

Midterm test Probability Theory for EE (191530062)
Wednesday, September 25, 2013, 8.45 - 10.30 uur

This test consists of 5 problems

Use of books is not allowed. A calculator is allowed, but not a graphical calculator

Put your name and student number on your work

Motivate your answers

1. Suppose that $P(A) = \frac{1}{3}$, $P(AB) = \frac{1}{4}$ and $P(A \cup B) = \frac{1}{2}$. Determine $P(B)$ and $P(\bar{A}\bar{B})$.
2. Give the probability definition of Laplace, and explain in which situations it can be applied.
3. To fix an old electrical device, Helen needs two resistors of $2.2 \text{ k}\Omega$, and one of $47 \text{ k}\Omega$. She draws 4 resistors at random from a bag with ten resistors in total. Of these ten, five are $2.2 \text{ k}\Omega$, three are $47 \text{ k}\Omega$, and the other two are 540Ω . What is the probability that her draw will be successful (i.e. that her draw contains at least two resistors of $2.2 \text{ k}\Omega$, and at least one of $47 \text{ k}\Omega$)?
4. In some experiment, event A happens with probability $P(A) = 0.2$. However, observing whether A happens or not is difficult, which may result in incorrect observations: when A happens, it is not observed with probability 0.1; when A does not happen, it is still 'observed' with probability 0.05.
 - a. When the observation indicates that A has happened, what is the probability that A indeed did happen?
 - b. What is the overall probability that the observation is incorrect?
5. a. Give the expected value, the variance, and the standard deviation for the random variable X that has $P(X=0) = P(X=2) = P(X=4) = \frac{1}{6}$ and $P(X=1) = P(X=3) = \frac{1}{4}$.
 - b. Give the expected value and the variance of X when X has a binomial distribution with parameters $n = 48$ and $p = \frac{1}{4}$.
 - c. John visits as many shops as needed until he finds a shop that sells a particular product. Assume each shop will have the product with probability 0.1, and assume that different shops are independent. Give $P(X = k)$, $k = 1, 2, \dots$, and EX , where X is the number of shops visited by John.

Standard:

1	2	3	4	5	Total
2	2	3	2	2	$+ 2 = 20$

Grade = Total/2