1. Canadian Revenue agency aims to audit 5% of companies every year.

   (a) What is the probability that a given company will be audited exactly once in the next 5 years?

   (b) What is the probability that a given company will be audited in the next 5 years?

   (c) What is the probability that a given company will be audited exactly twice next 5 years? At least two times?

2. The following data gives the number of sunny days per year in Sunnyville for the last 30 years:

   213 199 199 180 225 196 182 233 194 185 192 178 171 263 241 207 168 178 195 219 166 141 163 208 209 211 196 204 188 221

   (a) Assume normal distribution of sunny days. Compute the mean and standard deviation using Matlab. What are the chances that there will be at least 250 sunny days in Sunnyville next year?

   (b) What are the chances that at least one of the next three years will have 250 sunny days?

3. The average temperature in March in Halifax is -1.3 degrees celsius. In the last 100 years, the average temperature was above zero in 25% of them. Assuming the average temperature follows a normal distribution, what is the standard deviation? What are the chances that this year, the average temperature will be above 1 degree celsius?

4. Simulate the following scenario: in a telephone survey of 100 people, 45% stated their preference for candidate A, 48% prefer candidate B, and the rest are undecided. Your simulation should look something like this:

```
voteA=0; voteB=0; voteUndecided=0;
for i=1:100
    oo=rand(); % a random number from 0 to 1
    if oo<= 0.45
        voteA=voteA+1;
    elseif oo <= 0.45+0.48
        voteB=voteB+1;
    else
        voteUndecided=voteUndecided+1;
    end;
end;
```

   (a) Modify the above code to run this simulation 10000 times, storing the results. That is, the variables voteA, voteB and voteUndecided should now be arrays of 10000 elements, and create a loop to run this 10000 times.

   (b) Use the command `hist(voteA, 100)` to make a histograph showing the distribution of the votes for candidate A using 100 bins. Similar for voteB and voteUndecided. Hand in the printouts of the three histograms and your code.

   (c) Among the 10000 simulations, how many resulted in candidate A getting at least 50 votes? How many resulted in candidate B getting at least 50 votes? How many simulations resulted in candidate A getting more votes than candidate B?

   (d) Calculate the probability that candidate A will get at least 50% of the vote using two ways: (i) summing up the binomial distribution (using matlab) and (ii) approximating binomial distribution by the normal distribution. Comment how your results compare to the simulation in (c).

   (e) Calculate the probability that A will get more votes than B, using using (i) binomial and (ii) normal distributions. Comment how your results compare to the simulation in (c).

   (f) Redo part (ii) of question (d) assuming that 1000 people were interviewed instead of 100.

5. A baker put 500 raisins into dough, mixed well, and made 100 cookies. You take a random cookie. What is the probability of finding at least 4 raisins in it?

6. In the last four months, I had to replace five light bulbs in my house. What are the chances that I won't need to change a lightbulb next month?

7. It is estimated that one in ten parked cars do not pay the parking fare. A parking inspector is inspecting 20 cars and will give out fines to those who did not pay for parking.

   (a) What are the chances that the inspector does not give out any fines?

   (b) What are the chances that exactly 2 cars will get a fine?

   (c) What are the chances that at least 2 cars will get a fine?

   (d) It costs $1 to inspect each car, and each parking fine is for $20. The inspection company will make money if it collects more fines than it spends on inspecting the cars. What is the minimum number of cars that the company should inspect to be at least 95% sure that it will make money?

8. A radioactive source emits 4 particles on average during a five-second period.

   (a) Calculate the probability that exactly 4 particles are emitted during a 5-second period.

   (b) Calculate the probability that at least 4 particles are emitted during a 5-second period.

9. Air Canada estimates that 1% of its customers with purchased tickets fail to show up for their flights. For one particular flight, the plane has 300 seats and the flight has been fully booked. How many additional tickets can the airline sell so that there is at least a 90% chance that everyone who shows up will have a seat?

10. A life insurance insured 10000 individuals aged 30. The probability that a 35-year old will die within one year is 0.0035. Within the next year, what is the probability that the insurance company will pay between 30 and 33 claims (both inclusive) among these 10000 people?

11. Two taxi arrive on average at a certain street corner for every 20 minutes. Three people are waiting at the street corner for taxi (assuming they do not know each other and each one will have his own taxi). Each person will be late for work if they do not catch a taxi within the next 15 minutes.

    (a) What is the probability that all three people will make it to work on time?

    (b) What is the probability that exactly one person will late for work?

    (c) What is the probability that at least one person will late for work?