2022 HiMCM
Problem A: The Need for Bees (and not just for honey)

Honeybees, along with a few other key animals, are critical to human existence on our planet. Along with honey production, these insects provide the vital role of pollination of many trees and plants that provide food for our survival. In 2007, the term Colony Collapse Disorder (CCD) was created to describe the decline of honeybee populations around the world.[1] Bee decline can be attributed to factors such as viruses, pesticides, predators, habitat destruction, and environmental conditions.

Some information to consider (but you may find other helpful information online):

- Honeybees can travel up to 20 km, but typically stay within 6 km of their hive.[2]
- A typical honeybee hive contains between 20,000 and 80,000 honeybees.
- A single honeybee can visit approximately 2,000 flowers or more in a single day.
- Because of the high workload during summertime, most honeybees work themselves to death, resulting in a shorter lifespan.
- During autumn and wintertime, honeybees may live a bit longer (four to six months).

Photo credit: pixabay.com

- A honeybee's level of activity, pollen consumption, and protein abundance impacts its lifespan.

Requirements

1. Develop a model to determine the population of a honeybee colony over time.
2. Conduct sensitivity analysis on your model to determine which factors (e.g., lifespans, egg laying rates, fertilized/unfertilized egg ratios, or other factors) have the greatest impact on honeybee colony size.
3. Model and predict how many honeybee hives you will need to support pollination of a 20-acre (81,000 square meters) parcel of land containing crops that benefit from pollination.
4. Create a non-technical, one-page blog or infographic for a website that provides the information you developed.

Your PDF solution of no more than 25 total pages should include:
- One-page Summary Sheet.
- Table of Contents.
- Your complete solution.
- One-page blog or infographic.
- References list.

Note: The HiMCM Contest has a 25-page limit to your PDF solution submission. All aspects of your submission count toward the 25-page limit (Summary Sheet, Table of Contents, Reference List, and any Appendices).

References

[1] Yanes, J. (2021). The *Devastating Consequences of a World Without Bees*. Openmind [Internet]. www.bbvaopenmind.com/en/science/bioscience/consequences-a-world-without-bees.

[2] Greenwood, D. (2022). *How Far Do Bees Travel?* BeehiveHero [Internet]. https://beehivehero.com/how-far-do-bees-travel-from-their-hives.