**Title: HOW MANY TREES ARE NEEDED?**

**Today, the primary source of climate change is global warming. The Intergovernmental Panel on Climate Change (IPCC) has called on countries to make efforts to determine the amount of greenhouse gases they release into the atmosphere. Among greenhouse gases, carbon dioxide (CO2) holds a 50% share in global warming and is the most dangerous. This is because carbon dioxide can persist in the atmosphere for as long as 50 to 100 years. Therefore, reducing carbon dioxide emissions is a top priority in combating global warming.**

**Road vehicles are a major contributor to carbon dioxide emissions in residential areas. With the increasing number of vehicles in use worldwide, various regulations are being implemented to reduce vehicle greenhouse gas emissions, including the redesign of vehicle engines. Vehicle greenhouse gas emissions vary depending on the type of fuel used in vehicles (gasoline, diesel, LPG, or Hybrid) and their operating characteristics.**

**The level of carbon dioxide in the air is being balanced by photosynthetic organisms. Organisms containing chlorophyll can absorb carbon dioxide through photosynthesis, producing food and oxygen. In Turkey, the annual duration of sunlight is 2,640 hours. An adult tree can consume 2-3 kg of carbon dioxide per hour through photosynthesis. This is equivalent to the amount of carbon dioxide produced by 40 people in an hour. Scientific data indicates that an adult tree in the temperate climate zone can produce enough oxygen to meet the needs of an adult human for a year.**

**According to TUIK 2022 data, as of the end of September 2022, out of the 14,113,925 registered automobiles in traffic, 35.3% use LPG, 37.1% use diesel, 26.4% use gasoline, and 0.9% use hybrid or electric energy. The percentage of cars with unknown fuel type is 0.3%. Considering Turkey as a whole, it is known that 15.8% of these cars are Renault, 10.8% are Volkswagen, 11.1% are Fiat, 4.3% are Dacia, 5.5% are Opel, 6% are Hyundai, 6.6% are Ford, 5.1% are Toyota, 4.3% are Mercedes-Benz, 4.2% are Nissan, and 26.5% are from other brands.**

**The table below provides information on how many grams of carbon dioxide each of the most used car brands emit per kilometer.**

**Car Brands CO2(gr/km) Gasoline CO2(gr/km) Diesel Renault 209.5 182.5 Volkswagen 243 207 Fiat 157 154.5 Dacia 120 93 Opel 259.5 129 Hyundai 182 170.5 Ford 181.5 156.5 Toyota 161.5 189.5 Mercedes-Benz 265.5 214.5 Nissan 217 216 Other**

**It is known that vehicles running on LPG emit 20% less carbon dioxide than gasoline vehicles, and hybrid vehicles emit 5% less carbon dioxide than gasoline vehicles.**

**Istanbul Metropolitan Municipality is working on a project to compensate for the damage caused to nature. One of the subheadings of this project is afforestation. The question being asked is, "How many trees need to be planted in Istanbul to minimize the effect of carbon dioxide emissions from motor vehicles?" It has been shared that there are 3,162,884 registered vehicles in Istanbul, which has a population of 15,840,900. As a mathematician, you are asked to develop a model that will help the municipality calculate the required number of trees. This model should be designed in a way that other city municipalities can also use it in the future.**

**Helpful Information for the Solution:**

**1. For ease of calculation, you can assume that when calculating the annual average carbon dioxide production of vehicles, a car travels an average of 15,000 km per year.**

**2. For unknown car brands, you can assume the highest ratio belongs to Renault, and you can maintain their ratios here.**

**3. Since 0.3% of the 3,162,884 vehicles have an unknown fuel type, you can assume that they use LPG, as LPG has the highest usage ratio, and solve the problem with their data.**

**4. You can consider that a tree absorbs an average of 2.5 kg of CO2 during a well-lit hour of photosynthesis.**