《数学建模引论》作业题（要求第 8 周以前完成）

[注] 本题是美国中学生数学建模竞赛(HiMCM) 2001 年 1 月的竞赛题 B。请特别注意：数学建模问题通常没有标准答案，大家可以自由发挥想象力、洞察力；但请务必清晰、完整地列出你的模型假设，然后分析你所考虑的相关因素之间的关系，从而建立数学模型，并求解模型和分析、解释你的结论及模型的优缺点和可能的扩展方向。（即你的作业应该完整体现数学建模的全过程；要求每人独立完成，可以通过网络学堂提交电子版，也可以第 8 周课上提交手写版）。

HiMCM-2001 (January)　Problem B: Forest Service

Your team has been approached by the Forest Service to help allocate resources to fight wildfires.

In particular, the Forest Service is concerned about wildfires in a wilderness area consisting of small trees and brush in a park shaped like a square with dimensions 80 km on a side. Several years ago, the Forest Service constructed a network of north-south and east-west firebreaks that form a rectangular grid across the interior of the entire wilderness area. The firebreaks were built at 5 km intervals.

Wildfires are most likely to occur during the dry season, which extends from July through September in this particular region. During this season, there is a prevailing westerly wind throughout the day. There are frequent lightning bursts that cause wildfires.

The Forest Service wants to deploy four fire-fighting units to control fires during the next dry season. Each unit consists of 10 firefighters, one pickup truck, one dump truck, one water truck (50,000 liters), and

one bulldozer (w/ truck and trailer). The unit has chainsaws, hand tools, and other fire-fighting equipment. The people can be quickly moved by helicopter within the wilderness area, but all the equipment must be driven via the existing firebreaks. One helicopter is on standby at all times throughout the dry season.

Your task is to determine the best distribution of fire-fighting units within the wilderness area. The Forest Service is able to set up base camps for those units at sites anywhere within the area. In addition, you are asked to prepare a damage assessment forecast. This forecast will be used to estimate the amount of wilderness likely to be burned by fire as well as acting as a mechanism for helping the Service determine when additional fire-fighting units need to be brought in from elsewhere.

参考译文（来自网上，不一定准确，仅供参考）：

问题 B：林业部门

林业部门联系你们小组去帮助他们分配资源从而更好地与大火灾作战。林业部门特别担心大火灾发生在 80 公里*80 公里形成的一个类似公园的自然保护区，那里只有小树和灌木丛。几年前，林业部门建立了一个从南到北、从西到东的防火障网络，形成了穿过所有内陆地区的一个矩形网格。每隔 5 公里建立一个这样的防火障。火灾大部分发生在这个地区的干燥季节，从七月到九月。在这个季节里整天吹西风，频繁的闪电导致了大火灾。

林业部门希望有效地配置四个防火小组以便在干燥季节期间来控制火灾。每个小组有10 个消防员、一辆小卡车、一辆自倾货车、一辆水车（50000 升）和一辆推土机。每个小组还配备链锯、手工用具和其它防火工具。人们可以乘直升飞机快速地在自然保护区里移动，但是所有设备必须穿越防火障运输，直升飞机在干燥季节期间随时待命。

你们的任务是决定防火队在自然环境保护区里的最佳分布范围，林业部门可以在这些地区的任何地方建立防火队的大本营。而且，你们还要准备一个灾害评估预报，用来估计可能受火灾影响的地区的总量，以及寻找一种方法来帮助林业部门决定增援防火队的时间。