Math 215   4.5&4.6 Application and system of linear differential equations

Application #1: In a certain town, 30 percent of the married women get divorced each year and 20 percent of the single women get married each year. There are 8000 married women and 2000 single women. Assume that the total population of women remains constant.

(a) How many married women and how many single women will there be after 1 year? After 2 years?

(b) What about after n years?

A stochastic process is any sequence of experiments for which the outcome at any stage depends on chance. A **Markov process** is a stochastic process with the following properties.

(i)   The set of possible outcomes or states is finite.

(ii)   The probability of the next outcome depends only on the previous outcome.

(iii)   The probabilities are constant over time.

Application #2: An automobile dealer leases four types of vehicles: four-door sedans, sports cars, minivans, and SUVs. The term of the lease is 2 years. At the end of the term, customers must renegotiate the lease and choose a new vehicle.

The automobile leasing can be viewed as a process with four possible outcomes. The probability of each outcome can be estimated by reviewing records of previous leases. These records indicate that 80 percent of the customers currently leasing sedans will continue doing so in the next lease. Furthermore, 10 percent of the customers currently leasing sports cars will switch to sedans. These results are summarized as below.

Sedan	Sports car	Minivan	SUV	Current Next
0.80	0.10	0.05	0.05	Sedan
0.10	0.80	0.05	0.05	Sports car
0.05	0.05	0.80	0.10	Minivan
0.05	0.05	0.10	0.80	SUV

Suppose that initially there are 200 sedans leased and 100 of each of the other three types of vehicles.

(a) Determine how many people will lease each type of vehicle next year.

(b) What is the long-range behavior of the process?