

Statistical Analysis I
Examination

Please note the following

- The exams consists of 8 (equally weighted) problems for solution; for each problem you can get at most 10 points. You do not have to solve the individual problems completely, partial solutions are also possible. It is not enough, however, to give simply the result, but you should clearly display your approach and way to solution.
- For passing the exams you have to achieve a total of (at least) **25 points** from all problems.
- You are allowed to use: Pocket calculators, text books, mathematical and/or statistical tables, manuscripts and notes from the lectures and/or exercises.

Good luck !

Problem 1 (10 pts)

The profits from the sale of a company's product over a 12-week period are shown below

Week	1	2	3	4	5	6	7	8	9	10	11	12
Profit (\$100s)	15.4	13.7	10.5	16.3	13.2	12.5	17.3	12.8	10.9	15.6	13.8	12.5

- (a) Calculate the mean and the variance of the variable "profit per week".
- (b) The profits in all 12 weeks were decreased by \$100 because of higher fixed costs. Use the answer from part (a) to calculate the corrected mean and variance.
- (c) Calculate the mean and the variance of the variable "profit per week" if the profits would be 10% higher in every week.

Problem 2 (10 pts)

A city government conducted a survey to determine whether the occurrence of various crimes varies from one part of the city to another. The city was divided into three regions, and the following data were collected.

region	homicides	car thefts	cases of grand larceny
1	15	251	208
2	19	172	293
3	8	105	125

- (a) Calculate all corresponding marginal frequencies. In the region 2, what is the percentage of cases of grand larceny? Which percentage of car thefts occurred in region 3?
- (b) Compute Cramer's V from the contingency table and interpret your result.

Problem 3 (10 pts)

A company sets different prices for a particular stereo system in 8 different cities. The accompanying table shows the numbers of sold units (y_i) and the corresponding prices (x_i , in hundreds of dollars); the additional columns are given for convenience.

city	x_i	y_i	x_i^2	y_i^2	$x_i \cdot y_i$
1	5.5	42	30.25	1764	231.0
2	6.0	38	36.00	1444	228.0
3	6.5	35	42.25	1225	227.5
4	6.0	40	36.00	1600	240.0
5	5.0	44	25.00	1936	220.0
6	6.5	38	42.25	1444	247.0
7	4.5	45	20.25	2025	202.5
8	5.0	42	25.00	1764	210.0
Total	45.0	324	257.00	13202	1806.0

- Compute the correlation coefficient between “price” and “number of sold units”.
- Fit a regression line to the data points, taking “price” as the regression, and “number of sold units” as the response variable. Calculate the coefficient of determination.
- Predict the number of sold units when the price is \$590.

Problem 4 (10 pts)

A manuscript proofreader counted the number of typographical errors on each of 130 pages. The following data summarize the findings.

k	0	1	2	3	4
number of pages with k errors	39	45	32	10	4

- Let X be the number of errors on a randomly selected page. Find the probability function of X .
- Find the respective probabilities of the two events
 A : “There are at least 3 errors”,
 B : “There are at most 2 errors”.
- Are A and B mutually exclusive? Are they exhaustive?

Problem 5 (10 pts)

The average length of a telephone call which a professor receives from students the day before the final examinations is 3 minutes. The distribution of the length of calls is assumed to be exponential.

- What is the probability that the length of such a call is not more than 3 minutes?
- What is the probability that the length is between 3 and 5 minutes?
- What is the probability that a call which already took 2 minutes will take further 3 minutes?
- When the professor receives 4 (independent) calls on such a day, what is the probability that at least one of them takes not more than 3 minutes?

Problem 6 (10 pts)

A pizza delivery service delivers to a campus dormitory. Delivery times follow a normal distribution with mean 20 minutes and standard deviation 4 minutes.

- What is the probability that a delivery will take between 15 and 25 minutes?
- The service does not charge for a pizza if delivery takes more than 30 minutes. What is the probability of getting a free pizza from a single order?
- During final exams week, a student plans to order pizza on five consecutive evenings. Assume that these delivery times are independent of each other. What is the probability that the student will get at least one free pizza?