Communiqué

The Official Soft Skills Society of IIT Kharagpur

presents

The Guessing Game:

A HANDBOOK TO GUESSTIMATES

Acknowledgment

Communiqué,IIT Kharagpur recognises the contribution of its Executive Team 2019-2020 as the main authors from the book, however various sections of interview experiences on Quora.com and Glassdoor.com have been reproduced. Parts of casebooks by IIMA, ISB, and LSB, also The Guesstimate Compendium have been referred to and included in the book.

Thank You Executive Team 2019-2020

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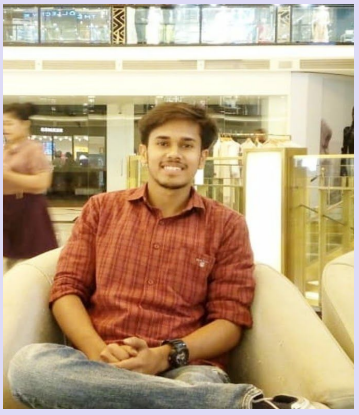

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CASE -1
Estimation of the number of petrol pumps in Delhi.

Approach 1:

Petrol pumps are located on the sides of roads, generally major roads and highways. So, we will estimate the length of all the major roads and highways and then place two petrol pumps at a suitable distance.

Area of Delhi:

Assume Delhi to be a square with Metro's blue and yellow line being as shown in the figure.

We assume that there are 30 metro stations each on both the routes and average distance between two stations being 2km.

Therefore, approximate area of Delhi= 0.5x60x60 = 1800sqkm

Delhi region:

- Residential use: 30% area
- Commercial use: 25% area
- Forest+ Agriculture use: 10% area
- Roads network: 20% area
- Others: 15% area

Area of roads in Delhi = 20% of 1800sqkm = 360sqkm = ~350sqkm

Roads types:

- Municipal roads: 35% =(~125)sqkm
- State roads: 50% =(~175)sqkm
- Central good roads: 15% =(~50)sqkm

State roads: (~175)sqm

- Main roads: ~50sqkm (30%)
  : Approximate width of the road is 15m.
- Flyovers and Highways: ~35sqkm (20%)
  : Approximate width of the road is 20m.
- Other interconnecting roads:~85sqkm(50%)
  : Approximate width of the road is 10m.

Central good roads:(~50)sqm

4. Generally, highways and flyovers would have petrol pumps on almost every road: Approximate width of the road is 25m.

Length of road of interest:

1. 50/0.015 =~3000km
2. 35/0.020 = 1750km
3. 85/0.010 = 8500km
4. 50/0.025 = 2000km

Total length would be approximately = 1500km

The average distance between 2 petrol pumps is generally 1-2 km, say 1.5 km.
Therefore, number of petrol pumps in Delhi
= 1500/1.5
= **10000 pumps(approximately)**

Note: If the average distance is taken as 1km, then there would have been 15000 pumps, and if the average distance would have been 2km, then there would have been 7500 pumps. Either number is good.

But if the interviewer said that 10k is a big number, then by taking the average distance of 2km we can scale it down, and if it is a smaller number then by taking the average distance as 1km, we can scale up the number.

Approach 2:

Delhi:

- 7 parliamentary seats (Central government)
- 70 legislative seats (State government)
- 235 wards (municipal council)

Delhi:

- Forest/Agriculture area = 10%
- Residential area = 30%
- Commercial (offices) = 30%
- Infrastructure and other miscellaneous areas(like parks,etc.) = 20%
- Industries = 10%

The approximate number of petrol pumps in residential and commercial areas = 50 per ward
The approximate number of petrol pumps in Forest/Agriculture areas = 30/ward
(More number of diesel pumps will be present than petrol pumps as tractors, trucks require diesel and not petrol.)

The approximate number of petrol pumps in miscellaneous areas and industries = 20/ward

Calculation:

- Residential and commercial areas:
  = (30+30)×50×235/100
  = 30×235
  = 7050 pumps
- Agriculture/Forest areas:
  = 10×30×235/100
  = 705 pumps
- Miscellaneous areas and industries:
  = 30×20×235/100
  = **1410 pumps**

Approximately, the total number of pumps = **9165 pumps.**
Note again if we are asked to scale up or down a number we can do so by increasing or decreasing the number of petrol pumps per ward in different regions. How did we get to this number, of say, 50 pumps per ward in a commercial area?
We can defend this by saying that we have estimated this based on what we saw during our visit to Connaught Place.
Note: Splitting the region into constituencies, legislative assembly seats or municipal wards can be a beneficial technique.

CASE -2

Estimate the amount of revenue generated by a single petrol pump.

Note: Here, revenue generated implies money generated. If the question was framed as the sales generated by a petrol pump, then there we should ask a clarifying question as to what they mean by sales- revenue(money generated by sales) or the amount of petrol sold(in litres).
Also, a good clarifying question can be to be sure that we need to consider the petrol pump to sell only petrol or do we need to consider diesel and gas sales as well.
Let us consider that the petrol pump sells petrol and diesel.

Petrol pump:

- Four petrol stations
- Two diesel stations

Petrol type:

- Normal (regular)
- Power (extra refined)

We will assume that a petrol pump is operational for 20 hours, starting from 6 am till 2 am : (6 am-12 am) and (12 am-2 am)
Also, we will assume that the average time taken to serve a customer is ninety seconds or forty customers can be served by a station in one hour.
However, the petrol pump never runs at full efficiency.

Assuming a working day: 6 A.M. - 2 A.M.

- 6A.M. - 11 A.M.
  School and office traffic
  Occupancy @ 80%
- 11A.M. - 2P.M.
  Relatively low traffic
  Occupancy @ 50%
- 2P.M. - 7P.M.
  School and office traffic
  Occupancy @ 80%
- 7P.M. - 11P.M.
  Relatively thin traffic
  Occupancy @ 60%
  People going out for dinner, movies and those returning from a job.
- 11P.M. - 2A.M.

Selective people are out of their home.
Occupancy @ 30%

Note: If there would have been a weekend then the traffic in the morning will be low. That will be compensated in the afternoon and evening when people move out to travel.
Also, Generally, people purchase in fixed denominations such as {50, 100, 200} (Two-wheelers generally), {500, 1000, 2000} (Cars and trucks generally).

Approach :
First, we will calculate the number of distinct transactions made and then we will repeat on the transaction site.
# of transaction = # of hours **x** occupancy **x** maximum feed rate **x** # of station

=(5X0.8X40X6) + (3X0.5X40X6) + (5X0.8X40X6) + (4X0.6X40X6)+ (3X0.4X40X6)
= 40 X 6 X (4 +1.5 + 4 + 2.4 + 1.2)
= 40 X 6 X 12.7
= 76.2 X 40 = 3048 transactions per day
~ 3000 transactions per day

Out of these 2000 were petrol-based and 1000 were diesel-based (as there were four petrol stations and two diesel station.)

We assume that diesel transaction = {500 (for 33% time) , 1000 (for 33% time) , 2000 (for 33% time)}
Therefore, Weighted average ~ 1200
Revenue generated from diesel station = 1200 X 1000
= 1200000
= 1200K or 12 Lakh

Petrol:

- 70% two wheelers approx 100/ "/?"
- 30% of Cars
    1. Regular
    ⅔ of the total approximately 750/ "/?"

Power:

⅓ of the total approximately 750/ "/?"
4 X 2000 X 0.7 X 100 + 4 X 2000 X 0.3 X 750
=560K + 1800K
Total revenue from Petrol station = 2360K
Total Revenue = 2360K + 1200K = 3560K (or 35.6 Lakh Revenue)

Additional Help:

Amount of diesel sold = 1200K (Average price of diesel)
Diesel cost say 50 per Litre = 1200/50 K Litres = 24000 L
Amount of petrol sold (in Litres) = [1200/70]K (Regular) + [600/75]K (Power)
= 17000 L + 8000 L
Therefore, Total of **25000 L**.

Note: Remember to defecate as much as possible.
Notice that diesel is used by heavy-duty vehicles such as buses, SUVs etc. So, they will be refuelling in larger quantities than bikes and other two-wheelers.
Also, note that the # of two-wheelers is much higher than the # of four-wheelers.
Hence, the spend on these two categories being different affects the revenue generated.
Also, notice that we have considered the money spent on each transaction. In India generally, we refuel based on a fixed denomination. We don't go out to refuel with the mindset that we need to purchase 10 L of fuel, for the car and so on.

CASE -3

Estimate the length of road in Delhi:

Approach :

We will begin by estimating the total area, which gives the area of roads, which further gives the length of the road.

Assume Delhi to be a square and Yellow and Blue metro lines run diagonally to each other. Each has 30 stations situated in Delhi with an average distance between them to be 2KM.

`

Therefore, Area of Delhi = ½ X (Diagonal)^2 = ½ X (2 X 30)^2 = 1800 sq.km

Delhi Area:

- Residential (30%)
- Commercial (20%)
- Forest / Agriculture (10%)
- Roads (20%)
- Others such as park, temples, malls, industries (20%)

Therefore, Area of Delhi Roads = 20% of 1800 sq km

= 360 sq. km

Types of Roads:

- Maintained by MCD (50%)
  These are small roads interconnecting roads, in-roads to society and other residential or commercial areas.
- Maintained by State Government (30%)
  These are larger main roads and highways.
- Maintained by the Central government (20%)
  These are used to connect one state to another. These are national highways and flyovers.

Calculations:

1. Approximate width of National highways and Flyovers = 25 Miles (They are broader as they are multi-lane highways and expressways.)

   Therefore, Length of road = ((0.2 X 360)/25) X 1000

   = 8 X 360 = 2880KM
2. The approximate average width of State-owned roads = 15 Meters (These are generally smaller in width than National Highways.)

   Therefore, Length of road = (0.3 X 360 X 1000)/15 = 7200KM

3. Approximate width of roads maintained by MCD = 10 Meters (These are generally smaller feeder roads and in-roads to societies.)

Therefore, Length of road = (0.5 X 360 X 1000)/10 = 18000KM
Total Length = 2880 + 7200 + 18000 KM
= **28080 KM**

CASE -4
Estimate the number of planes at the Delhi Airport.

Note that here, we have to guess the number of planes currently standing at the airport, i.e. at this moment.

Approach :
Delhi Airport:

- Terminal 1: This has, say 3 runways.
- Terminal 2: This has, say 3 runways.
- Terminal 3: This has, say 6 runways

.

Calculations:
Since it is broad-daylight, the airport is expected to run at near full operational capability.
Let us assume that the time to take off / land a plane is 2 minutes. Further, the time to board or deboard the plane is 1 hour.
This means, currently we can estimate:

= (12 runways) x (1 hr)/(2 min)
= 12 x 30 = 360 planes.

Additionally, we can assume a certain percentage of planes (say an additional 10%) which may be running late or are parked due to technical issue glitches.
Therefore, total numbers of planes = 360 + 0.1 x 360 = **396 planes**.

CASE -5

Estimate the number of planes starting or terminating to Delhi in a day.

Delhi Airport:

- Terminal 1: This has, say 3 runways.
- Terminal 2: This has, say 3 runways.
- Terminal 3: This has, say 6 runways.

Since it is broad-daylight, the airport is expected to run at near full operational capability.
Let us assume that the time to take off / land a plane is 2 minutes.
Further, approximately 30 planes can land on a runway in one hole.

Percentage efficiency of airport

11 pm to 6 am	6 am to 12 pm	12 pm to 5 pm	5 pm to 11 pm
70%	90%	100%	100%

Note: Here, the fact that Delhi airport is highly crowded has been taken into account. So a relatively low number of flights will include descent to good occupancy.

= 7 x 0.7 x 30 x 12 + 0.9 x 6 x 30 x 12 + 11 x 30 x 12

= 30 x 12 x (4.9 + 5.4 + 11)

= 30 x 12 x 21.3

= 639 x 12 = 7668 flights

So around 7500 / 8000 flights

Additional Question: Estimate the number of people flying in and flying out from Delhi in a day.

Types of bookings :

- Economy Class
- Economy Plus
- Business Class

= 7 column x 20 rows + 4 column x 15 row + (approx) 25 passengers

= Total 225 passengers (max capacity)

Let the arrange occupancy be 80% which implies, 180 passengers

People flying daily = 180 x 7500= 1,350,000

Note: These approx. Half of those who flew into Delhi and half of those who flew out of Delhi.

Additional follow-up question: Estimate the revenue generated by all of these flight tickets sales.

Types of booking are:

- Economy Class (60%): Average ticket price = 5000
- Economy Plus (30%): Average ticket price = 12000
- Business Class (10%): Average ticket price = 25000

Weighted average = 3000 + 3600 + 2500 = 9100 or 9000 approx

Revenue: 1.35 x 9000 million = **13.15 billion**

CASE -6

Estimate the number of planes flying over India at this very moment.

Number of Planes flying over India includes:

- All domestic and international flights, originating or terminating in India.
- Other International flights, flying over Indian airspace.

Part 1: All domestic and international flights, originating or terminating in India.

1. Tier-1 city = 20 cities (all of them have airports with many terminals and runways)
2. Tier-1 city = 60 cities (80% of them have airports with single terminal and 3 runways)
3. Tier-1 city = 120 cities (20% of them have airports with single terminal and 2 runways)

Available runways = 20 x 1 x 2 x 3 + 80 x 0.6 x 1 x 3 + 120 x 0.2 x 1 x 2

= approx 300 runways.

Let's say that the runway operates at 75% efficiency.

= 0.75 x 300 = 225 runways.

Average time to take off is 2 minutes. Further to incorporate planes currently flying, we take an average flight duration of 90 minutes.

Per runway approx 45 planes may be in Indian airspace. I.e. 225 x 45

= 900 + 112 = 1012 flights approx.

Part 2: Other International flights, flying over Indian airspace.

Approx 200 countries.

Europe to Oceania, Europe to Australia and New Zealand, and Africa to Oceania. Also, we assume that each country in Europe travels to each country in Oceania with at least a flight in 30 minutes which is approximately the time the plane may be lying over India. Europe to Oceania and vice versa = 30 x 20 x 2 = 1200

Europe to Australia and New Zealand & vice versa = 30 x 2 x 2 = 120

Africa to Oceania and vice versa = 40 x 20 x 2 x 0.5 (not all countries in Africa have an airports = 800

Total international planes = 120 + 1200 + 800 = 2120 planes

Total planes = 1012 + 2120 = **3132 planes**

Note: Here private planes are not being considered and government officials planes are not being considered.

CASE -7

Estimate the number of traffic lights in Delhi.

Approach-

Estimate the road and then estimate the traffic lights.
Area of Delhi=½(60)(60)sq. Km=1800 sq km
Residential-25%
Commercial-25%
Forest/agri-10%
Industry and other miscellaneous parts-20%
Roads-20%
Area of roadways=20% of 1800 sq km=360 sq km

Types of roads-

- Maintained by Municipal Corporation -35%=125 sq km
- Maintained by State Government(main roads, flyovers)-50%=175 sq km
- Maintained by Central Government-15%=50 sq km

A. Main roads(30%)-Almost 100% roads have a traffic light at an approximate distance of 2 km
50 sq km
Width of road=15 m

B. Flyovers and highways(20%)-Almost all flyovers have a traffic light at an approximate distance of 4km
35 sq km
Width of road=20 m

C. Other inter-connecting roads (50%)-Around 30% of them have a traffic light at an approximate distance of 2 km
85 sq km
Width of road=10 m

Central Roads(50 sq km)-

D. All of them have traffic lights at a distance of 8 km
Width of road=25 m

A--(50 X 1000)/(15 X 2)=1666
B--(35 X 1000)/(20 X 4)=4375
C--(85 X 1000 X 0.3)/(10 X 2)=12750
D--(50 X 1000)/(8 X 25)=250 Thus, **19035 traffic lights.**

CASE -8

Estimate the number of CCTV Cameras in Mumbai.

Approach

Where are CCTV Cameras used?

- They are used for safety and surveillance
- Banks
- Markets
- Hospitals
- Houses
- Malls
- Shops
- Office
- Colleges

The population of Mumbai=approx 21 million (or 2 crores)

Age-wise segregation of population-

- Infants (upto 3 years) --3% --(0.63 million)
- School-going age (4-18 years) --30% -- (6.3 million)
- 18-30 years -- 33% -- (7 million)--
    - Can go to college-- 25% --
        - 80% went to college
        - 20% did not go to college
    - Rest go to job
- 30-50 years -- 16.66% -- (3.5 million)
- 50 and above -- 16.66% --(3.5 million)

Assuming we have a bank branch for every 10,000 persons--
Assuming 80% of people have an account in a bank
No. of bank branches=(14000/10000) X 1000 X 0.8 = 1120 bank branches
Let each branch has approximately 15 cameras
=1120 X 15 = 16800 cameras

Assuming we have a hospital for every 15000 persons--
(21 X 1000 X 1000)/(15 X 1000)= 1400 hospitals
Each hospital has around 50 cameras
1400 X 50 =70000 cameras

Assuming we have a school for every 8 X 50 X 14 = 5600 =6000 approx students--
1050 schools
Each school has approx 40 cameras--

1050 X 40 = 42000 cameras

Assuming we have a college for every 2000 students
(7 X 1000 X 1000)/2000 X (¼) X (4/5) = 700 colleges

Let each college has 50 CCTV
50 X 700 =35000 cameras

Working people-- 60% --(12.6 million)--

- 6.3 million males (All working)
- 6.3 million females (⅓ working)--2.1 million

Total working people = (6.3 +2.1)million=8.4 million--

- Office (75%)--6.3 million
- Shops (25%)--2.1 million

An office per 500 people on an average, 100 cameras per office
6300 X 1000 X 100/500=1.26 lac cameras
A shop for every 10 persons, 10 cameras per shop
21000 X 1000 X 10/10=2.1 million

Population=21 million
Average family size in India is 4-5.
-> 4 to 5 million families= 4.5 million families--

- Below poverty line (10%) --None will have cameras installed
- Low middle class (40%) -- 30% will have cameras installed--(average 5 cameras)
  1.8 X 1.5 million = 2.7 million
- Middle income (30%)--80% will have cameras installed (average 5 cameras)
  4 X 1.35 million = 6.4 million
- High income (20%) --all will have cameras installed (average 10 cameras)
  0.9 X 10 million= 9 million camera

18.1 million cameras for houses.

Total=**20.49 million CCTVs installed.**

Now, if the number seems too large to be accurate, then some of our assumptions are false. Maybe there are not enough households where CCTV is installed.
Also, note that we have assumed that all the shops are CCTV installed. That's not a correct assumption. Every office having CCTV is justified, but not every shop will have it.

Also, the average number of cameras that we thought are required in a house/shop etc. may be incorrect. We need additional data to be sure. However, we need to demonstrate to the interviewer that we thought of it.
Also, note that it is a very important guesstimate as it uses surreal segregation techniques such as age split, economical split. Also, it uses a shortcut to estimate the number of hospitals, schools etc.

CASE-9

Estimate the number of schools in Delhi.

Approach

Population of Delhi =1.5 crores--

- 0-3 years --3%
- 3-18 years --30%-- 45 lacs--
    - I. can afford education -- 90% --40 lacs approx
    - II. cannot afford education --10%
- 18-35 years --33%
- 35-60 years --25%
- 60 and above --8%

No. of class-1st to 12th, nursery I & II = 14 classes
No. of sections=10
No. of students/section=50
No. of students/school=50 X 10 X 14=7000
No. of schools=40,00,000/7000=**5700 schools(approx)**

Follow-up question: Estimate the number of teachers teaching in schools.

Take the teacher to student ratio 40 students/teacher.
People attending school=40 lac
No. of teachers=40 lac/40=**1 lac**

Follow-up question: Estimate the number of Govt. Schools in Delhi.

Govt School--

- Run by State Govt
- Run by the Central Govt.

Delhi has--

- 7 Parliamentary seats
- 70 Legislative seats/ 235 council wards

If we have an average of 10 schools/ward, the State Govt operates around 235 X 10 = 2350 schools.
The Central Government has 7 Parliamentary seats; if we have 70 schools/seats, then the Central Government operates 70 X 7 = 490 schools.
Total Govt. schools = 2350 + 490 =**2840 schools.**
No. of private schools = 5700 - 2840 =**2660 schools**

Other follow-up questions can be-

Estimate the number of benches, chairs, fans etc. in schools located in Delhi.

For this, break down the no. of schools to no. of classrooms.

14 X 10 = **140 classes**

Also, there are practice labs, so we assume 10 computer labs, 2 chemistry, 2 physics labs and 10 more classrooms for drama, music, instrumentation and so on. (Around 25 labs)

CASE -10

Estimate the number of hospitals in Delhi

Approach:

Hospitals

- State/Government-owned
- Private Hospitals

State/Government-owned

- Meant for everyone but generally targets the poor.

Private Hospitals

- Generally, target the reach.

Delhi Population:

(~1.5)crores

- Below Poverty Line: 10%= (~15)lakhs
- Low Middle Income: 45% = (~67.5)lakhs
- Middle Income: 35%= (~52.5)lakhs
- High Income: 10%= (~15)lakhs

1. Below Poverty Line
   (~15)lakhs: Can't afford private
2. Low Middle Income
   (~67.5)lakhs: Can't afford private
3. Middle Income
   (~52.5)lakhs: (~25)lakhs can afford private(50%)
4. High Income
   (~15)lakhs: All can afford private

Now assuming that we have a bed for every 1000 people
= (25,00,000+15,00,000)/1,000
=4000
Assuming 30 beds/Hospital = 4,000/30
= roughly 130 private Hospitals

Government-Owned Hospitals:

Delhi
Central
State
MCD

Central: 7 Constituencies

15 Central government Hospitals/ Constituency

= 15×7

= 105 Hospitals

State: 70 Legislative assembly seats

3 State government Hospitals/ Legislative seat

= 3×70

= 210 Hospitals

MCD: They generally have clinics and hence are not Hospitals

Number of government-operated Hospitals = 105+210 = 315 Hospitals

Number of Charitable Hospitals = 1/ Legislative assembly = 70 Hospitals

Total number of Hospitals = 120+315+70 = **505 Hospitals**

CASE -11

Estimate the number of ATMs in Delhi

ATMs

- Stand-alone ATMs
- Along with the bank branch

Population of Delhi = 1.5 crores and 25% aged-below
So 75% eligible to open an account
Say 90% of those eligible do have an account
= (9/10)×(3/4)×1.5 crores
~ 1 crore people (67.5% of 1.5 crore)
Now let there be a bank branch for every 5000 people, then
= (1,00,00,000)/5,000
= 2,000 bank branches
Say out of this 60 % do have an ATM along with the branch
=(60/100)×2,000
=1,200 ATMs

Stand Alone ATMs

- Metro Stations
- Markets
- Hospitals
- Others (like college area, residential area etc.)

Metro Stations

- 5 Metro routes
- Each has an approx 35 stations
- 2 ATMs at average on either side (there are two sides)
  = 5×35×4
  =700 ATMs

Hospitals

- One bed per thousand person
  = 15,00,00,000/1,000
  = 15,000
- 30 beds/ Hospital
  = 15,000/30
  = 500 Hospitals
- 3 ATMs/ Hospital
  = 15,00 ATMs

70 constituencies, we take an average 2 market/ constituency and 2 ATMs/market
= 70×2×2

= 280 ATMs

Similar for residential areas, 2/constituency = 2×70

= 140 ATMs

Total of Stand-alone ATMs = 700+280+1500+140

= 2,760 ATMs

Total number of ATMs = 2760+1200

= **3,960 ATMs**

CASE -12

Estimate the number of Band-Aids sold in India

Approach:

Band-Aids:

- Chemist Shops
- Hospitals
- Sports facilities

Assuming that we have a bed for every 10,000 persons and for a population of 120 crores, we have
= 120,00,00,000/10,000
=1,20,000 beds

And since we have a shortage of Hospitals, I assume that 5/6th of the total is always occupied = 100k beds.

These patients will require, say 2 band-aids/day = 200k beds
But not all of them requires band-aids, so let 80% of them needs it
= 80% of 200k
= 160k band-aids

Also, if we assume that one hospital at an average has 20 beds, the
Total of hospitals = 100k/20= 50 Hospitals

Now if we assume that there exists a chemist shop for every 20k people, then
120,00,00,000/20,000
=60,000 shops

If each shop sells 15 band-aids at an average, then 15×60k=900k band-aids

India has approx 550 constituencies and if we take an average, 2 sports facilities per constituencies, we have 2×550 = 1100 sports facilities.
If each sports facilities uses 50 band-aids a day
= 50×1.1k
=75k band-aids

Total number of Band-aids= 160k+1000k+900k+75k= 2135k= **2.135 million**

CASE -13

Estimate the number of people travelling in Metro (Delhi Metro).

Approach:

No. of Metro Routes=5

No. of metro lanes =2 per route =10 lanes

No. of stations = approx 40 per route = 40*10=400 metros

No. of coaches in a metro = 8 per metro rail = 8*400 = 3200 coaches

Frequency of metro = one metro/2 min = 30 metro /hr

Operating hours = 20 hours (approx)

=20*30*3200

=600*3.2K

=1920 K or 1.92 million

Now the maximum capacity of a metro coach = 200

Occupancy of Delhi metro:

- 5-7 AM 2hrs(60%)
- 7-11 AM 4hrs(100%)
- 11AM-5PM 6hrs(70%)
- 5-9 PM 4hrs(60%)
- 9-1 AM 4hrs(60%)

Weighted average of occupancy = (1.2+4+4.2+4+2.4)*(1/20)

= 15.8/20= 80%

Daily Ridership of Delhi metro =0.192 million *200*80%

=0.192 million *160

= 30.70 million ridership

However, the question is the number of people travelling by Delhi metro and not daily ridership.

So if we assume that a single person travels to and fro from Delhi metro, then we need to count two ridership as one person. However, not everyone may do that. Suppose that 80% of the total people use the metro for a round-trip journey and 20% for a single-sided journey.

Therefore, average ridership per person= 0.8*2 +0.2*1 = 1.8

No. of people using Delhi Metro = 30.70/1.8 million

≈17 million people

CASE -14

Estimate the number of copies of Sherlock Holmes sold in India this year.

Approach:

Digital copy or hard copy? -------- (Hard copy only)

First hand or second hand? ---------- (First hand only)

Language -> regionally translates language or English ---------- (English only)

Languages are spoken (1.2 crores):

- English speaking (25%)
- Non-English Speaking (75%)

300 million can speak/write or are proficient in the language

(We can also state that India has the second-largest pool of English speaking people, after the U.S.)

Economic Status:

- Below poverty line (15%)
- Low income (40%)
- Middle income (30%)
- High income (15%)

Therefore, 85% can afford a book -> 85% of 300 million = 255 million

Say 250 million

Age-wise split:

- Below 12 years (20%) ---- 5 million --- Barely can read
- 12-18 years (15%) ----37.5 million ---- 25% interested
- 18-30 years (30%) ---- 75 million ---- 20% interested
- 30-50 years (20%) ---- 50 million ---- 10% interested
- 50 and above (15%) ---- 37.5 million ----5% interested

Therefore, 5+15+10 million = 30 million includes in reading a novel.

Types of novels:

- Crime: 20%
- Adventure: 15%
- Biography: 15%
- Romantic: 20%

- Misc: 10%

Of crime genre, say, 15 % may be interested in

Buying a Sherlock Holmes novel.

i.e. 0.9 Million (interested)

Now some people, out of those interested, may

- Have brought and read all of the novels.
- Some will buy this year.
- Some may not buy this now but can buy in the future.
- Also, not everyone interested can buy a novel; they can rent it or buy a second hand.

Interested Person (0.9 million)

- Rent: 40%
- Second Hand: 30%
- Purchase: 30%

Of all purchases (0.27 million)

- Brought and read: 25%
- Purchase: 15%
- Future Potential Buyers: 60%

Therefore purchases = 0.27* 15 * (1/100)

=0.0405 Million

=**40.5K copies**

CASE -15

Estimate the number of gulab jamuns sold in Delhi on a single day.

Approach:

Gulab Jamun is sold at:

- Sweet shops
- Restaurants
- Snacks outlet (like BTW)

Now the sale of gulab jamun will be very different on a casual day compared to a festival day like Diwali, Rakhi etc.

So we need to ask this to the interviewer for clarification. Let us for now. Assume that it is a typical day.

There are seventy legislative assembly seats in Delhi. And if I was to recall my seat (Karol Bagh), there are around 10 shops (which are branded) and another 25 shops which are local.

Taking this as a standard, we have around 700 standard shops and 1750 local shops.

Considering daily average consumption of around 20 kg in branded shops and 10 kg in local shops,

700*20 + 1750*10 = 14000 + 17500 = 31500 kg

Let a single kg of gulab jamun have 20 pieces,

31500*20 = **630,000 pieces ---------- (A)**

Again we have 70 legislative seats, and in my area, there are around 100 restaurants and at least 20 hotels.

All the hotels will have gulab jamun on their menu, but only North Indian restaurants will have gulab jamun on their menu.

Restaurants:

- South Indian (30%)
- North Indian (30%)

- Chinese (15%)
- Rest (15%)

Therefore, 45 restaurants and 20 hotels.

For 70 constitutions we have,

45*70 + 20*70 = 3150 restaurants and 1400 hotels.

Now, we assume that the hotel has at least 30 rooms with an average of 2 and out of the 10% may order Gulab jamun. (one per person).

Similarly, we assume that a hotel feeds 100 customers with an average customer size of 3 people and 10% of them order gulab jamun. (one per person)

3150*100*3*(1/10) and 1400*30*2*(1/10)

i.e. 94500 from restaurants and 8400 from hotels = **102900 ---------- (B)**

Snacks shops:

- Pizza
- Burgers
- Indian snacks
- Shakes

Only Indian snacks are required for estimation.

Again in Karol Bagh, I can safely say that there are 10 such Indian snacks shops which serve around 15 people. Say only 10% of them have gulab jamun and we have 70 legislative seats.

70*10*150*(1/10)*1 = **10500----------(C)**

Total: 630,000 + 102900 + 10500 = **743.4 K gulab jamuns per dayNote:** Had it been a festive day then we need to simply increase the number of gulab jamuns sold by the sweet shops by several multiples.

CASE -16

Estimate the number of cars crossing Delhi-Gurgaon toll in a day:

Approach:
We will begin by estimating the # of people of different working classes who cross the toll on a working day.

Population of Delhi = 1.5 crores

# of families (on an average scale consisting of 4 to 5 members each) = 45 Lakh

Types of Occupation	Contribution	# of people working
AGRICULTURE	10%	4.5 Lakh
SELF / BUSINESS	30%	13.5 Lakh
SERVICES	60%	27 Lakh

Now for a service family, we have

- 100% of Husbands working
- 60% of wives working
- 40% of children working (assuming one child is working)

Therefore, Total # of working people = 2 X 27 Lakh = 54 Lakh

Place of working	Contribution	# of people working
GURGAON	40%	21.6 Lakh
DELHI	15%	8.1 Lakh
NOIDA	35%	18.9 Lakh

Also, there may be some people who may visit from Delhi to Gurgaon for schooling or shopping purposes.
Assume the # of such people = 25 Lakh

Modes of transport	Contribution	# of people

Delhi Metro	40%	10 Lakh
Bus Services	15%	3.75 Lakh
Personal Vehicle	20%	5 Lakh
Cabs • Pool cab • Personal cab	25% 60% 40%	6.25 Lakh 3.75 Lakh 2.5 Lakh

Let the number of passengers in a cab pool be 3 on an average.
Therefore,# of such pool cabs = 3.75/3 = 1.25 Lakh

Therefore, Total # of cars =(# of pool cabs + # of personal vehicles + # of personal cabs)

= 1.25 + 5 + 2.5 Lakh
= **8.75 Lakh**

Note: This is the case for a working day. The situation will be different for a weekend(Saturday or Sunday).

CASE -17

Estimate the revenue of an MCD outlet coming out from a burger sales:

Approach:

Type of sales

- Online
- Offline

Do we need to count both types of sales?

- No.Only the offline ones.

The MCD at any place has 3 billing mid-range counters.
Average time for preparing the burger and the bill for the customer is approximately 2 minutes.
Hence there are 30 burgers being prepared per hour per burger counter.

Distribution of sales

Timings	Percentage of customers
10 am - 1 pm	60%
1 pm - 4 pm	80%
4 pm - 7 pm	75%
7 pm - 11 pm	80%

What MCD sells?

Items	Percentage of sale
Fries/Wraps	20%
*Burgers	60%
Desserts/Drinks	20%

So 60% of the time, a sale at MCD implies the sale of a burger.

# of burgers,
= 0.6 X 30 (4 X 0.6 + 3 X 0.8 + 3 X 0.75 + 4 X 0.6) X 4
= 0.6 X 30 (2.4 + 2.4 + 2.25 + 2.4) X 4
= 0.6 X 30 (9.45) X 4
= 72 X 9.45
= 680 burgers

Types of burger	**Percentage of sale**	**Actual Cost (INR)**	**Average Cost(INR)**
Low priced • Veg • Non-veg	40% 60% 40%	 40 50	45
Mid-range • Veg • Non-veg	30% 60% 40%	 100 120	110
High priced • Veg • Non-veg	30% 60% 40%	 150 170	160

The weighted average price of a burger,
= 0.4 X 45 +110 X 0.3 + 0.3 X 160
= 18 + 33 + 48
= 99 INR

/Therefore, Total Revenue = 680 X 99 INR
= **67,320 INR**

Note:
The sale/occupancy shall vary depending upon whether it is a working day or a weekend. Also, if the total revenue was to be estimated, then the revenue from fries/wraps/desserts/meals are required to be taken care of. The choice of 4 counters was very random.
It is a good idea to divide the meal as veg & non-veg when we are considering Indian consumers. This may not be required in the international market(the US or Europe)
Also, the question can be further extended to calculate the MCD from Delhi region. For this, simply assume 1 to 2 stores per legislative assembly. This counts for nearly 90-140 stores.
The same set of questions can be extended to estimate the revenue of a restaurant. But you need to ask whether the restaurant operates in the Budget, Mid-tier or Premium segment and then proceed.

CASE -18

Estimate the number of televisions and refrigerators sold in Delhi in a year (Also estimate the revenue) :

Approach:

Population of Delhi = 1.5 crores

# of families (on an average scale consisting of 4 to 5 members each) = 45 Lakh

Economic distribution	Contribution	# of people	Average # of refrigerators
Below poverty line	15%	6.75 Lakh	0
Low income	40%	18 Lakh	1
Middle income	30%	13.5 Lakh	1.2
High income	15%	6.75 Lakh	1.5

Weighted average = 0 X 0.15 + 1 X 0.4 + 1.2 X 30 + 1.5 X 0.15
= 0.4 + 0.36 + 0.225
= 0.965

Therefore, # of refrigerators in Delhi households = 0.965 X 45 Lakh
= 43 Lakh

Average lifespan of a refrigerator = 15 years

Therefore,units sold annually due to replacement = 43 / 15 = 2.9 Lakh

However, there are also first-time buyers. Those people who bought for the first-time will be those who have been uplifted from poverty. Say 5 % of the people are uplifted from poverty.

= 6.75 X (1 / 20) Lakh

= 32,250 INR

Therefor,Total sales annually = 2.9 + (0.32250 ~ 0.32)
= 3.22 Lakh

Other than this , refrigerators are bought for commercial purposes as well.

Commercial Use:

- Hotels
- Restaurants
- Storage Facilities

However, they are generally not asked to be estimated.
Revenue generated by refrigerator sales(considering different types of refrigerators):

Types of refrigerator	**Percentage of the market**	**Average unit price**
Entry-level	40%	15K
Mid-level	40%	40K
High/premium level	20%	75K

Total Revenue = 3.22 X (0.4 X 15K + 0.4 X 40K + 0.2 X 75K) Lakh
= 3.22 X (6K + 16K + 15K) Lakh
= 3.22 Lakh X 37K
= 120K Lakh
= 120 crores (roughly $2 billion)

The second part is to estimate the # of televisions sold in Delhi.

Distribution of televisions:

- Hospitals
- Hotels
- Offices
- Personal Use
- Residential
- Commercial(e.g. stores)

Population of Delhi = 1.5 crores

# of families (on an average scale consisting of 4 to 5 members each) = 45 Lakh

Economic situation	**Contribution**	**Average # of TV**	**Percentage of families**
Below poverty line	15%	0	6.75 Lakh
Low income	40%	1	18 Lakh
Mid income	30%	2	13.5 Lakh
High income	15%	3	6.75 Lakh

Total # of TVs in households = 0 X 6.75 + 1 X 18 + 2 X 13.5 + 3 X 6.75 Lakh
= 65.25 Lakh
The average lifespan of a TV = 10 years

Therefore,units sold annually due to replacement = 65.25 / 10 = 6.525 Lakh

Economic activity	**Number of paracetamol tablets sold in Delhi**
	Places where they are sold ● Hospitals ● Chemist shops Delhi (7 parliament constituency) ➔ Legislative 70 constituency ➔ 235 Wards In my ward, I can estimate that there are roughly 20 chemist shops. Therefore, No. of chemist shops = 235 X 20 = 4,700 shops. Each shop on an average may sell ten shops (100 tablets). Therefore, tablets sold = 4,700 X 100 = 470,000 or 470k tablets. Population of Delhi = 1.5 Crore Let there be a bed for every 5000 persons = 15,000,000/5,000 = 3,000 beds. Let there be 30 beds per hospital = 3,000/30 = 100 hospitals If at an average, a hospital sells 100 strips (1,000 tablets), then tablets sold by hospital = 100 X 1,000 = 100k. Total number of tablets sold = 470k+100k = 570k tablets. Note, parameters like several beds or 1,000 persons or so on are also general parameters which can help us to determine the quality of health-care in the country.

	If the question was several paracetamol tablets sold in India, then take that India has approx 550 constitutions ➔ Approx 5,000 state counselling seats ➔ 35,000 municipal wards ➔ 20 chemist shops/ward = 700k chemist shops. Similarly, Delhi has a better medical facility than the national average. Hence we can take 10,000 persons/bed to estimate hospitals. Further, notice that these variations are in the general present for developing nations. Developed nations do not have these many disciplines in the data. If we, for example, had to estimate for the state of California, then. The US population ➔ 50 states, the average population per state = 7 million. But since California is an industrial state and near the coastline, it's population will be slightly higher than the average/mean value. So, begin by taking 8 million citizens. Also, we can estimate that one bed/500 persons may be available in California or one bed/1000 persons, as it's medical facilities will be better than Delhi.
Agriculture/Forestry	10%
Business	30%
Service	60%

Let half of the females be working = 67.5 Lakh
Therefore, people working in service = 39 Lakh
Assuming 500 persons working per office.
Average size of office = 39 / 500 Lakh = 7800 offices
Average # of TV in offices = 7800 X 100 = 7.8 Lakh

Similarly let there be a bed for every 10,000 persons in the population.
# of beds = 1.5 crore / 10,000 = 1500 beds
Average # of beds per hospital = 20
# of hospitals = 1500 / 20 = 75 hospitals
Average # of TV per hospital = 100
Therefore, Total # of TVs in hospitals = 7500

Therefore, Total # of TVs = 6.525 Lakh + 7.8 Lakh + 7500
= **14.395 Lakh**

CASE - 19

The number of iPhones sold in India :

Approach :

Number of mobile users = 100 Crores

100 Crores :

- 2G/3G Network (60 Crores Users) (60%)
- 4G Network (40 Crores users) (40%)

Smart Phones :

- Budget (50 Crores Users) (50%)
- Mid-level (10 Crores Users) (25%)
- Upper mid (6 Crores Users) (15%)
- Premium (4 Crores Users) (10%)

The average life of a smartphone = 3 Years

So, 4/3 = 1.33 Crores phones

Premium phones :

- Samsung (26 Lacs Users) (20%)
- HTC (15%)
- LG (10%)
- Chinese (35%)
- Apple (26 Lacs Users) (20%)

The average income of Delhi = 126,000Rs annually

The average income of India = 65,000Rs annually

So, Delhi has 2X more wealth.

The population of Delhi = 1.5 Crore

The population of India = 120 Crore

So, 120/1.5 = 80

Also, Delhi has two times more wealth so that it will be 40

Number of iPhones sold in Delhi = 26/40 Lacs = 65,000 iPhones

Sales :

- Q1 (30%) (New year)
- zQ2 (20%) (Relatively low sale period)
- Q3 (20%) (Relatively low sale period)
- Q4 (30%) (Diwali) (⅓ rd of the total comes in the Diwali period) (say)

- So, iPhones sold in Delhi in Diwali sale = 65,000 X 30/100 X ⅓ = 6,500 iPhones.

The question can be further extended to estimate the number of iPhones sold online v/s offline.
Also, instead of iPhones, we can be asked to estimate the sale of a new Samsung/Google phone.
We can also be asked to estimate the revenue generated by a telecom company/ telecom industry by offering only voice & data services.
The economic distribution for Delhi, Mumbai, Chennai, Kolkata, Hyderabad, etc. will be similar.

Delhi

- Budget phones (30%)
- Low-mid level (30%)
- Mid-level (20%)
- High level (20%)

India

- Budget (40%) (Dominated by Chinese vendor & Samsung)
- Low-mid (30%) (Dominated by Chinese vendor & Samsung)
- Mid (20%) (Highly fragmented by Chinese player)
- High end (10%) (Dominated by Samsung/Apple followed by Chinese vendor)

CASE-20

A number of paracetamol tablets sold in Delhi :

Approach :

Places where they are sold

- Hospitals
- Chemist shops

Delhi (7 parliament constituency) ➔ Legislative 70 constituency ➔ 235

Wards:
In my ward, I can estimate that there are roughly 20 chemist shops.
Therefore, No. of chemist shops = 235 X 20 = 4,700 shops.
Each shop on an average may sell ten shops (100 tablets).
Therefore, tablets sold = 4,700 X 100 = 470,000 or 470k tablets.

Population of Delhi = 1.5 Crore
Let there be a bed for every 5000 persons = 15,000,000/5,000 = 3,000 beds.
Let there be 30 beds per hospital = 3,000/30 = 100 hospitals

If at an average, a hospital sells 100 strips (1,000 tablets), then tablets sold by hospital = 100 X 1,000 = 100k.
Total number of tablets sold = 470k+100k = 570k tablets.

Note: Parameters like several beds or 1,000 persons or so on are also general parameters which can help us to determine the quality of health-care in the country.

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Further, notice that these variations are in the general present for developing nations.
Developed nations do not have these many disciplines in the data.
If we, for example, had to estimate for the state of California, then.
The US population ➔ 50 states, the average population per state = **7 million.**

But since California is an industrial state and near the coastline, it's population will be slightly higher than the average/mean value. So, begin by taking 8 million citizens.
Also, we can estimate that one bed/500 persons may be available in California or one bed/1000 persons, as it's medical facilities will be better than Delhi.

CASE -21
Estimate the number of lakes in the world:

Approach :
Radius of the Earth=6400 km=2^6 X100 km
Therefore, the surface area of the Earth=4 X 3.14 X 2^6 X 2^6 X 100 X 100km² = 12.56 X 4,096 X 10,000km²
Assuming Earth to be a perfect sphere ~ 510 million km².

Earth:-

- Water(70%) (357.5million km²)
- Land(30%) (152.5 million km²)

98% of the water on earth is in the ocean and sea. That is approximately 350 million square kilometres.
And the rest 2 %, i.e., 7 million square kilometres.

Out of the total freshwater, 98% is in the form of glaciers(6.84 million square kilometres). The remaining 2% of the freshwater(0.16 million square kilometres) is in the form of rivers, lakes and ponds.

Out of this 0.16 million square kilometres 85% is in the form of rivers(119,000km²), 10% in the form of lakes(14,000km²) and 5% in the form of ponds(7,000km²) .

Now let us assume that the average side of a lake is 1,000mt X 100mt = 0.01km².
Total no. of lakes = 14,000 X 100= 14 lakh lakes

(According to Google, we have approximately 20 lakh lakes. But these can be both saltwater and freshwater lakes.)

Also, we can say that these lakes are natural lakes. There may be some artificial lakes made by human beings for their use.

Lakes can be classified as:-

- Freshwater lakes
- Saline Lakes

Lakes can also be classified as:-

- Natural
- Man-made (or) Artificial

CASE - 22

Estimating the size of the tyre industry in India in 2020 :

Approach :

The population of India = 125 crores with the average family size of 4 to 5 = 30 crore to 25 crore

Say we take 27 crore families in India.

Low income – No one will own an SUV

Mid/High income – These people may own a new/used SUV.

SUV by the high-end people= 2.7 crores (0.5+0.6=0.3)

2.7crore*1.4=3.5 crores

Assuming that the average life of an SUV is 15 years, we have 350/15 lac SUV sold

Approx. 2 million SUV = 20 lac SUV

So we have,

26.6 lakhs new SUV sold in India in 2020 and a total of 4.2 crore SUV in the country.

Also, let us assume that 12% of the new SUVs sold in India (brought by Indian) are explored abroad.

Therefore, the new SUV requires 5 tyres = 150 lakh tyres for new SUVs.

(4tyre+1extra)

Let every one out of five cars require a tyre replacement in a year.

è 350/5*1=70 lakh replacement tyres.

Total tyres = 150lakh+70lakh

= 220lakh

(over 22 million tyre)

Revenue of the SUV tyre industry – Let the average price of the tyre be 10,000.

220 million * 10,000

= Rs. 220 billion

Revenue in = $ 220/60 billion = **$ 3.67 billion**

CASE- 23

The number of roses sold in Delhi on 14th February :

Approach :

Delhi population = 1.5 crore

Now everyone will not celebrate Valentine day by giving a rose.

Therefore, approximately 1.5 lac roses can be sold on 14th February in Delhi.

180K Roses.

Follow up question -> Estimate the number of roses sold by a flower vendor in Delhi on 14th February.

A-- 350 Vendors (shops)

But during the 14th February, various street vendors also sell roses.

They are primary at metro stations and markets.

The number of metro stations = five metro lines * 40 average number of stations per line.

B -- 200 stations

At an average 3 vendors per station (one vendor /entry or exit gate) = 600 vendors.

Again 70 constituencies, taking two markets per constituency, approximately 150 markets.

5 vendors per market => C-- 750 vendors

Total vendors = 350+600+750

= 1800 Vendors

Average number of roses sold per vendor = 150000/1800 = 83 rose

Average revenue = average price * unit sold

(taking the average = 25*83

price to be 25 = 8300/4

rupees per rose) = **2075 /vendor**

CASE-24

The number of footballs sold in India:

Approach :

Population of India = 125 crores.

Now,14 classes for ten sections with 50 students each.

- The average number of students in a school=14*10*50=7000

.:. The number of schools=250000000/7000=35700 schools.

Say 80%, of these school, have football facility, and that they order ten football each in a calendar year

=35700*10*0.8=295600

=>2.956 lac **.....(a)**

Out of 18.75 crore people who can pursue higher education, say 40% of them pursue a college degree.

(Assuming that many people in rural areas are deprived of getting higher education).

Number of people pursuing a college=18.75*0.4 crore

=7.5 crore

Assuming that at an average a college hosts 5000 persons, the average number of colleges= 75000000/5000=15000 colleges.

Assuming that each college orders 20 footballs and 90% of them have a football-playing facility.

=>15000*0.9*10=135000 or 1.35 lac**.....(b)**

Say 90% of the states have a state football team and each state has at an average 30 clubs/sports facilities where football is being played. And each club purchases 20 footballs annually.

.:. 30*35*0.9*20

=2100*9

=18900

Assume 20k as with the national/state team.
Also Indian Super League, we have around ten teams, each playing two with the other, followed by elimination rounds.
Each match requires two balls and approx 20 for making the players practice.

.:.(45+5)*22=1100 footballs.
Total number of footballs for sports club/state and national team=1100+18900+1100=21100 footballs. .....(c)
.:. Total number of footballs =a+b+c
=295k+135k+21.1k
=441.1 k footballs
Or **4.411 lac footballs**.

CASE - 25
Number of students attending 10th/12th/college in India :

Approach :

Population of India = 125 crores
Age - wise split:

a. Below 18 years - 25% - 31.25 crores
b. 18 - 25 years - 15% - 18.75 crores
c. 25 - 40 years - 25% - 31.25 crores
d. 40 - 60 years - 20% - 25 crores
e. 60 years & above - 15% - 18.75 crores

Now, if we assume a uniform distribution of people in under 18 year age group, we have
31.25 ÷ 18 crore people in 16th & 18th year of age
1.73 crore people

Economic Status:

a. Below poverty line - 15% - can't study 10th, 12th, college due to affordability.
b. Low - income - 40% - many in rural areas may not be able to study 12th class due to economic reasons. Many more can't go to college.
c. Mid - income - 35% - Everyone goes to 10th, 12th. Almost 80% go to college
d. High Income - 10% - Everyone goes to 10th, 12th & college.

10th class
0% from BPL + 90% from Low income + 100% from mid-income + 100% from high-income
1.40 crores
12th class
0% from BPL + 70% from Low income + 100% from mid-income + 100% from high-income
1.10 crores
College
Also, note that for higher education, though everyone in the high-income category can afford a college education in India, not everyone goes to Indian university. Some may go abroad as well and hence 70%.

0% from BPL + 20% from Low income + 50% from mid-income + 70% from high income
0.325 crores

Total = 0.325 X 18.75 X 20% (These are those who want to go to college and do not have family business to support)

1.50 crores

CASE - 26
The number of golf balls that can fit in the room :

Approach :

Assume the room to be approximately 4m wide & 6m long. The height of the room can be assumed to be 4m.

Volume of the room = 4 X 6 X 4 = 960k cm^2
Let the average diameter of a golf ball is assumed to be 5cm
Volume of golf ball = 3.14 X 4 X 5 X 5 X 5 ÷ 3 = 523.30 cm^

Way I
A cube of volume radius^3 packs the golf ball
Number of balls = 960 X 1000 ÷ 125 = 7680 golf balls

Way II
A packing arrangement like Face Centred Cubic (FCC) of crystals
The volume (2 X radius / √3)^3 holds two golf balls.
Number of balls = 7680 ÷ 0.77 = 9600 golf balls

Alternate Question - How many golf balls can fit in a Boeing 747 plane.
Assume that the plane consists of a pyramid (height 5m, base 10m X 3m) at the head followed by a cuboid (30m X 3m X 10m)
Volume of the plane = 0.33 X area of base X height + length X breadth X height
The volume of the plane = 9500k cm^2

Volume occupied by -

a. Cockpit, engine, seats & other critical infrastructure = 30% = 2580k cm^2
b. Free / unoccupied = 70% = 6650k cm^2

Way I
Number of golf balls = 6650 X 1000 / 125 = **53,200 golf balls**

Way II
Number of golf balls = 6650 X 1000 / (0.77 X 125) = **69,090 golf balls.**

CASE - 27
Estimate the number of hair on your scalp:

Approach :

Estimating area of the head -

a. Assuming head to be rectangular
    Assuming that the width (of the forehead) is 10cm & the length is 15 cm
    Area = 150 cm^2
    Assuming 80% of the scalp is covered with hair
    Effective area = 150 - 30 = 120 cm^2
    Assuming the thickness of hair to be 0.2 cm, we have
    Number of hair = 120 / 0.2 = **600 hair**
b. Assuming it to be curved (half of the curved surface area of the head)
    Assuming that radius is 5 cm
    Area = 167 cm^2
    Assuming 80% of the scalp is covered with hair
    Effective Area = 167 - 33.4 = 133.6cm^2
    Assuming the thickness of hair to be 0.2 cm, we have
    Number of hair = 133.6 / 0.2 = **668 hairs.**

CASE 28

Estimate the number of people travelling in Metro (Delhi Metro)

Approach:

No. of Metro Routes=5

No. of metro lanes =2 per route =10 lanes

No. of stations = approx 40 per route = 40*10=400 metros

No. of coaches in a metro = 8 per metro rail = 8*400 = 3200 coaches

Frequency of metro = one metro/2 min = 30 metro /hr

Operating hours = 20 hours (approx)

=20*30*3200

=600*3.2K

=1920 K or 1.92 million

Now the maximum capacity of a metro coach = 200

Occupancy of Delhi metro:

- 5-7 AM 2hrs(60%)
- 7-11 AM 4hrs(100%)
- 11AM-5PM 6hrs(70%)
- 5-9 PM 4hrs(60%)
- 9-1 AM 4hrs(60%)

Weighted average of occupancy = (1.2+4+4.2+4+2.4)*(1/20)

= 15.8/20= 80%

Daily Ridership of Delhi metro =0.192 million *200*80%

=0.192 million *160

= 30.70 million ridership

However, the question is the number of people travelling by Delhi metro and not daily ridership.

So, if we assume that a single person travels to and fro from Delhi metro, then we need to count two ridership as one person.

However, not everyone may do that. Suppose that 80% of the total people use the metro for a round-trip journey and 20% for a single-sided journey.

Therefore, average ridership per person= 0.8*2 +0.2*1 = 1.8

No. of people using Delhi Metro = 30.70/1.8 million

≈17 million people

CASE 29

Estimate the number of copies of Sherlock Holmes sold in India, this year

Assumptions:

Digital copy or hard copy? -------- (Hard copy only)

First hand or second hand? ---------- (First hand only)

Language -> regionally translates language or English ---------- (English only)

No. of languages spoken: 1.2 crores

- English speaking (25%)
- Non-English Speaking (75%)

300 million can speak/write or are proficient in the language.

(We can also state that India has the second-largest pool of English speaking people, after the U.S.)

Economic Status:

- Below poverty line (15%)
- Low income (40%)
- Middle income (30%)
- High income (15%)

Therefore, 85% can afford a book -> 85% of 300 million = 255 million

Say 250 million

Age-wise split:

- Below 12 years (20%) ---- 5 million --- Barely can read
- 12-18 years (15%) ----37.5 million ---- 25% interested
- 18-30 years (30%) ---- 75 million ---- 20% interested
- 30-50 years (20%) ---- 50 million ---- 10% interested
- 50 and above (15%) ---- 37.5 million ----5% interested

Therefore, 5+15+10 million = 30 million includes reading a novel.

Types of novels:

- Crime: 20%

- Adventure: 15%
- Biography: 15%
- Romantic: 20%
- Misc: 10%

Of crime genre, say, 15 % may be interested in

Buying a Sherlock Holmes novel.

i.e. 0.9 Million (interested)

Now some people, out of those interested, may

- Have brought and read all of the novels.
- Some will buy this year.
- Some may not buy this now but can buy in the future.
- Also, not everyone interested can buy a novel, the interested person (0.9 million)
- Rent: 40%
- Second Hand: 30%
- Purchase: 30%

Of all purchases (0.27 million)

- Brought and read: 25%
- Purchase: 15%
- Future Potential Buyers: 60%

Therefore purchases = 0.27* 15 * (1/100)

=0.0405 Million=**40.5K copies**

CASE 30

Estimate the number of gulab jamuns sold in Delhi on a single day

Approach:

Gulab Jamun is sold at:

- Sweet shops
- Restaurants
- Snacks outlet (like BTW)

Now the sale of gulab jamun will be very different on a casual day compared to a festival day like Diwali, Rakhi, etc.

So we need to ask the interviewer for clarification.

Let us for now, assume that it is a normal day.

There are seventy legislative assembly seats in Delhi. And if I was to recall my seat (Karol Bagh) there are around 10 shops (which are branded) and another 25 shops which are local.

Taking this as a standard, we have around 700 standard shops and 1750 local shops.

Considering daily average consumption of around 20 kg in branded shops and 10 kg in local shops,

700*20 + 1750*10 = 14000 + 17500 = 31500 kg

Let a single kg of gulab jamun have 20 pieces,

31500*20 = **630,000 pieces ---------- (A)**

Again we have 70 legislative seats and in my area, there are around 100 restaurants and at least 20 hotels.

All the hotels will have gulab jamun on their menu but only North Indian restaurants will have gulab jamun on their menu.

Restaurants:

- South Indian (30%)
- North Indian (30%)
- Chinese (15%)
- Rest (15%)

Therefore, 45 restaurants and 20 hotels.

For 70 constitutions we have,

45*70 + 20*70 = 3150 restaurants and 1400 hotels.

Now, we assume that the hotel has at least 30 rooms with an average of 2, and out of them, 10% may order Gulab jamun. (one per person).

Similarly, we assume that a hotel feeds 100 customers with an average customer size of 3 people and 10% of them order gulab jamun. (one per person)

3150*100*3*(1/10) and 1400*30*2*(1/10)

i.e. 94500 from restaurants and 8400 from hotels = **102900 ---------- (B)**

Snacks shops:

- Pizza
- Burgers
- Indian snacks
- Shakes

Only Indian snacks are required for estimates.

Again in Karol Bagh, I can safely say that there are 10 such Indian snack shops that serve around 15 people. Say only 10% of them have gulab jamun and we have 70 legislative seats.

70*10*150*(1/10)*1 = **10500----------(C)**

Total : 630,000 + 102900 + 10500 = **743.4 K gulab jamuns per day**

Note: Had it been a festive day then we need to simply increase the number of gulab jamuns sold by the sweet shops by several multiples.

CASE 31

Estimate the number of cars crossing Delhi-Gurgaon toll in a day:

Approach:

We will begin by estimating the no. of people of different working classes who cross the toll on a working day.

Population of Delhi = 1.5 crores

No. of families (on an average scale consisting of 4 to 5 members each) = 45 Lakh

Types of Occupation	Contribution	No. of people working
AGRICULTURE	10%	4.5 Lakh
SELF / BUSINESS	30%	13.5 Lakh
SERVICES	60%	27 Lakh

Now for a service family, we have

- 100% of Husbands working
- 60% of wives working
- 40% of children working (assuming one child is working)

Therefore, Total no. of working people = 2 X 27 Lakh = 54 Lakh

Place of working	Contribution	No. of people working
GURGAON	40%	21.6 Lakh
DELHI	15%	8.1 Lakh
NOIDA	35%	18.9 Lakh

Also, there may be some people who may visit from Delhi to Gurgaon for schooling or shopping purposes.
Assume the no. of such people = 25 Lakh

Modes of transport	Contribution	No. of people
Delhi Metro	40%	10 Lakh
Bus Services	15%	3.75 Lakh
Personal Vehicle	20%	5 Lakh
Cabs • Pool cab • Personal cab	25% 60% 40%	6.25 Lakh 3.75 Lakh 2.5 Lakh

Let the number of passengers in a pool cab be 3 on an average.
Therefore,no. of such pool cabs = 3.75/3 = 1.25 Lakh

Therefore, Total no. of cars =(No. of pool cabs + No. of personal vehicles + No. of personal cabs)

= 1.25 + 5 + 2.5 Lakh
= **8.75 Lakh**

Note: This is the case for a working day. The situation will be different for a weekend(Saturday or Sunday).

CASE 32

Estimate the revenue of an MCD outlet coming out from a burger sales

Approach:

Type of sales:

- Online
- Offline

Do we need to count both types of sales?

- No.Only the offline ones.

The MCD at any place has 3 billing/servicing counters.
Average time for preparing the burger and the bill for the customer is approximately 2 minutes
Hence there are 30 burgers being prepared per hour per burger counter.

Distribution of sales

Timings	Percentage of customers
10 am - 1 pm	60%
1 pm - 4 pm	80%
4 pm - 7 pm	75%
7 pm - 11 pm	80%

What does MCD sell?

Items	Percentage of sale
Fries/Wraps	20%
Burgers	1. 60%
Desserts/Drinks	20%

So 60% of the time, a sale at MCD implies the sale of a burger.
No. of burgers,
= 0.6 X 30 (4 X 0.6 + 3 X 0.8 + 3 X 0.75 + 4 X 0.6) X 4
= 0.6 X 30 (2.4 + 2.4 + 2.25 + 2.4) X 4
= 0.6 X 30 (9.45) X 4
= 72 X 9.45
= 680 burgers

Types of burger	Percentage of sale	Actual Cost (INR)	Average Cost(INR)
Low priced • Veg • Non-veg	40% 60% 40%	 40 50	45
Mid-range • Veg • Non-veg	30% 60% 40%	 100 120	110
High priced • Veg • Non-veg	30% 60% 40%	 150 170	160

The weighted average price of a burger,
= 0.4 X 45 +110 X 0.3 + 0.3 X 160
= 18 + 33 + 48
= 99 INR

Therefore, Total Revenue = 680 X 99 INR
= **67,320 INR**

Note:
The sale/occupancy shall vary depending upon whether it is a working day or weekend. Also, if the total revenue was to be estimated then the revenue from fries/wraps/desserts/meals are required to be taken care of.
The choice of 4 counters was very random.
It is a good thought to divide the meal as veg & non-veg when we are considering Indian consumers. This may not be required in the international market(the US or Europe)
Also, the question can be further extended to calculate the MCD from Delhi region. For this, simply assume 1 to 2 stores per legislative assembly. This counts for nearly 90-140 stores.

The same set of questions can be extended to estimate the revenue of a restaurant. But you need to ask whether the restaurant operates in the Budget, Mid-tier or Premium segment and then proceed.

CASE 33

Estimate the number of televisions and refrigerators sold in Delhi in a year (Also estimate the revenue)

Approach:

Population of Delhi = 1.5 crores

no. of families (on an average scale consisting of 4 to 5 members each) = 45 Lakh

Economic distribution	Contribution	no. of people	Average no. of refrigerators
Below poverty line	15%	6.75 Lakh	0
Low income	40%	18 Lakh	1
Middle income	30%	13.5 Lakh	1.2
High income	15%	6.75 Lakh	1.5

Weighted average = 0 X 0.15 + 1 X 0.4 + 1.2 X 30 + 1.5 X 0.15
= 0.4 + 0.36 + 0.225
= 0.965

Therefore, no. of refrigerators in Delhi households = 0.965 X 45 Lakh
= 43 Lakh

Average lifespan of a refrigerator = 15 years

Therefore,units sold annually due to replacement = 43 / 15 = 2.9 Lakh

However, there are also first-time buyers. Those people who bought for the first-time will be those who have been uplifted from poverty. Say 5 % of the people are uplifted from poverty.

= 6.75 X (1 / 20) Lakh

= 32,250 INR

Therefor,Total sales annually = 2.9 + (0.32250 ~ 0.32)
= 3.22 Lakh

Other than this , refrigerators are bought for commercial purposes as well.

COMMERCIAL USE

- Hotels
- Restaurants

- Storage Facilities

However, they are generally not asked to be estimated.
Revenue generated by refrigerator sales(considering different types of refrigerators):

Types of refrigerator	Percentage of the market	Average unit price
Entry-level	40%	15K
Mid-level	40%	40K
High/premium level	20%	75K

Total Revenue = 3.22 X (0.4 X 15K + 0.4 X 40K + 0.2 X 75K) Lakh
= 3.22 X (6K + 16K + 15K) Lakh
= 3.22 Lakh X 37K
= 120K Lakh
= 120 crores (roughly $2 billion)

The second part is to estimate the no. of televisions sold in Delhi

Distribution of televisions

- Hospitals
- Hotels
- Offices
- Personal Use
  -Residential
  -Commercial(eg. stores)

Population of Delhi = 1.5 crores

no. of families (on an average scale consisting of 4 to 5 members each) = 45 Lakh

Economic situation	Contribution	Average no. of TV	Percentage of families
Below poverty line	15%	0	6.75 Lakh
Low income	40%	1	18 Lakh

Mid income	30%	2	13.5 Lakh
High income	15%	3	6.75 Lakh

Total no. of TVs in households = 0 X 6.75 + 1 X 18 + 2 X 13.5 + 3 X 6.75 Lakh
= 65.25 Lakh
The average lifespan of a TV = 10 years

Therefore,units sold annually due to replacement = 65.25 / 10 = 6.525 Lakh

Economic activity	Contribution
Agriculture/Forestry	10%
Business	30%
Service	60%

Let half of the females be working = 67.5 Lakh
Therefore, people working in service = 39 Lakh
Assuming 500 persons working per office.
Average size of office = 39 / 500 Lakh = 7800 offices
Average no. of TV in offices = 7800 X 100 = 7.8 Lakh

Similarly, let there be a bed for every 10,000 persons in the population.
no. of beds = 1.5 crore / 10,000 = 1500 beds
Average no. of beds per hospital = 20
no. of hospitals = 1500 / 20 = 75 hospitals
Average no. of TV per hospital = 100
Therefore, Total no. of TVs in hospitals = 7500

Therefore, Total no. of TVs = 6.525 Lakh + 7.8 Lakh + 7500= **14.395 Lakh**

CASE 34
Number of iPhones sold in India

Approach:

Number of mobile users = 100 Crores

100 Crores :

- 2G/3G Network (60 Crores Users) (60%)
- 4G Network (40 Crores users) (40%)

Smart Phones :

- Budget (50 Crores Users) (50%)
- Mid-level (10 Crores Users) (25%)
- Upper mid (6 Crores Users) (15%)
- Premium (4 Crores Users) (10%)

The average life of a smartphone = 3 Years
So, 4/3 = **1.33 Crores** phones

Premium phones :

- Samsung (26 Lacs Users) (20%)
- HTC (15%)
- LG (10%)
- Chinese (35%)
- Apple (26 Lacs Users) (20%)

The average income of Delhi = 126,000Rs annually
The average income of India = 65,000Rs annually
So, Delhi has 2X more wealth.
The population of Delhi = 1.5 Crore
The population of India = 120 Crore
So, 120/1.5 = 80
Also, Delhi has two times more wealth, so it will be 40
Number of iPhones sold in Delhi = 26/40 Lacs = 65,000 iPhones

Sales :

- Q1 (30%) (New year)

- Q2 (20%) (Relatively low sale period)
- Q3 (20%) (Relatively low sale period)
- Q4 (30%) (Diwali) (⅓ rd of the total comes in the Diwali period) (say)

So, iPhones sold in Delhi in Diwali sale = 65,000 X 30/100 X ⅓ = 6,500 iPhones.

The question can be further extended to estimate the number of iPhones sold online v/s offline.

Also, instead of iPhones, we can be asked to estimate the sale of a new Samsung/Google phone.

We can also be asked to estimate the revenue generated by a telecom company/ telecom industry by offering only voice & data services.

The economic distribution for Delhi, Mumbai, Chennai, Kolkata, Hyderabad etc. will be similar.

Delhi

- Budget phones (30%)
- Low-mid level (30%)
- Mid-level (20%)
- High level (20%)

India

- Budget (40%) (Dominated by Chinese vendor & Samsung)
- Low-mid (30%) (Dominated by Chinese vendor & Samsung)
- Mid (20%) (Highly fragmented by Chinese player)
- High end (10%) (Dominated by Samsung/Apple followed by Chinese vendor)

CASE 35
Number of paracetamol tablets sold in Delhi

Approach:

Places where they are sold

- Hospitals
- Chemist shops

Delhi (7 parliament constituency) ➔ Legislative 70 constituency ➔ 235 Wards
In my ward, I can estimate that there are roughly 20 chemist shops.
Therefore, No. of chemist shops = 235 X 20 = 4,700 shops.
Each shop at an average may sell 10 strips (100 tablets).
Therefore, tablets sold = 4,700 X 100 = 470,000 or 470k tablets.

Population of Delhi = 1.5 Crore
Let there be a bed for every one in 5000 persons = 15,000,000/5,000 = 3,000 beds.
Let there be 30 beds per hospital = 3,000/30 = 100 hospitals

If at an average, a hospital sells 100 strips (1,000 tablets), then tablets sold by hospital = 100 X 1,000 = 100k.
Total number of tablets sold = 470k+100k = **570k** tablets.

Note, parameters like a number of beds or 1,000 persons or so on are also general parameters which can help us to determine the quality of health-care in the country.

If the question was a number of paracetamol tablets sold in India, then take that India has approx 550 constitutions ➔ Approx 5,000 state counselling seats ➔ 35,000 municipal wards ➔ 20 chemist shops/ward = 700k chemist shops.

Similarly, Delhi has a better medical facility than the national average. Hence we can take 10,000 persons/bed to estimate hospitals.

Further, notice that these variations are in the general present for developing nations.
Developed nation do not have these many disciplinary in the data.
If we, for example, had to estimate for the state of California, then
US population ➔ 50 states ➔ the average population per state = 7 million

But since California is an industrial state and near the coastline, it's population will be slightly higher than the average/mean value. So, begin by taking 8 million citizens.

Also, we can estimate that one bed/500 persons may be available in California or one bed/1000 persons, as it's medical facilities will be better than Delhi.

CASE 36

Estimate the no. of lakes in the world

Approach:

Radius of the Earth=6400 km=2^6 X100 km
Therefore, the surface area of the Earth=4 X 3.14 X 2^6 X 2^6 X 100 X 100km^2 = 12.56 X 4,096 X 10,000km^2
Assuming Earth to be a perfect sphere ~ 510 million km^2.

Earth:-

- Water(70%) (357.5million km^2)
- Land(30%) (152.5 million km^2)

98% of the water on earth is in the ocean and sea. That is approximately 350 million square kilometres.
The rest 2 %, i.e., 7 million square kilometres.

Out of the total freshwater 98% is in the form of glaciers(6.84 million square kilometres). The rest 2% of the freshwater(0.16 million square kilometres) is in the form of rivers, lakes and ponds.

Out of this 0.16 million square kilometres 85% in the form of rivers(119,000km^2), 10% in the form of lakes(14,000km^2) and 5% in the form of ponds(7,000km^2) .

Now let us take that an average size of a lake is 1,000mt X 100mt = 0.01km^2.
Total no. of lakes = 14,000 X 100= **14 lakh lakes**

(According to Google, we have approximately 20 lakh lakes. But these can be both saltwater and freshwater lakes.)

Also, we can say that these lakes are natural lakes. There may be some artificial lakes made by human beings for their use.
Lakes can be classified as:-

- Freshwater lakes
- Saline Lakes

Lakes can also be classified as:-

- Natural
- Man-made (or) Artificial

CASE 37

Estimating the size of the tyre industry in India in 2020

The population of India = 125 crores with the average family size of 4 to 5 = 30 crore to 25 crore

Say we take 27 crore families in India

Low income – No one will own an SUV

Mid/High income – These people may own a new/used SUV.

SUV by high end people= 2.7 crore (0.5+0.6=0.3)

2.7crore*1.4=3.5 crores

Assuming that the average life of an SUV is 15 years, we have 350/15 lac SUV sold

Approx. 2 million SUV = 20 lac SUV

So weave

26.6 lakhs new SUV sold in India in 202 and a total of 4.2 crore SUV in the country.

Also, let us assume that 12% of the new SUV sold in India (brought by Indian) are explored abroad.

Therefore, the new SUV requires 5 tyres = 150 lakh tyres for new SUVs.

(4tyre+1extra)

Let every one out of five cars require a tyre replacement in a year.

è 350/5*1=70 lakh replacement tyres.

Total tyres = 150lakh+70lakh

= 220lakh

(over 22 million tyre)

Revenue of the SUV tyre industry – Let the average price of the tyre be 10,000.

220 million * 10,000

= **Rs. 220 billion**

Revenue in = $ 220/60 billion = $ 3.67 billion

US $ term

CASE 38

Number of roses sold in Delhi on 14th February

Delhi population = 1.5 crore

Now, everyone will not celebrate Valentine day by giving a rose.

Therefore, approximately 1.5 lac roses can be sold on 14th February in Delhi.

180K Roses.

Follow up question -> Estimate the number of roses sold by a flower vendor in Delhi on 14th February.

A-- 350 Vendors (shops)

But during the 14th February, various street vendors do also sell roses.

They are primary at metro stations and markets.

The number of metro stations = 5 metro lines * 40 average number of stations per line.

B -- 200 stations

At an average 3 vendors per station (one vendor /entry or exit gate) = 600 vendors.

Again 70 constituencies, taking 2 markets per constituency approximately 150 markets.

5 vendors per market => C-- 750 vendors

Total vendors = 350+600+750

= 1800 Vendors

Average number of roses sold per vendor = 150000/1800 = **83 rose**

Average revenue = average price * unit sold

(taking the average = 25*83

price to be 25 = 8300/4

rupees per rose) = **2075 /vendor**

CASE- 42.

Estimate the average distance run by a football player in an average match. (**45-90 metres and 90-120 metres**)

A football match is of two halves, each of 45 minutes and the stoppage time is added to each half.
So, the total playing time is 90 minutes and stoppage time compensates for any delays.
Generally, the attacker/defender disperses a distance of two-thirds of the whole field.

Now, average length of field = 2/3*105 m = 70m
dispersed by a player
The average width of field = 65mtrs

Generally, a player travels half the width = 35mtrs approx.
At an average, let the player move along this area and in round trip travels covers a distance = 70+ 70+20+20 =180mtrs

Let a player do this in every 2 minutes (Time period between making the next goal attempt).
And thus 45 attempts are made in the whole match.
Also, let the person remain on the field for $2/3^{rd}$ of the time and is substituted for the remaining time.

Therefore, average distance covered = 180*45*2/3 = 5400mtrs = **5.4kms**.

CASE -43.
Estimate the power consumed in your house in a day

Power consumed on a summer day will be different from that on a winter day. We will show the summer day as from there winter day calculations can be visualized easily.

- The power rating of AC - 1 unit/hour

No. of ACs = 2

1. 1 AC operates for 3 hours (during daytime)
2. 2 ACs operate for 3 hours (during night time)

Therefore, 9 hours / day = 9 units / day.

- Power rating of a Refrigerator = 0.2 units / hour

1. No. of hours working in a day = 22 hours

Therefore, 4.4 units/day.

- Power Rating of a water pump = 2units/hour

Usage = 1 hour / day

Therefore, 2 units/day.

- Power Rating of a microwave oven= 0.5 units/hour

1. Usage = 1 hour

Therefore, 0.5 units / day.

- Power Rating of a water heater= 1units/hour

1. Usage = 2 hour / day

Therefore, 2 units/day.

- No. of fans in the home = 3 bedrooms + 3 washrooms + 1 kitchen + 2 Drawing rooms
  = 5(ceiling fans) + 4(exhaust fans)

Power Rating of fans = 0.1 units / hour

Usage = 2 hours / day for exhaust fan+22 hours / day for ceiling fan

=(2*4 + 9*22)*0.1 units/day

= 19.8 + 0.8 units

=20.6 units/day

- No. of Lamps /Tubelight = 5 *3 bedrooms + 3*3 washrooms + 8*1 drawing rooms + 481 kitchen
  =36 lamps / tubelight
  Average power rating = 0.025 units/day
  Average usage= 10 hours/day for each lamp/tube light
  =0.025*36*10
  =9 units/day

- Power rating of a TV = 0.3 units/ day
  Average usage = 3 hours / day
  no. of TV = 2
  Therefore, 1.8 units/day

- Power consumption of a laptop /PC = 0.4 units / day
  Average usage= 2.5 hours / day

  Therefore, 1 unit/day.

Average Power consumption of electronic gadgets like mobile phone, electric iron, other kitchen types of equipment like a grinder, juicer etc = 2 units/day

Therefore total consumption = 57.3 units / day

Monthly bill during summer = 57.3*30 = 1719 units / month

Average cost of electricity = Rs. 6 / unit
= 1719*6=**Rs. 10,314/month**
Approx 10k /month

CASE- 44.

Estimate the number of youtube videos streamed in Delhi on a day

- The population of Delhi - 1.5 crores.

Delhi

Below Poverty Line	Above Poverty Line
(15%)	(85%)
20 Lakhs	1.3 Crores (These people have mobile access)

Mobile Access

2G Handset	3G/4G Handset
(Feature phone)	(Smart Phone)
20%	80%
26 Lakhs	1.04 Crores

Internet Access Methods:

- Mobile Phone (80%)
- Broadband (20%)
- Cyber Cafe (~1%)

This means that out of a total of 1.5 crores people, 1.04 crores or approx ⅔ rd have internet access.

Also, the amount of time spent will be different on a working day than a weekend.

Delhi Population

Below 20 Years	20-35 Years	35-50 Years	50-65 Years	65 Years and above
33%	33%	16%	10%	8%

Average time spent on the Internet

4 hrs/day	3 hrs/day	2 hrs/day	1.5 hrs/day	1 hr/day

➔ 4 * ⅓ + 3 * ⅓ + 2 * ⅙ + 1.5 * 1/10 + 1 * 1/12
= 4/3 + 1 + ⅓ + 0.15 + 0.08 = 2.67 + 0.15 + 0.08 = 2.90 hrs/day

Time spent on the Internet - Internet Usage

Social Network	Youtube	News or Music	Others
30%	20% (approx 36 mins)	30%	20%

Youtube Videos

Short duration below 6 mins	Medium Duration 6 - 20 mins	Long Duration 20 mins+
60 %	30%	10%
Songs, Trailers	Short Films, Shows, movie clips	TV Series, Shows, Educational Videos

Average Duration of Youtube Video
= 5 mins * 0.6 + 10 mins * 0.3 + 15 mins * 0.1 = 3 + 3 + 1.5 = 7.5 mins

No. of youtube videos streamed
= 1 crore * 36 / 7.5 = 1 crore * 36/3 * 4/10 = 48/10 crore videos

- **4.8 crore** times videos are streamed on youtube.

CASE 47.
Estimate the number of SRK fans in India.

Population of India

- Male -65 crores

- Females - 60 crimes

The age-wise population of India

1. Below 20yrs - they will have a larger portion of new actors prefered.
2. 20-35 yrs - this group will have a larger section of SRK fans.
3. 35-50 yrs - this group will have a larger section of SRK fans.
4. 50-65 yrs - moderate SRK fans.
5. 65 and above - low %, as they prefer old actors.

Also, there are larger female fans than male fans.
Also, there will be a section who do not have any actor\actress as their favourite

Major actors

- Amitabh Bachan
- SRK
- Salman khan
- Actors like -Nawaj, Irfan, etc.
- New generation and others

Also, we assume that foreign actors are not considered.

Male fans

- Below 20 yrs - (33%) 10% SRK fans .
- 20-35 yrs - (33%) 16% SRK fans .
- 35-50 yrs - (16%) 16% are SRk fans .
- 50-64 yrs - (10%) 12% are SRK fans .
- 65 yrs and above -(7%) 7% are SRK fans.

Total number of SRK fans (male) = 3.3% + 5,56% + 2.75% + 0.49%
=13.33% of total
=8.66 crore

Female fans

- Below 20 yrs -(33%) 12% are SRK fans .
- 20-35 yrs -(33%) 20% are SRK fans .
- 35-50 yrs - (16%) 20% are SRK fans .
- 50-65 yrs - (10%) 15% are SRK fans .
- 65 yrs and above - (7%) 10% are SRK fans.

Total number of SRK fans (female) = 19.36% of 60 crores.
= 11.61 crore.

The total number of SRK fans = **20.27 crore**.

CASE 48.

Estimate the amount of money drawn from an ATM machine in Delhi in one day.

Assuming the average time to withdraw money from an ATM machine is 90 seconds.
So in one hour, we can draw 60 / 1.5 = 40 withdrawals.

Amount of money drawn from an ATM:

- Average of ₹500: 55% withdrawals.
- Average of ₹2000: 30% withdrawals.
- Average of ₹5000: 10% withdrawals.
- Average of ₹10000: 5% withdrawals.

As generally, people withdraw money from an ATM when they are out of cash or when they have to purchase something from a place where a card is not accepted. In Delhi generally, we have swipe machines at outlets and have the former cause no more likely.

Average withdrawal amount per person= 0.55 x 500 + 0.3 x 2000 + 0.1 x 5000 + 0.5x10000
= 275 + 600 + 500 + 500
= ₹ 1875 per withdrawal

Occupancy of an ATM:

- 6-9 am: 40%
- 9am-12pm: 50%
- 12-4pm : 60%
- 4-7 pm: 70%
- 7-10pm: 60%
- 10pm-6 am: 10%

Average occupancy = [0.4 x 3 + 0.5 x 3 + 0.6 x 4 + 0.7 x 3 + 0.1 x 8] / 24
= (6.6 + 0.8) / 24
= 7.4 / 24 (approx 30% occupancy)

Total withdrawal = ₹1875 x 24 hours x 40 withdrawals/ hour x 30% occupancy
= ₹1875 x 24 x 40 x 0.3
=**₹ 5,40,000**

Note: that the occupancy of the ATM depends upon its location. Occupancy will be higher for an ATM located in a metro station near a hospital. It will be also higher at peak market time (evening and afternoon time) if an ATM is located in a commercial space/shopping market.

For an ATM located in a residential area, occupancy will be different. Similarly, occupancy is also affected by other factors like the presence of other ATMs and bank branches.

CASE 49.
Estimate the market size of formal ties in India on an annual basis.

Population- 125 crores or 1.25 billion.
People in working-age- 52.5 crores or 525 million
Division of 525 million people:
1.Agriculture and Fishery :50% (262.5 million)
2.Industry and Allied Sectors: 20%(105 million)
3.Services: 30%(157.5 million)
  a.Organised Sector: 33% (52.5 million)
  b.Unorganised Sector: 67%(105 million)

Note: Services include retail as well which has a large portion in the unorganised sector.

Distribution in the organised sector:

1. Dressing Code: Formal- 70%(36.75 million)
   Many large scale companies, hotel chains, doctors and other service firms.
2. No Dressing Code: 30%(15.75 million)
   Many startups, companies like Google.

Many people in the unorganised sector may also wear a tie, like many restaurants, small retail outlets etc.
Unorganised sector: 105 million

1. Tie Required: 15%(15.75 million)
2. Tie not required: 85%(89.25 million)

Total number of people who use a tie as formal dressing = 36.75+15.75
=52.5 million
At an average let the ageing of the formal tie be as follows-
52.5 million:

1. No tie is purchased (20%)
2. Purchase 2 ties a year (20%)
3. Purchase 1 tie a year (50%)
4. Purchase 3 ties a year (10%)

Average tie purchased per person = 0.2x0+0.2x2+0.5x1+0.1x3
= 1.3 tie/person

No.of formal tie sold= 1.3x52.5 million =68.25 million

Now note that the question is to estimate the market size, this can be the revenue generated or can be the number of ties sold.
Revenue generated by the formal tie industry=

= 68.25 million x cost of one tie
= 68.25 million x 100 INR
= 6825 million INR or 6.825 billion INR

In dollar terms,

= 6825/65 million dollars
= **105 million dollars annually**.

Also, note that formal ties are not just used by office going people. They are also used in formal events like parties, anniversary, marriages etc.
They are also used in school/ college events like MUN Debates or other presentation based competitions.
(The above two regions are not explored)

CASE 50.

Estimate the annual size of socks sales in India.

Population of India = 125 crores

Distribution of 125 crores:

1. Below poverty line: 20%
2. Low income: 40%
3. Middle income: 30%
4. High income: 10%

Population who can afford socks = 80% of 125 crore

= 100 crore

Age-wise usage:

1. Below 20 years: 33%

Generally, school and college-going age.

3 pair of socks for school and 3 for personal use.

2. Between 20 years to 65 years: 60%

A. Males: 50%

Employed: 90%

Unemployed: 10%

B. Females: 50%

Employed: 40%

Unemployed: 60%

3 pairs for office use and 3 for personal use annually.

3. Above 65 years: 7%

3 pairs of socks annually.

Socks used by below 20 years population:

6 x ⅓ x 100 crore = 200 crores.

Socks used by population between 20 -65 years:

[6 x(0.3 x0.9 + 0.3 x0.4) + 3 x(0.3 x0.1 +0.3 x0.6)] x100 crore

= [6 x(0.39) + 3 x(0.21)] x100 crore

= (2.34 + 0.63) x100 crores

= 2.97 x100 crore

= 297 crores.

Socks used by population above 65 years of age:

7/100 x 100 crore x 3 = 21 crores.

Total socks sold = (200+297+21) crore

= 518 crores

Average cost of a sock = 50 INR/pair

Revenue = 50 INR x 518 crores

= 25900 crores or 259 billion INR

In dollar terms,

= $ 259/65 billion

= **$ 4 billion approx.**

CASE 51.

Estimate the daily amount of water consumed by an Indian.

Water usage:

1. Drinking
2. Bathing and pooping
3. Washing clothes, utensils, cars, scooters, bikes.
4. Cleaning of the house (Dusting and mopping)
5. Watering plants
6. Hand wash, face wash etc.
7. Cooking food

Drinking(assuming summers)- 7 glasses of 200ml each - 1.4 L
Bathing(assuming summers)- 1 bucket of water - 40 L
- Pooping - 3 L

Washing clothes
We wash our clothes once in three days and we are a family of five.
Estimated water consumption:
= 15 buckets of water
= 15 x 40 L for 5 persons in 3 days
= 15 x 40 / 5 x 3 L per person/ day
= 40 L
Washing utensils- They are washed twice daily.
Estimated water consumption = 150 L
Therefore, per person per day consumption = 150/ 5 x 2 L = 15 L
Assuming that 1 bucket each is to clean two scooters and 1 bucket for a car.
2 buckets of water for a family of 5 = 2 x 40/ 5 L = 16 L/day
Cleaning of house = 1 bucket of water = 40/5 = 8L/day
Hand Wash = 3 times before having meal + 3 times after having meal
+ 5 times extra for various reasons
= 12 times handwash each consuming 200ml per wash
= 2.4L/day
Cooking food - 1.5L per meal for 5 person meal (includes water used for cooking vegetables and making flour)
= 1.5 x ¾ L or 0.9L

Total water consumption = 1.4 +3 +40 +40 +16 +15 +8 +2.4 +0.9
= 123.7 L/day
Monthly consumption per person = 123.7 x 30
= 3711 L/monthly
Monthly consumption (family of five) = 3711 x 5 L/month

= 18555 L/month.

CASE 52.
Estimate the number of Indians on Twitter.

Distribution of Indians:

1. NRIs : 2.5% of the population = 2.5% of 1.25 crore = 31.25 million
    a. Twitter: 60% (approx 20 million)
    b. Non twitter presence: 40% (approx 11.25 million)
2. Non-NRIs: 125 crores

Many NRIs are present in Arab Nations and penetration of Facebook/ Twitter is relatively low. Other major chunks are present in US/ Canada/ Europe which has good twitter penetration.

Indian Residents: 125 crores

1. Internet Access: 70% (87.5 crores)
    a. Urban: 40% (35 crores)
    b. Rural: 60% (42.5 crores)
2. No Internet Access: 30% (37.5 crores)

Now Rural area has relatively low social media integration and urban people have higher social media integration.

Social Media Integration:

1. Urban: 35 crore
    a. Use social media: 80%(28 crore)
    b. Don't use social media: 20%(7 crore)
2. Rural: 42.5 crore
    a. Use social media: 20%(8.5 crore)
    b. Don't use social media: 80%(34 crore)

Total population with social media presence = 28+8 crore
= 36 crore

Distribution of social media presence:

1. Facebook: Very high market share and impacts twitter market share (Market Leader)
2. Youtube, WhatsApp, Others: Their market share doesn't impact Twitter's market share
3. Twitter: very low market share (2nd position in terms of market share)
   Age-wise usage of Twitter:
    a. Below 20 years: 33% (7.5% use twitter)
    b. Between 20 to 35 years: 33%(10% use twitter)
    c. 35-50 years: 16%(5% use twitter)

d. 50-65 years: 10% 65 years and above: 7% (both combined use 2.5% of twitter)

Average Penetration = (5%+6.33%+1.66%+0.85%) x ½
= 13.85% x ½
= 24.93 crores

Similarly, if we had to estimate the number of Facebook users then the penetration would have been much higher.

Age wise usage of Facebook:

1. Below 20 years: 33% (80% on Facebook)
2. 20-35 years: 33%(70% on Facebook)
3. 35-50 years: 16%(60% on Facebook)
4. 50-65 years: 10% 65 years above: 7% (both combined 25% on Facebook)

Average %age on Facebook = 0.8 x 33% + 0.7 x 33% +0.6 x 16% + 0.25 x 17%
= 64.25%

Number of Facebook users = 64.25% of 36 crore
= 23.13 crore
Or **approx 231 million Facebook users.**

Another follow up question can be to **estimate the number of photographs of Indians on Facebook.**

Approx. number of users = 230 million

Facebook was launched in the year 2004 (February). Now it is the year 2019. 16 years of life span.

Internet penetration in India has improved drastically in the last five years. So many users have joined in the last five years only.

Therefore, the average time an Indian is on Facebook = 4 years approx.

Types of Facebook users:

1. Ones who add their photos at a fast pace (20%)
2. Ones who do not add their photos i.e, except on special occasions (60%)
3. Do not upload any photos (rarely use the Facebook or only browse it)(20%)

Let there be at an average of 10 instances (special occasion) on which photos are tagged. Let there be at an average of 5 photos per tag.

Therefore, 80 photos a year for special occasions.

Let ones those add photos at a very fast pace add 5 photos a week

= 5 x 52 or 260 photos/year

Average number of photos added = 0.2 x 260 + 0.6 x 80
= 52+48
= 100 photos/year

Total photos added in 4 years = 4 x 100 = 400 photos

Total number of photos on Facebook of Indians = 400 x 230 million

= 400 x 0.23 billion
= 92 billion photographs

Note: Here photographs of Indian is considered. These do not include photos containing memes or other stuff.

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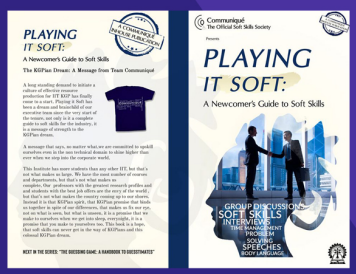

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