

Sleep Problem:

Suppose that after many years of observation, you notice that your sleep is self-correcting: The amount of sleep you get one night is the average of the amount of sleep you got on the previous two nights. On two particular nights (initial conditions), you got 7 hours of sleep, followed by 8 hours of sleep. How much sleep will you get n nights later? How much sleep will you get each night in the long run if this pattern continues? Are the results the same if the initial conditions are reversed (on two particular nights, you got 8 hours of sleep, followed by 7 hours of sleep)?

Population dynamics:

Consider a population of beetles who have exactly one life cycle per year. The adults lay on average k eggs, and a fraction f of these eggs survives over the winter to produce new eggs next season.

Bank account problem 1:

At the beginning of the year you deposit \$5000 into a savings account and the bank pays monthly interest at a rate of 0.5%. Model a model for the increase in value over time. How much money is in the account by the end of September?

Bank account problem 2:

Same as above, but in addition you deposit an extra \$200 each month. Modify your above model and compute the value for September.

Which car to buy?

You wish to buy a car, and narrow your search to a Volkswagen, a Chevrolet and a Hyundai. Each company offers you its best deal:

- Volkswagen: \$13,999, \$1000 downpayment, and 3.5% annual interest for a duration of 60 months.
- Chevrolet: \$13,550, \$1,500 downpayment, and 4.5% annual interest for a duration of 60 months.
- Hyundai: \$12,400, \$500 downpayment, and 6.5% annual interest for a duration of 48 months.

You can afford to pay \$1500 downpayment and up to \$475 per month. Use a mathematical model to determine which car to buy.