be that Ghana's market still needs to be polished enough for such technological business to flourish. Also, implementation can be done by focusing on the employees of the café and their convincing skills. To hold onto customer loyalty, the growing demand needs to be met up.

**2.The client of Bain and Company is The Ministry of Railways of China, which is responsible for the management of the railway industry, the facilitation of services to the passengers and the maintenance of the railway infrastructure and plans for the growth of such a blooming industry. The Ministry also is in charge of the 16 railway bureaus and 2 companies operating in the mainland of China. Beijing and Shanghai are two of the most important cities and economic zones in the country. The Ministry had been planning an investment in developing a high-speed railway network for a proper communication between these two places. They have turned to your company Bain and Company to counsel them in this regard whether they should or should not go with their plans. How would you do that?**

**Possible answer:**

Estimation can be made about the population of China using the railways. Also, a difference between regular railway network and a high-speed network can be sought beforehand and the budget which would be needed to execute this particular plan. This will give a probable idea of the market size the company would be dealing with. A list of possible advantages and disadvantages of the plan can be looked into to suggest anything on the matter. To go ahead with this plan the profit line can be checked. The population of these two cities in specific is to be checked as well and the competitions of the side transportation systems like the roadways or the airlines. After going through a list of question to ask and explanations, the framework would be ready. So the ultimate advice would be to properly campaign for the project, association of national pride with such a progressive development, keep the initial price of the tickets lower to increase the sales (till a stable considerable period of time).

**3. The client of our company is The Minnesota Mining Manufacturing Company of United States whose main office is in Minnesota, United States. The company manufactures products such as car décor products, medical products, adhesives, electronic products and dental products etc. On a global level, the company is a thriving one with its employee population of over 84000 and product types of over 55000 and business in over 60 countries. One of their major investments is in Brazil, which is the manufacturing of a particular kind of steel that is only produced by two other companies in Brazil. Throughout the world, Steel has an amazing market capture and increasing demand. Now, the company has hired BCG to frame a plan for the progress of this business only after acquiring a proper knowledge of the market trend. What would you do about it?**

**Possible answer:**

The candidate would begin by discussing the market dynamics in Brazil as well as globally on which he/she has to base the suggestion. Furthermore, an idea is to be framed up about the cost, market, value, customers, transportation facility and price if the steel is to be exported. Also, Brazil has some taxes on foreign goods export which would only add up to the price. Since the local market is more profitable than the international trade, it is advisable to try out the products first in the local market of Brazil since there is a chance of price war.

**4. The client for our company this time is the Moldovan Coffins who has a high reputation for making best quality coffins in Moldova. The country of Moldova has Romania to the west and Ukraine is surrounding the country from all other three sides. The country finally declared itself independent in the year 1991. As per the records of 2001, it has a population of only 4 million. But lately, the owner of this company is having second thoughts on remaining in this age-old business. Till date, the company had manufactured handmade coffins which required more labor. However, with the introduction of the new technology in the market which uses less labor and gives comparatively more production the owner is in a dilemma whether or not to invest in it. How would you solve his dilemma?**

**Possible Answer:**

Some key points need to be focused, to begin with, which includes the alternatives such as – selling value of the business to a third party, buying the machinery for new technology, continuing with the same old technique or sell the assets and lockdown the company. Now, estimation is to be made of the death rates, population growth, average life expectancy of the market. After calculating the numbers, a possible threat to the business has been noticed. Therefore, it is suggested to sell the business.

There is no such particular correct solution that the employers are looking for. Through this, they examine the candidate's approach towards the problems, thinking ability and calmness in dealing with it.

## **Company Name – Myntra**

### **Round – 2 Case Study**

**Topic:-**

**5. Suppose you have a restaurant and there is a crunch of sitting space, apart from that you have one kitchen door which is generally crowded with the waiters and food delivery guys which leads to delay in serving the food. Would you like to create room for one more small window to expand the kitchen and make the service quicker?**

**What will be the impact on the already small sitting space?**

**How to optimize the above scenario?**



**P.S. – The approach and points need not be the best which you can think of. You may add your points and think through the problem**

**Approach:-**

Take a stand and always talk about your solution with the mindset of a data scientist. Throw numbers wherever possible

If I were the owner of the restaurant, I would have added a small room for some selected food items. Looking at the data, we can conclude on a few food items which are served most often to the dining customers as well as to the delivery customers.

Suppose it's a Punjabi restaurant and the best sellers are Naan, Butter Chicken, and Punjabi Biryani. Once we have the data, we can have these items prepared in the main kitchen, but the delivery/serving should be done on the small room/window which is newly created. What about the space crunch? The waiters will have a hard time going back and forth?

The space crunch needs to be compromised and in return, we will be providing quicker service which should compensate for space. The serving time and sitting time of the customer will decrease which might counter the space crunch as more number of customers can be entertained. There is one more problem with the restaurant and that is the wastage of raw materials as the shelf life of a few ingredients are very low. How to counter it?

Looking at the data we can come up with a few nodes of this problem. We can ask these questions to the data:-

1. Which all items are sold the most?
2. What is the key ingredient of these items?
3. Day-Food item pair, with this we can get which all items are sold on which day

We can predict the amount of demand in the coming week and can act accordingly. But prediction might not work the best in every case, right? I agree, to counter this we can have a variable price menu, so if the shelf life of a particular item is low, we can give a discount on these items or can give a combo offer to clear the stock at the very end of the day. There were questions on the formula which you will use to determine the new price in the above situation. Basically, you need to come up with parameters and you have to decide the importance of the parameters by either giving them multiplicative or additive importance in the formula or you can club your answer with any other offer. Following were the discussion points:-

**1. We can take those items which will get wasted by the end of the day(looking at the stock near the closing time) and can set a variable price.** Suppose, you realize at 9 pm that at least 100 kgs of Biryani will be wasted tonight(by 12 am), then you can set a variable price on Biryani

Cost Price of 1 kg of Biryani – 100

Selling Price of 1 kg of Biryani – 200

Stock left – 100 Kgs

Time left – 3 hours

Aim – To minimize the loss Revised Price =  $((180 - x)/180) * \text{Selling Price}$   
where x is the number of minutes after 9

So, at 9:30 pm, the price of the Biryani will be =  $((180-30)/180) * 200 = \text{Rs. } 166$

This is one way where we can help the restaurant in clearing the stock.

We can also give the customers a Mega Offer, where if they buy a Biryani today, then they will get some y% discount tomorrow. This will also help in retaining the customers.

Apart from that, we can also give them more Biryani at a lesser price.  
Suppose Rs. 166 is the price at 9:30 pm, then we can offer them 1.5 kgs of Biryani at Rs.210. This will clear the stock easily.  
Keep thinking about more points ??

## **Company Name – Sapient Round – 2 (Case Study)**

**Topic –**

**6. Recommendation of food items to new customer in a restaurant**  
**Punjabi By Nature, a restaurant in Bangalore, delivers and serves food to its customer. It has been in the business for the last 10 years.**  
**Recently the owner heard about Data Science and they want to leverage the opportunity in order to boost its revenue.**



The restaurant has been collecting the following data since the last 10 years:-

1. Name of Customer
2. Sex of Customer
3. Age of Customer
4. Food item code

Your job is to recommend 2 food items to a customer new to the restaurant. Answer the following questions:-

a. Looking at the data, provide 3 findings for the restaurant to boost their performance

A. i. Food item combination can help you recommend a particular item. For example, if people prefer curd with Parathas, then you can recommend it

ii. A list of the most popular food item

iii. Looking at the customer's age and sex you can decide what to offer to a new customer. If the data suggests that a girl in the age group 20-25 likes chocolate ice cream then you can recommend this ice cream to the new girl

customer b. Think of 4 more data points which might help you with the analysis

i. Pincode of delivery

ii. Time of order

iii. Phone Number

iv. Date and Day of service c. Now, what else can you find out from this data?

A. i. Day of service can get you the popular food item on each day and weekend

ii. Pincode can help you identify if there is a demand for some specific food items in a particular area

iii. The phone number to inform about new offers

iv. Time of order can get you the time at which the restaurant should shoot a particular offer for a specific food item

## **7. How Netflix Used Data Science to Improve its Recommendation System?**



Do you remember the last movie you watched on Netflix? I don't want to know the name; just think about it- after watching the movie, were you recommended of similar movies? How does Netflix know what you'd like? The secret here is Data Science. Netflix uses Data Science to cater relevant and interesting recommendations to you. So, today, in this article, we will discuss the same. Let's start exploring Data Science at Netflix with a basic introduction to Netflix.

### **Data Science at Netflix**

Netflix initially started as a DVD rental service in 1998. It mostly relied on a third party postal services to deliver its DVDs to the users. This resulted in heavy losses which they soon mitigated with the introduction of their online streaming service in 2007. In order to make this happen, Netflix invested in a lot of algorithms to provide a flawless movie experience to its users. One of such algorithms is the recommendation system that is used by Netflix to provide suggestions to the users. A recommendation system understands the needs of the users and provides suggestions of the various cinematographic products.



## **What is a Recommendation System?**

A recommendation system is a platform that provides its users with various contents based on their preferences and likings. A recommendation system takes the information about the user as an input. This information can be in the form of the past usage of product or the ratings that were provided to the product. It then processes this information to predict how much the user would rate or prefer the product. A recommendation system makes use of a variety of machine learning algorithms.

Another important role that a recommendation system plays today is to search for similarity between different products. In the case of Netflix, the recommendation system searches for movies that are similar to the ones you have watched or have liked previously. This is an important method for scenarios that involve cold start. In cold start, the company does not have much of the user data available to generate recommendations. Therefore, based on the movies that are watched, Netflix provides recommendations of the films that share a degree of similarity. There are two main types of Recommendation Systems –

### **1. Content-based recommendation systems**

In a content-based recommendation system, the background knowledge of the products and customer information are taken into consideration. Based on the content that you have viewed on Netflix, it provides you with similar suggestions. For example, if you have watched a film that has a sci-fi genre, the content-based recommendation system will provide you with suggestions for similar films that have the same genre.

### **2. Collaborative filtering recommendation systems**

Unlike the content based filtering that provided recommendations of similar products, Collaborative Filtering provides recommendations based on the similar profiles of its users. One key advantage of collaborative filtering is that it is independent of the product knowledge. Rather, it relies on the users with a basic assumption that what the users liked in the past will also like in

the future. For example, if a person A watches crime, sci-fi and thriller genres and B watches sci-fi, thriller and action genres then A will also like action and B will like crime genre.

There is also a third type of recommendation system that combines both Content and Collaborative techniques. This form of recommendation system is known as Hybrid Recommendation System. Netflix makes the primary of use Hybrid Recommendation System for suggesting content to its users.

**Company Name – Xiaomi**  
**Round 3 – Case Study**

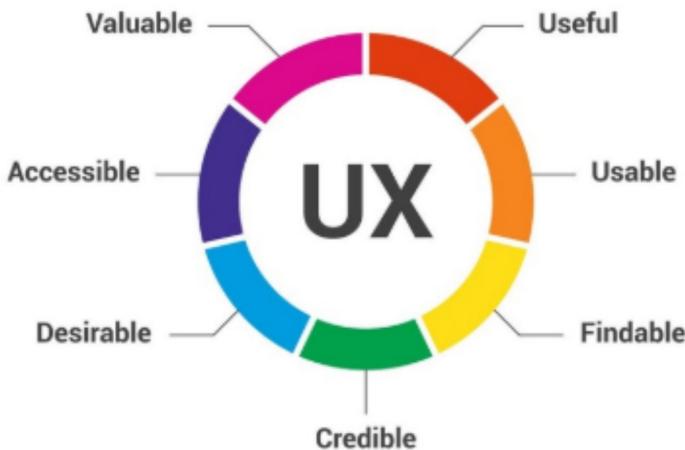
**Topic –**

**8. Profit of a company selling mobile back cover is declining. List out all the possible reasons**

Following is the way in which discussion proceeded with the interviewer:-

1. The demand itself has declined i.e. customers are not using cover that much. Asked to think more by the interviewer
2. Maybe the competitor is also facing loss which again means that the demand is low. Competitors are making a decent profit
3. Bad Marketing – The company is not putting stalls or shops in a crowded place. The interviewer told that the company was making a decent profit 6 months back
4. Maybe the footfall of the mall or place decreased. Could be(first positive response)
5. Maybe a popular mobile phone shop has shifted somewhere else. Could be(again a so-so response)
6. Maybe the other companies have reduced the price of their product which is why customers are drifting to these companies. The interviewer seemed pleased
7. New technology in the cover market to make covers more durable and the company we are talking about is using the same old technology. Seemed good enough point
8. Since we are talking about back covers, there could be new or trending designs which are not produced by the company
9. The company has not registered on different e-commerce websites and the website they are present on is not doing good business. He looked satisfied with the point

## **9.How would you construct a feed to show relevant content for a site that involves user interactions with items?**



There are seven pillars of User interaction

1. Valuable
2. Useful
3. Usable
4. Findable
5. Credible
6. Desirable
7. Accessible

We can do so using building a recommendation engine. The easiest we can do is to show contents that are popular other users, which is still a valid strategy if for example the contents are news articles. To be more accurate, we can build a content based filtering or collaborative filtering.

If there's enough user usage data, we can try collaborative filtering and recommend contents other similar users have consumed. If there isn't, we can recommend similar items based on vectorization of items (content based filtering).



## 10. How would you design the people you may know feature on LinkedIn or Facebook?

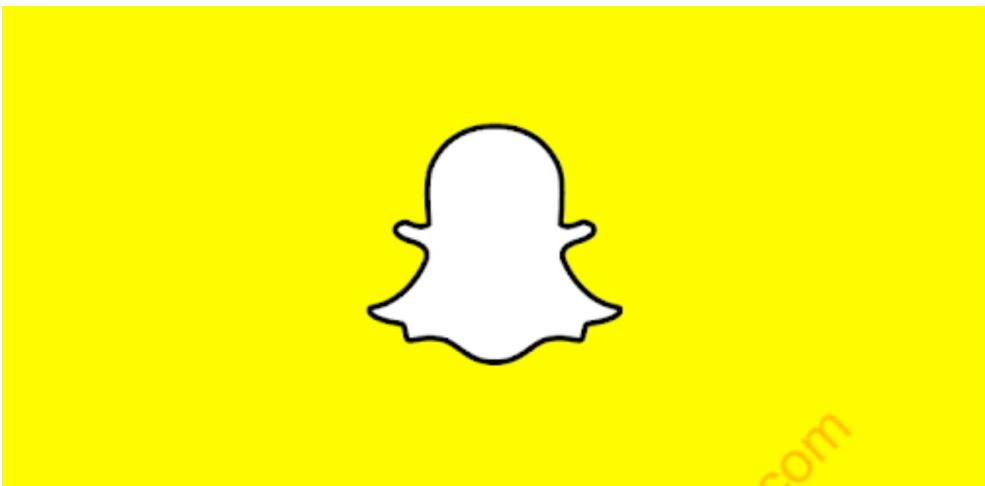
The screenshot displays a list of "People You May Know" on a LinkedIn interface. It includes three entries:

- Jay Kreps, Principle Engineering Manger at LinkedIn. Below his name is a "Connect" button.
- Jeremy Gillick, Senior Web Developer at LinkedIn. Below his name is a "Connect" button.
- Albert Wang, User Experience Design at LinkedIn. Below his name is a "Connect" button.

A "See more »" link is located at the bottom right of the list.

1. Find strong unconnected people in weighted connection graph
2. Define similarity as how strong the two people are connected
3. Given a certain feature, we can calculate the similarity based on
  - friend connections (neighbors)
  - Check-in's people being at the same location all the time.
  - same college, workplace
4. Have randomly dropped graphs test the performance of the algorithm
5. News Feed Optimization
6. Affinity score: how close the content creator and the users are
7. Weight: weight for the edge type (comment, like, tag, etc.).
8. Emphasis on features the company wants to promote
9. Time decay: the older the less important

**11. How would you predict who someone may want to send a Snapchat or Gmail to?**



For each user, assign a score of how likely someone would send an email to the rest is feature engineering:

- Number of past emails
- How many responses
- The last time they exchanged an email
- Whether the last email ends with a question mark
- Features about the other users, etc.
- People who someone sent emails the most in the past conditioning on time decay.

## 12. How would you suggest to a franchise where to open a new store?



- Build a master dataset with local demographic information available for each location.
- Local income levels
- Proximity to traffic, weather, population density, proximity to other businesses
- A reference dataset on local, regional, and national macroeconomic conditions (e.g. unemployment, inflation, prime interest rate, etc.)
- Data on the local franchise owner-operators, to the degree the manager identify a set of KPIs acceptable to the management that had requested the analysis concerning the most desirable factors surrounding a franchise
- Quarterly operating profit, ROI, EVA, pay-down rate, etc.
- Run econometric models to understand the relative significance of each variable
- Run machine learning algorithms to predict the performance of each location candidate

**13. In a search engine, given partial data on what the user has typed, how would you predict the user's eventual search query?**



-Based on the past frequencies of words shown up given a sequence of words, we can construct conditional probabilities of the set of next sequences of words that can show up (**n-gram**).

-The sequences with highest conditional probabilities can show up as top candidates.

-To further improve this algorithm, we can put more weight on past sequences which showed up more recently and near your location to account for trends show your recent searches given partial data

**14. Given a database of all previous alumni donations to your university, how would you predict which recent alumni are most likely to donate?**



- frequency of donations
- Amount of donation
- Graduation year
- Major subject
- Business domain
- Network strength of the alumuni

Construct a supervised regression (or binary classification) algorithm.

**15. You're Uber and you want to design a heat map to recommend to drivers where to wait for a passenger. How would you approach this?**



- Based on the past pickup location of passengers around the same time of the day, day of the week (month, year), construct
- Based on the number of past pickups
- Account for periodicity (seasonal, monthly, weekly, daily, hourly)
- Special events (concerts, festivals, etc.) from tweets
- Public holidays

**16. How will you change the UI of the game to increase the number of people buying coins from the shop section (Clash Of Clans)?**



This was a business case study, we had the discussion on the following points:-

1. Project the offer directly on the home page instead of clicking on the shop button
2. Put the price to buy elixir and gold near the collector(the pink and yellow images)
3. After every attack resulting in a loss, give an option to buy back the points
4. Get the country-wise data and see the most engaging time of the player and project the offers accordingly
5. Give a variable discount to the players on the basis of their day-to-day performance to allure them in buying coins on the day they performed well

**17. How do you think TVF makes a profit? Did moving to it's own website advantageous to TVF?**



Following are the points on which we discussed:-

1. TVF has some 10Million subscriber on Youtube, and it release it's video on Youtube after a week of it's original release on the TVF website. These videos give it a good amount of money to keep the show running
2. The main reason for TVF to move to it's own website was to create an ecosystem comparable to Netflix so that people buy subscription to watch the show.
3. Netflix charges some \$9 for subscription, TVF could be planning to launch it's series exclusively to any of these and can get some part of the subscription. Even a dollar per person can get them close to 10Million dollars
4. The estimated revenue of a Youtube channel with 10 Million subscriber is ~500,000 dollars per year.
5. Apart from these, a major chunk of the production cost is taken care by the sponsor of the show. For example Tiago in Trippling, Kingfisher in Pitchers, etc. So the production cost is next to zero for the episodes
6. TVF is also going for it's own website and raising funding to acquire customers and drive them to their website

It's hard to get a \$10 subscription, but even a basic subscription or tie-up with some other production can get them a handful of money

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**18. Taj Group of Hotels is planning to start a new branch, What are the parameters it should consider to find the appropriate place?**



The following points were discussed:-

- a. Find out the place where people have mostly searched for 5 or 7 star hotels
- b. Find the place where the average annual income is high, may be Bangalore, Pune, Delhi, Hyderabad, etc.
- c. Look for that place which is known for tourism as it will attract foreign customers
- d. Look for that area which has good facilities around like popular restaurants, pubs, malls, etc.
- e. Look for that city where there are all the necessary facilities like airport near the city, railway station, etc.
- f. Look for that city where you can get good service from third party vendors for basic services like laundry, service employees, security service, etc.

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