

## ASSIGNMENT 7

### Sections 1, 2, 3, 4, and 5 in the Grey Module

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1. A population of lions  $p_t$ , where  $t = 0, 1, 2, \dots$ , is modelled by  $p_{t+1} = p_t + I_t$ . The immigration term is equal to  $I_t = 25$  with an 80% chance and  $I_t = -30$  with a 20% chance. Assume that  $p_0 = 100$ .

(a) What is the deterministic part of this model? What is the stochastic part?

(b) What is your prediction for the population of lions in 10 years? Will the population increase, decrease, or remain about the same? Explain.

1. continued...

(c) Write the sample space for the population of lions after 3 years. (Hint: Draw a tree diagram).

(d) Assuming that immigration from year to year is independent, determine probabilities for each outcome in the sample space in part (c).

(e) What is the probability that the population of lions will increase after 3 years?

2. A family has 5 children. Assume that female and male children are equally likely to be born.

(a) What is the probability that at least one child is a girl?

(b) What is the probability that exactly one child is a girl?

(c) If it is known that at least one child is a boy, what is the probability that at least one child is a girl?

3. For the purposes of a study, university students were divided into two categories: those who work (at a paid job) throughout the school year and those who only work during the summer. Is this a partition of the sample space? If not, suggest a way in which the sample space could be partitioned based on the work habits of students.

4. The incidence of bacterial meningitis within a certain population was estimated to be about 3.4 cases per 100,000 people during 2012. A test for meningitis shows a positive result in 85% of people who have it and in 7% of people who do not have it (false-positive). If you belong to this population and test positive for bacterial meningitis, what is the probability that you actually have it?

5. It is estimated that ADHD affects 3 to 5 percent of school aged children globally, with males being diagnosed more frequently than females. Consider a population of school aged children comprised of 160 girls and 145 boys. Suppose that 3% of girls and 5% of boys within this population are estimated to be affected by ADHD.

(a) What is the probability that a randomly chosen child will be affected by ADHD?

(b) What is the probability that a child with ADHD is a girl?

6. In roulette, a wheel with numbered slots is spun and a ball is rolled in the opposite direction around the wheel. Players can bet on a single number or range of numbers based on where they expect the ball will stop. In American roulette, the wheel is numbered from 0 to 37 and the ball has an equally likely chance of stopping on any one of these numbers. If you always bet on 13, what is the probability of the ball stopping on 13 at least once in 10 rolls? What is the probability of the ball stopping on 13 for all 10 rolls?

7. An online dating site claims that 1 out of 4 blind dates end in disappointment. To avoid disappointment, you decide to limit yourself to 3 blind dates in a year. What is wrong with this reasoning?

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THE END