

Ph11 First Hurdle (2016)

A popular trend in many cities ranging from New York City to Aspen, Colorado to Paris, France is called Bike-Share. The idea is that throughout the city are a series of bike stations with bikes that can be taken once you have paid a nominal fee and returned at another bike station elsewhere in the city. However, in cities such as Paris, France, where there are roughly 14,500 bicycles and 1,230 bike stations at last count, there are very important “sources” and “sinks”. Concretely, what this means is that quite often one finds bike stations at the top of hills completely empty (a source) and bike stations near important destinations completely full (a sink) meaning that there is nowhere to return a bike that you have ridden. For example, the Montmartre district has a huge hill that commands a view of the whole city and places like Luxembourg Gardens and the Louvre are especially important tourist destinations. Your task in this problem is to put yourself in the position of a Bike-Share city planner (you can use Paris or some other city or make up your own imaginary city) and to work out the best plan to avoid the source and sink problems.

Rules: Clearly state all assumptions made. You may use any reference you like, but you cannot collaborate*. The use of computers, etc. is ok. The hurdles are due before Monday, October 24, 2016 by 2:00 pm in Powell-Booth, room 215.

You can find a description of Ph11 in the Caltech catalog. On the basis of your performance on this and the second hurdle in November, you may be offered admission to Ph11, which includes pay for summer (2017) research at Caltech at the current SURF rate, which was \$6,000 for ten weeks in 2016. Usually 4-9 students are admitted to Ph11 every year. You do not have to be enrolled in PH10 to be eligible for Ph11, nor do you have to imagine yourself as a physics major.

**For the purpose of this competition, “collaborate” means that you cannot work together with other students, teachers, etc. You cannot ask anyone how you should attack the problem; however, you can ask people about suitable references to techniques that might be applied to the hurdle’s solution.*