

UMB 551I Linear algebra - examples

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Participants of a trip

There were 45 participants of a two-day bus trip. On the first day, the fee for a watchtower visit was 30 Eur for an adult, 16 Eur for a child and 24 Eur for a senior. The total fee for the first day was 1116 Eur. On the second day, the fee for a bus with a palace and botanical garden tour was 40 Eur for an adult, 24 Eur for a child and 34 Eur for a senior. The total fee for the second day was 1542 Eur. How many adults were there among the participants?

Savings

A friend and I save for a holiday together by monthly payments in the following way. At the beginning I give 10 Eur and he gives 20 Eur. Every consecutive month each of us gives as many as last month plus one half of what the other has given the month before. How much money will I pay in the twelfth month? How much money will my friend pay in the twelfth month? How much money will we have in one year?

Pond

Suppose we have a simple model of a pond where there lives a population of white fish (roach, bleak, vimba, nase, etc.). Assume that 20% of babies survive their second year and from that age on they are able to reproduce. For these young fish, approximately 60% of them survive their third year and in the following years the mortality can be ignored. Furthermore we assume that the birth rate is three times the number of fish that can reproduce. Such a population would clearly fill the pond very quickly. Thus we want to maintain a balance by using a predator, for instance esox. Assume that one esox eats per year approximately 500 mature white fish. How many esox should be put into the pond in order for the population to remain constant?

Farmer

Consider the following Leslie model in which a farmer breeds sheep. The birthrate of sheep depends only on their age and on average is 2 lambs per sheep between one and two years of age, 5 lambs per sheep between two and three years of age and 2 lambs per sheep between three and four years of age. Younger sheep do not deliver any lambs. Every year, half of the sheep die, uniformly distributed among all age groups. Every sheep older than four years is sent to the butchery. The farmer would like to sell (living) lambs younger than one year for their skin. What proportion of the lambs can be sold every year to ensure that the size of the herd remains the same?