BSM SMD, Final SAMPLE

1. State the Central Limit Theorem and solve the following problem. In our town 2500 new births are expected next year. If the gender of children is independent and the boy-girl probability is $\frac{1}{2} - \frac{1}{2}$, then

   (a) formulate the exact probability that the number of boys will be at least 1200;

   (b) approximate the above probability by means of the Central Limit Theorem.

2. • Define the notion of the Type I and Type II error, and power of a statistical test.
   • Which parametric test is applicable to decide about the following alternative, based on a normally distributed sample:

   $$H_0 : \ \mu \leq 10 \quad \text{versus} \quad H_1 : \ \mu > 10,$$

   where $n = 64$, $\sigma = 2$ (known) and $\alpha = 0.025$.
   • Describe the rejection region with the help of $\bar{X}$.
   • Sketch the $\gamma(\mu)$ function!
   • Give the probability of the Type II error for $\mu_1 = 11$!

3. We compare the effect of two stimulating pills on four patients. Their reaction times increased with 6, 10.1, 8, 13 seconds under the effect of pill A, and 6.2, 9.9, 8, 13.1 seconds under the effect of pill B. Do the effects of the two pills differ significantly with level of significance $\alpha = 0.05$? Justify for the choice of the test.

4. The following counts are recorded as for smoking and cancer cases:

	cancer	no cancer	sum
smoker	42	18	60
non-smoker	6	34	40
sum	48	52	100

Table 1

Decide (with the available significances) whether there is a significant dependence between smoking and cancer.

5. Analyzing the output of a statistical program (regression, ANOVA, factor analysis, hypotheses tests).