Special Methods of Data Analysis
Exam test (90 minuts, 0-67 points)

1. A desk lamp produced by The Luminar Company was found to be defective (*D*). There are three factories (*A*, *B*, *C*) where such desk lamps are manufactured. A Quality Control Manager (QCM) is responsible for investigating the source of found defects. This is what the QCM knows about the company's desk lamp production and the possible source of defects:

Factory	% of total production	Probability of defective lamps
A	0.35 = *P(A)*	0.015 = *P*(*D* | *A*)
B	0.35 = *P(B)*	0.010 = *P*(*D* | *B*)
C	0.30 = *P(C)*	0.20 *P*(*D* | *C*)

The QCM would like to answer the following question: If a randomly selected lamp is defective, what is the probability that the lamp was manufactured in factory C? (**12p**)

2. Joint probability distribution of a random vector $(X; Y)$ is given as:

X\Y	-1	0	2
-2	0,2	0,2	0,3
3	0	0,3	0

Find:
a) marginal probability functions $P_X(x)$ and $P_Y(y)$,
b) expected values $E(X)$ and $E(Y)$,
c) standard deviations $\sigma(X)$ and $\sigma(Y)$,
d) correlation coefficient $\rho(X; Y)$.

2p+2p+4p+4p

3. In each of 4 races, the Democrats have a 60% chance of winning. Assuming that the races are independent of each other, what is the probability that:
a) The Democrats will win 0 races, 1 race, 2 races, 3 races, or all 4 races?
b) The Democrats will win at least 1 race?

3p+4p

4. An article „Earthquakes are not uncommon in California“ in the *Annals of the Association of American Geographers* (June 1992) investigated many factors that California residents consider when purchasing earthquake insurance. The survey revealed that only 133 of 337 randomly selected residences in Los Angeles County were protected by earthquake insurance. Do the data provide sufficient evidence to indicate that less than 40% of the residents of Los Angeles County were protected by earthquake insurance? Use $\alpha = 0{,}10$.(**12p**)

5. A random sample of 500 persons is questioned regarding their political affiliation and opinion on a tax reform bill. Test if the political affiliation and their opinion on a tax reform bill are dependent at 5% level of significance. The observed contingency table is given below:

	favor	indifferent	opposed	total
democrat	138	83	64	285
republican	64	67	84	215
total	202	150	148	500

Using alpha = 0,05, would you conclude that political affiliation and their opinion on a tax reform bill are independent? (**12p**)

6. A marketing research firm tests the effectiveness of three new flavorings for a leading beverage using a sample of 30 people, divided randomly into three groups of 10 people each. Group 1 tastes flavor 1, group 2 tastes flavor 2 and group 3 tastes flavor 3. Each person is then given a questionnaire which evaluates how enjoyable the beverage was. The scores are as in Figure 1. Determine whether there is a perceived significant difference between the three flavorings. (**12p**)

Flavor 1	Flavor 2	Flavor 3
13	12	7
17	8	19
19	6	15
11	16	14
20	12	10
15	14	16
18	10	18
9	18	11
12	4	14
16	11	11