Math Circles: Population Models With Randomness

Marek Stastna, Kris Rowe

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1 Activities

Example 1: The simplest growth problem with hunters Recall from the slides that the model with hunters is written as

$$P^{(n+1)} = \lfloor (1 + \alpha - \beta) P^{(n)} \rfloor - H^{(n)}$$

where $H^{(n)}$ is the number of hunters that actually managed to catch a pair of goats. In this first example we ask you to do redo the example from the slides. Thus take $P^{(0)} = 20$, $\alpha = 0.5$ and $\beta = 0.25$ with ten hunters. Use a coin and figure out the population for the first ten years (you can work in small groups).

Example 2: The effect of birth and death rate Repeat the last exercise but with $\beta = 0.4$. Is there a difference in your result? Can you explain any difference you find.

Example 3: Controlling for the randomness, method 1 This time do all the count flips ahead of time and record them. So you don't have to flip the coin too many times consider a slightly different problem. $P^{(0)} = 5$, $\alpha = 0.5$ with 4 hunters. For ten years that means you will have to record 40 coin flips. Now consider changes in the death rate. Try $\beta = 0.1$, $\beta = 0.2$, $\beta = 0.3$, and $\beta = 0.4$. Explain what you find.

Example 4: Controlling for the randomness, method 2 Get together with 4 other groups to make a supergroup of 5 groups. Discuss and find a sensible way to average the results for problem 1.