# Exercise Sheet 5

1. A supermarket chain purchases 2 tons of Galia melons from a fruit trading company. The guarantee they get from the trading company is that at most 4% of the melons are rotten. To check this, the quality control officers of the supermarket chain select 50 melons at random and use them to investigate.

    a) Which distribution is suited to the description of the number of rotten melons? Which assumptions are implicitly made when this model is used?

    b) Assume that of the 50 melons, 4 are found to be rotten. Has the trading company lied about the quality of their melons? Formulate suitable null and alternative hypotheses. Compute the rejection set for a significance level 5% and perform the test.

    c) Compute the p-value for the test in part b).

    d) Compute the probability of a Type II error when the null hypothesis $p = 4\%$ is being tested against the alternative $p = 10\%$? What are the consequences of having a Type II error this size?

2. It is widely known that the city of Zurich is afflicted with many roadworks. Let X denote the duration of roadworks at a location; it is a random variable whose range is between 0 and 20 weeks. Assume that its density is as follows:
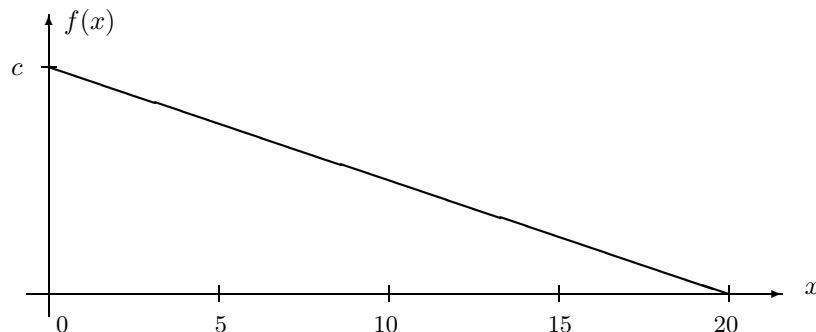
    a) Why is $c = 0.1$? Write down the density $f(x)$ in an explicit form.

    b) Compute the probability that the duration X of work at a site is less than *(i)* 5 weeks; *(ii)* 10 weeks.

    c) Sketch the cumulative distribution function of X.

    d) Compute the mean, median and standard deviation of X.

    e) Let the cost of work be $K = 40'000 \cdot \sqrt{X}$ Swiss francs. What is the probability that the work at a site costs no more than CHF $120'000.-$?

The distribution we have used so far is just a model. We could also model the duration of roadworks by an exponential distribution.

    f) Which value must we take for the parameter λ if the exponential distribution is to have the same mean as the distribution used so far?

    g) Repeat part e) with the exponential distribution using this value of λ.