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# **CASE 1**

1. **Prompt**

Estimate the total numbers of vehicles during peak-time in Hanoi/HCM city.

1. **Analysis**
2. **Scope**

Based on the problem statement, we can easily determine the scope of the problem as follows:

* Geographical Scope: Applies to two major cities:
  + Hanoi
  + Ho Chi Minh City
* Time Frame to Determine Peak Hours:
  + Morning Peak: Typically from 7:00 AM to 9:00 AM.
  + Evening Peak: Typically from 5:00 PM to 7:00 PM.

1. **Factors Influencing the Problem**

Based on subjective assessment, the factors influencing the problem can be identified as follows:

* Geographical Location:
  + For different districts, travel demand also varies (due to population density and economic scale of each region).
  + The higher the population, the higher the traffic volume.
  + The higher the economic scale, the higher the traffic volume.
* Time of Season in Year:
  + Weather conditions will affect the demand for transportation (excluding sudden weather factors that are time-specific).
* Age: Different age groups have different travel needs.
  + Ages 1-6 usually do not have personal vehicles, so they do not affect the statistical results.
  + School-age and working-age individuals mainly contribute to traffic volume.
  + Older ages often have less need for travel, so they have a low impact on statistical results.
* Ownership of Personal Vehicles:
  + Individuals who do not own vehicles do not affect (or have negligible impact on) the statistical results.
* Nature of Transportation:
  + Personal vehicles: Influenced by user demand.
  + Commercial vehicles: Have a significant but fixed impact.
  + Public transportation: Fixed weight.

1. **Quantitative Method:**
2. Chosen Method

Based on the assessment of influencing factors, the chosen method for building a model is: Population-Based Estimation using Statistical Surveys.

* Criteria for Segmentation:
  + Geography: Divide into smaller units by District.
  + Time: Divide into 4 seasons of the year.
  + Age Groups:
    - * Preschool, Elementary, Middle School, High School, University, Working Age
  + Type of Vehicle Usage:
    - * Owns Personal Vehicle
      * Uses Commercial Vehicle
      * Uses Public Transportation
  + Frequency of Travel During Peak Hours: Yes/No
* Exclusions: The survey will not be applied to preschool-aged children.
* Survey Implementation: The survey will be conducted in each district and for each time period (season of the year).

1. Calculation Formula:

Definitions (per District and Age Group):

* A1(age, area): Total population excluding preschool-aged children.
* B(age, area, time): Number of individuals who own personal vehicles and have a need to travel during peak hours. C: Total number of public transportation vehicles operating during peak hours.
* D(age, area): Survey response rate (number of survey responses / total population excluding preschool-aged children).

Formula for Calculating Average Traffic Participation by Time Period (time - by season), Area, and Age Group:

*E(time,area,age) = (A1 / D) \* B*

Translate: Formula for calculating the average number of vehicles participating in traffic for each time period (time - by season):

1. Data Sources:

* Obtain data from direct surveys of residents (through flyers, the internet, etc.).
* Obtain data from databases of management agencies (such as the Department of Urban Transport, Department of Population Management of each city).
* Obtain data from private sectors.

1. Prediction Method

With the above method, because the parameters involved in the survey will change over time, the parameters will only be suitable for the present time but not for the future. However, it is possible to rely on the following factors to predict the results:

* Population growth rate
* Increase in public transportation
* Increase in demand for personal vehicles
* Aging of the population (transition from one age group to another)
* Climate change (compared to previous periods, if the climate is similar and does not change much, the old formula can be applied)

1. **Survey template**

A sample survey template could be as follows:

|  |
| --- |
| KHẢO SÁT NHU CẦU THAM GIA GIAO THÔNG GIỜ CAO ĐIỂM TẠI TP.HCM  Thời gian khảo sát: [Thời gian khảo sát]  **A. Thông tin Cá nhân:**  **1. Thông tin email hoặc định danh CCCD**  <Input text >  **2. Nơi bạn đang sinh sống (ghi rõ theo địa bàn quận)**  <Select box>  **3. Độ tuổi: (chọn 1)**  - Cấp 1  - Cấp 2  - Cấp 3  - Đại học  - Đi làm  **4. Tính chất Phương tiện: (Chọn một hoặc nhiều phương án phù hợp)**  - Sở hữu phương tiện cá nhân (xe máy, ô tô, ...)  - Sử dụng phương tiện kinh doanh (taxi, xe ôm công nghệ, ...)  - Sử dụng phương tiện công cộng (xe buýt, tàu điện ngầm, ...)  **B. Nhu cầu Tham gia Giao thông:**  **1. Bạn có thường xuyên tham gia giao thông vào các khung giờ cao điểm không? (Chọn một)**  - Có  - Không  **2. Nếu có, bạn thường tham gia giao thông vào khung giờ nào? (Chọn một hoặc nhiều phương án phù hợp)**  - Sáng sớm (7:00 - 9:00)  - Chiều tối (17:00 - 19:00)  **3. Bạn thường di chuyển đến đâu trong các khung giờ cao điểm? (Điền thông tin cụ thể, ví dụ: Trường học, Công ty, Chợ, ...)**  **C. Thông tin Bổ sung: (Không bắt buộc)**  1. Bạn có gặp khó khăn gì khi tham gia giao thông trong giờ cao điểm không? (Nếu có, vui lòng mô tả cụ thể)  2. Bạn có đề xuất gì để cải thiện tình hình giao thông giờ cao điểm tại [Tên Quận] không?  **Xin chân thành cảm ơn bạn đã tham gia khảo sát!** |

1. **Evaluation**
2. **Advantages/Disadvantages**

Evaluating the aforementioned method:

* Advantages:
  + Simplicity
  + Feasibility in terms of data collection
  + Due to the linear statistical model, prediction is easy
* Disadvantages:
  + The calculation formula is somewhat subjective, so there may be many errors.
  + Highly dependent on survey results.
  + There is no method to compare and confirm the accuracy of the results.

1. **Optimization Plans:**

Points that need to be optimized and refined in the above method:

* Compare Estimates: See if different methods produce similar results.
* Expert Input: Consult with traffic engineers or urban planners for insights.
* Sensitivity Analysis: Vary your assumptions (e.g., peak hour usage percentage) to see how it impacts the results.
* Incorporate Additional Parameters and Tools into the Calculation Formula:
  + Data from traffic cameras
  + Data from vehicle registration
  + ... (other relevant data sources)

# **CASE 2**

1. **Prompt**

Estimate the total number of bus school drivers in New york.

1. **Analysis**
2. **Method:**

This data can be accurately collected from the database of the local traffic management unit. Therefore, the proposed method here is: accurate statistics from the database of vehicle registration and driver management of New York City.

1. **Data Sources:**

There are two data sources to consider:

* Database from the New York City Department of Motor Vehicles (DMV)
* Database from the New York City Taxi and Limousine Commission (TLC)