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The “START BIG” approach & The “START SMALL” approach

1. How many gallons of white house paint are sold in the U.S. every year?

THE “START BIG” APPROACH: If you’re not sure where to begin, start with the basic assumption that there are 270 million people in the U.S. (or 25 million businesses, depending on the question). If there are 270 million people in the United States, perhaps half of them live in houses (or 135 million people). The average family size is about three people, so there would be 45 million houses in the United States. Let’s add another 10 percent to that for second houses and houses used for other purposes besides residential. So there are about 50 million houses. If houses are painted every 10 years, on average (notice how we deftly make that number easy to work with), then there are 5 million houses painted every year. Assuming that one gallon of paint covers 100 square feet of wall, and that the average house has 2,000 square feet of wall to cover, then each house needs 20 gallons of paint. So 100 million gallons of paint are sold per year (5 million houses x 20 gallons). (Note: If you want to be fancy, you can ask your interviewer whether you should include inner walls as well.) If 80 percent of all houses are white, then 80 million gallons of white house paint are sold each year. (Don’t forget that last step!)

THE “START SMALL” APPROACH: Take a town of 27,000 (about 1/10,000 of the population). If you use the same assumption that half the town lives in houses in groups of three, then there are 4,500 houses, plus another 10 percent, which makes 5,000 houses. Painted every 10 years, 500 houses are being painted in any given year. If each house has 2,000 square feet of wall, and each gallon of paint covers 100 square feet, then each house needs 20 gallons – so 10,000 gallons of house paint are sold each year in your typical town. Perhaps 8,000 of those are white. Multiply by 10,000 you have 80 million gallons.

Reference :

<http://www.bc.edu/clubs/bcfa/docs/vault/Brainteasers%20and%20Guesstimates.pdf>

Estimate the market for bicycles India.

- India has a population of 1.2B; India has ~30% population living below the poverty line. It would be fair to assume that a negligible proportion of poor population owns bicycles.
- Of the remaining 0.84M, approximately 50% fall in the age group of 8-40, the core bicycle using population. This amounts to ~0.42M people.
- Of these, assuming equal distribution between sexes, there are ~0.21M males and ~0.21M females.
- Here we assume that 75% of men buy at least single cycle in their lifetime and at least 20% women buy single cycle at some point. That makes a total of ~0.2M.
- Let's divide the population further into high users, middle users and low income groups. Assume high income is 10%, middle income is 60% and low income is 30%. Assume that the high income group buys a cycle every 5 year; middle usage buys a cycle every 10 year, low usage buy 1 during their lifetime
- Calculating, cycles bought in a year = $0.2 (0.1/5 + 0.6/10 + 0.3/30) = 0.2 (0.02 + 0.06 + 0.01) = \sim 0.02M$
- Assume the average price per denim to be 1000Rs. Thus, market size = Rs. 20B

Answer: Market size of cycles bought in India is ~Rs. 20M

Estimate the litres of cola sold in Delhi per day

- Population of Delhi is approximately 15M people.
- Assume 30% of population is below poverty line, does not consume cola.
- Population above poverty line is approximately 10M people. Cola drinking population is typically in age group 5-40 years of age. Approximately 60% of Delhi's population is in this range, i.e ~6M people.
- Dividing this population into High consumers (20%), Moderate consumers (40%) and Low consumers (40%). Assume high consumers consume approximately 1L per day, moderate consumers consume 0.5L per day and low consumers consume 0.1L per day.
- Thus total daily consumption = $1.2*1 + 2.4*0.5 + 2.4*0.1 = 1.2 + 1.2 + 0.24 = \sim 2.6M$ litres per day.

Answer: ~2.6M litres of cola is consumed in a day in Delhi

Estimate the number of denims sold in India in a year.

- India has a population of 1.2B; India has ~30% population living below the poverty line. It would be fair to assume that a negligible proportion of poor population wears denims.
- Of the remaining 0.84M, approximately 50% fall in the age group of 6-35, the core denim wearing population. This amounts to ~0.42M people.
- Of these, assuming equal distribution between sexes, there are ~0.21M males and ~0.21M females.
- Here we assume that 80% of men buy atleast single denim in a year and atleast 50% women buy single denim.
- Let's divide the population further into high income, middle income and low income groups. Assume high income is 10%, middle income is 60% and low income is 30%. Assume that the high income group buys 3 denims per person per year; middle income buys 2 denims per person per year, low income buy 1 denim per person per year.
- Calculating, male denims bought = $0.8 \times 0.21 \times (0.1 \times 3 + 0.6 \times 2 + 0.3 \times 1) = 0.8 \times 0.21 \times 0.18 = 0.03M$; calculating female denims bought = $0.5 \times 0.21 \times (0.1 \times 3 + 0.6 \times 2 + 0.3 \times 1) = 0.02M$. Thus, total = 0.05M
- Assume the average price per denim to be 1000Rs. Averaging for branded products in the 1800Rs price range and non-branded in the ~500Rs. range. Thus, market size = Rs. 5B

Answer: Market size of denims bought in India is ~Rs. 5B

Estimate the amount of petrol used in Delhi per day

- Population of Delhi is approximately 15M people.
- Assume family size of 5, there are approximately 3M households in Delhi. Approximately top 40% households would own a car. Thus there are approximately 1.2M cars in Delhi.
- We can divide these car users into Heavy, Moderate and Light users. Let's assume heavy users are 20% of total car owners and travel approximately 80km a day, to and fro work in Delhi-NCR etc. Assume Moderates are 50% of total car owners and travel ~30 km per day. Assume Light users are 30% of population and travel 10km a day (including low usage multiple cars owned by families etc.)
- Thus total distance traversed by Delhites in a day = $1.2 \times (0.3 \times 80 + 0.5 \times 30 + 0.3 \times 10) = 1.2 \times 70 = 84M \text{ km}$.
- Assume average mileage of a petrol car is 12km/l. Thus, amount of fuel consumption in a day = 7M litres

Answer: ~7M litres of petrol is consumed in a day in Delhi

Estimate the market size of paint industry in India

Working assumption – The household sector contributes to approximately 70% of the paint industry in terms of volume of paint used. The industrial sector accounts for the remaining 30%. We will first calculate the contribution of the HH sector and use this as a proxy for industrial segment.

- India has a population of 1.2B, India has 70% population living in rural India. It would be fair to assume that a negligible proportion of rural population uses paints.
- Given an urban population of 36M and an assuming a average family size of 5, number of households in urban India are 7.2M
- Assume that only 75% of urban houses use paint or related products. Some houses in India still use lime (chuna) to paint walls. Thus, relevant households are 5.4M
- Assuming an average wall space in every household to be 5000 sq.ft, the amount of wall space painted in Indian urban households is = 27×10^9
- Further, one gallon of paint can be used to approximately paint 200 sq.ft area. Thus, the number of gallons required to paint these urban household walls is $\sim 14 \times 10^7$ gallons of paint
- Using this figure to represent 70% of the volume of paint used, we can estimate the remaining volume of paint used by industrial sector, this would amount to $\sim 6 \times 10^7$ gallons of paint
- Considering that a household gets painted once in every 2 years, annual volume of paint required = 10×10^7 gallons of paint
- Considering industrial sector gets painted once in 4 years (average), annual volume of paint required = $\sim 3 \times 10^7$ gallons of paint
- Hence, the total annual consumption is approximately 13×10^7 gallons of paint across all segments.
- Adding 10% to this for rural consumption and another 10% for painting of newly constructed households, we get a total consumption of 16×10^7 gallons of paint
- Assuming an average price of Rs 1000 per gallon of paint, the market size of paint annually in India is approximately Rs. 16×10^9

Answer: Market size of paint in India is approximately Rupees 1600 crores or 1.6B

Estimate the amount of water that can fill an aircraft

Working assumption – This estimation is done taking into consideration Boeing 747, the most common airplane in India. Also, the plane is considered to be empty from inside, i.e. there are no seats, baggage cabins installed.

- Let us assume the length of the plane to be ~70m, internal width of the plane can be calculated taking into consideration the seat and gallery space, given a 3*3 configuration of seats, each set of 3 seats would approximately be 2.5m wide. Thus, internal cabin width is approximately 6m. Similarly, the height of cabin can be estimated – the cabin allows a 6ft. man to stand comfortably, cabin height is approximated at 7ft. or 2m
- The cabin space represents a cuboid with rounded edges. Estimating the volume of the cuboid, we arrive at 840 cu.m
- Correcting for loss of volume due to rounded edges, decrease this by 10%, arrive at cabin volume of ~760 cu.m
- Assuming cockpit, food gallery, washroom areas cumulatively account for ~10% of cabin area, estimated volume of plane is ~830 cu.m
- Assuming cargo space to be of dimension of 2m (height), 8m(width) and 10m (length), cargo space volume is ~160 cu.m
- Adding up, approximately 1000cu.m of water can fit in a Boeing 747

Answer: ~1000cu. m of water can fit in a plane

Estimate the number of red lights in Delhi

Working assumption – Number of red lights refers to the traffic signals on the roads of Delhi, not any other lights which are red in colour!

- We know that Delhi is approximately 1600 sq.km in area. This is pretty much evenly divided between North, South, East and West
- Imagine Delhi to be a square area with dimensions 40*40 as length and breadth.
- We divide the entire city into blocks of equal area, hence, 20 blocks from east to West and 20 blocks from North to South (with each block representing 2 sq. km)
- Every intersection of four adjacent blocks would give us a cross road. Each crossroad would have a traffic signal. Hence, the number of signals at crossroads would be 400 across Delhi, averaging out for different areas.
- Since there are 400 crossroads in Delhi, the number of red light at each crossroad is 4. Hence, the total number of red lights at crossroads in Delhi is 1600
- Let us assume that there are 20% additional red lights to the ones found at crossroads that are meant to control traffic on straight roads. These would amount to ~300 red lights.

Answer: 1900 red lights in Delhi

Estimate the number of leather balls sold in India in a year

Working assumption – Number of leather balls primarily implies leather cricket balls.

- India has a population of 1.2B. Assuming almost equal distribution between both sexes, India has 0.6B males. Here we assume that a *very small fraction of girls play cricket* and can be ignored for this calculation.
- India has 50% population below the age of 25 years. Applying this ratio to male population, there are 0.3B men in India below 25 years of age.
- Assuming equal distribution of people in the age 0-24, there are approximately 0.2B males in the age group 10-25.
- According to the World Bank, ~50% of Indian population lives on less than US 2\$ per day, or approximately less than 100Rs per day. Given the approximate cost of a cricket leather ball is 150-200 Rs, we can assume that a *very small fraction of leather balls are bought by this segment*.
 - This reduces our target set of potential customers to 0.1B males in the age group 10-25
- In a cricket crazy nation like India, let us assume 75% of these have played cricket at some point in time. This gives us 75M cricket players in India.
- Of these, let us assume 10% have played with leather balls and 5% have bought a leather ball ever in their lives. Thus, approximately 3.8M Indians have ever bought a leather ball.
- Of these, we can further assume that 50% are one-time purchasers, 40% are sporadic purchasers and 10% are regular purchasers.
- Of the one-time purchasers (~2M), distributing over 20 years of life at an average, yearly purchase is equal to 1,00,000.
- Of the sporadic purchasers (1M), assume they buy a single leather ball every 2 years. Thus, every year they buy 5,00,000 leather balls.
- Of the regular purchasers (0.8M), assume they buy 2 leather balls per year. Thus, they buy 16,00,000 leather balls yearly. (These include the professional players and team members of various cricket clubs – assume, at an average, the association/club buys 2 balls per payer per year)
- Accounting for all kinds of purchasers, total leather balls bought in India in a year = 22,00,000
- Adjustments:
 - Adding 5% of this number to account for balls used in national/international cricket matches = 1,10,000
 - Also, adding 2% for balls bought by those with income below \$2 per day and for girl cricket enthusiasts = 44,000
 - Total = 22,00,000 + 1,10,000 + 44,000 = ~ 23,50,000

Answer: ~23,50,000 balls are bought every year in India

Estimate the number of light bulbs used in St. Stephens in a year.

Working assumption – Required to calculate the number of incandescent/CFL bulbs replaced in a year *but not the number of tube lights replaced in a year.*

- St. Stephens has approximately 20 classrooms in the main wing of the building and approximately 10 classrooms in the science block. Since each classroom has 4 tube lights and 2 incandescent bulbs, we can calculate the total number of bulbs fixed in classrooms.
 - Number of incandescent light bulbs in classrooms = $2 * 30 = 60$
- The mess has 8 long tables and each table has 4 bulbs hanging above it. Tube lights line the walls of the mess. Further, the kitchen area inside the mess has approximately 5 light bulbs.
 - Number of incandescent bulbs in the mess = $4 * 8 + 5 = 37$
- The Stephens café has 2 sections; each section has approximately 6 incandescent light bulbs. Further, the cop store inside the café has 2 bulbs and the café kitchen has 3 incandescent light bulbs.
 - Number of incandescent bulbs in the café = $6*2 + 2 + 3 = 17$
- The administration block has close to 10 small rooms with 2 bulbs each and a main reception area with 4 bulbs.
 - Number of incandescent bulbs in the admin block = $10*2 + 4 = 24$
- The main seminar hall and stage are largely lit by tube lights. There are approximately 4 bulbs backstage.
- The academic block has 10 washrooms (men + women) and each has 3 incandescent light bulbs.
 - Number of bulbs in washrooms = $3*10 = 30$
- The corridors, pathways and parking area of Stephens are lit by incandescent bulbs. There are approximately 30 bulbs that light these corridors and pathways.
- Stephens has 6 residence blocks, with 30 rooms in each block. Each room has one light bulb and one tube light. Further, the washrooms in the residence blocks have only tube lights.
 - Students in residence prefer to buy CFL bulbs. I have seen that one in every two students has a CFL bulb instead of an incandescent bulb.
 - Number of total bulbs in residence = $6*30 = 180$
 - Number of incandescent bulbs = 90
 - Number of CFL bulbs = 90
- Total number of incandescent bulbs = $60 + 37 + 17 + 24 + 30 + 30 + 90 = 288$ or ~ 300
- Total number of CFL bulbs in use in Stephens = 90
- Let's assume the life of an incandescent bulb at an average is 2 months and the life of a CFL bulb is 6 months
 - The total number of incandescent bulbs used in a year = $12/2 * 300 = 1800$
 - The total number of CFL bulbs = $12/6 * 90 = 180$
 - Total number of bulbs used in a year = 1980

Answer: 1980 bulbs are used in St Stephens per year

Estimate the number of one rupee coins that would fit in a normal size room

Working assumption – The room is empty, i.e bare, without any furniture/person/object.

- Let's assume the dimensions of a normal size room to be as follows,
 - Height = 3m; Length = 4m, Breadth = 5m
 - Volume of the room = 60 m^3
- Consider a one rupee coin to be a square of area $2\text{cm} \times 2\text{cm}$. (Since when two one rupee coins are kept adjacent, the space in between will remain unused and effectively, the space taken up by each coin would equal the space taken up by a square of side equalling the diameter of the coin)
 - Let the thickness of the coin be $2\text{mm} = 0.2 \text{ cm} = 0.002\text{m}$
 - Volume of the coin = $0.02 \times 0.02 \times 0.002 = 0.0000008 \text{ m}^3$
- Number of coins that would fit into the room = volume of room/volume of one rupee coin (incorporated as a square) = $60/0.0000008 = 7.5 \times 10^7$

Answer: Number of coins that would fit a normal size room are 7.5×10^7

Estimate the number of vehicles crossing the road in front of FMS.

Working assumption : A normal working day in DU north campus with all colleges open. People using vehicles are Students, Teachers, Staff, Residents and Visitors while types of vehicles are Cars, two wheelers, autos/ rickshaws, Buses, cycles

- Estimating the traffic based on time:
 - 0000 - 0600 hours: 5 vehicles per hour (2 cars, 2 two wheelers and 1 cycle/rickshaw/ auto) buses won't run at that time
Total vehicles: 30
 - 0600 - 0900 hours: 10 vehicles per hour (3 cars, 3 two wheelers, 3 cycles/rickshaw/ auto and 1 bus)
Total vehicles: 30
 - 0900 - 1800 hours: 100 vehicles per hour (30 cars, 30 two wheelers, 35 cycles/ rickshaw/ auto, 5 buses)
Total vehicles: 900
 - 1800 - 2200 hours: 50 vehicles per hour (10 cars, 20 two wheelers, 15 cycles/ rickshaw/ auto, 5 buses)
Total vehicles: 200
 - 2200 - 2400 hours: 10 vehicles per hour (5 cars, 5 rest) no buses.
- Total vehicles: 20

Answer: Total number of vehicles crossing the road in front of FMS in the day: 1200 approx.

Estimate the number of number of subscribers of Economist in India

- Population of India: 120 crores
- Economist target market is urban upper middle class, educated
- Percentage of population in target: 20% (24 crores)
- Percentage of people interested in economics, intelligent articles etc.: 10% (2.4 crores)
- Percentage of people who prefer reading hard copy magazines: 20% (50 lakhs approx.)
- People choosing economist among similar magazines (time, Newsweek etc): 40% (20 lakh)
- Hence estimated subscriptions will be less as there may be more than 1 person using a subscription
- Total number of subscriptions: 15 lakhs
- Add subscriptions by libraries, colleges, corporates etc: 1 lakh approx

Answer: Total subscriptions approx. 16 lakhs

Estimate the number of cars sold by Maruti in India.

- Population of India= 120 crores
- % of population willing to purchase cars= 30% of 120 crores= 36 crores
- % of population looking for cars in higher range(above 7 lakhs)= 10% of 36 crores= 3.6 crores
- Popular brands in this category =5
- Maruti cars sold in higher range (assuming equal sale of all cars= $3.6/5=720000$ cars
- Life of a car= 10 years
- Cars in higher range sold annually = 72000 cars
- % of population looking for cars in lower range(below 7 lakhs)= 20% of 36 crores= 7.2 crores
- Popular brands in this category = 8
- Maruti cars sold in higher range (assuming equal sale of all cars= $7.2/8=900000$ cars
- Life of a car= 15 years
- Cars in higher range sold annually = 60,000 cars

Answer: Total Maruti cars sold in India in a year= $60,000 + 72,000= 1,32,000$

Estimate the number of beers sold in Goa every day.

- Population of Goa: 15 lakh (approx.)
- Percentage of population drinking per day: 20% (3 lakhs)
- Average amount of beer consumed per person: 3 pints
- Total beer consumed by local: 9 lakh pints
- Tourist population on an annual basis: 20 lakh (approx.)
- Tourist population on a day (assuming tourist season is on, December first week): 50,000
- Percentage of tourist population drinking: 90% (45000)
- Per capita consumption: 5 pints
- Total consumption by tourists: 2.25 lakhs pints

Answer: Total in a day during season = 23 lakh pints approx.

Estimate the market for air conditioners in Bangalore in 1 year.

- Population of Bangalore: 80 lakhs approx.
- Two types of ACs sold: Domestic use and Commercial use.
- For the purpose of this guesstimate we will assume only domestic ac sales.
- ACs can only be afforded by middle class and above
- Percentage of population falling in above category: 40% (approx.) = 32 lakhs
- Average size of household: 4 Number of households: 8 lakhs
- Bangalore has pleasant weather throughout the year hence people who can avoid spending the money will do so.
- Also fresh grads and students form a very large percentage of the population. They will also avoid buying ACs even though they fall in the target demographic.
- Number of households thinking of buying AC = 60% of target = 5 lakhs approx.
- Average age of an AC = 5 years
- Average number of ACs in a household of 4 = 3
- Number of target ACs = 15 Lakh

Answer: The number of sales of air conditioners in Bangalore in a year = $15/5 = 3$ lakh.

Additional Examples

1. Estimate the number of working ATMs in NCR?
2. How many Maggi packets are used in the FMS canteen in a week?
3. Estimate weekly revenues of the FMS canteen (Assume normal week and no seasonal variations)
4. Estimate the number of males who get a haircut in Delhi in 1 day?
5. How many people in India will be in flight at any given point of the day?
6. What is the number of flights leaving the Mumbai terminal each day?
7. What is the market size of disposable diapers in India?
8. Estimate the total number of chairs in the Delhi University North Campus
9. What is the total number of cars sold in Delhi per year?
10. Estimate total rail-line network in India
11. Estimate the number of vehicles crossing the road in front of FMS.
12. Estimate the number of popcorns sold in PVR Saket everyday.
13. Estimate the market for Pepsi in India.
14. Estimate the number of subscribers of Economist in India.
15. Estimate the market for Iphone4 in India
16. Estimate the number of Macbooks sold in India per day.

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<http://www.consultingcase101.com/tag/estimate-or-guesstimate/page/5/>

Useful Data Sources

<http://www.census2011.co.in/states.php>.

<http://www.indiademographics.com/default.aspx>