Wydział Inżynierii Zarządzania, stopień 1 (studia licencjackie), semestr 2. **Engineering menagement**.
Descriptive statistics. Below there are listed problems discussed in the course. On Monday 5th of June, 2017, I will propose at least 5 of them, and every student answers, in writing, to three he/she chooses of these five ones. Depending on the correctness and completeness of answers I will issue the mark for the course (5, 4.5, 4, 3.5, 3 or 2; 2 means that the course is not approved). Every student who fails the test on 5th of June gets an opportunity to have a positive mark in the retake test taking place on 12th of June.

1. Three branches of statistics: experiment theory, descriptive statistics, inferential/mathematical statistics.
2. n-th triangular numbers, t_n.
3. $\Sigma_{k=1..n} k^2$.
4. Harmonic series $\Sigma_{k=1..\infty} 1/k$ and alternating harmonic series $\Sigma_{k=1..\infty} (-1)^{k+1}/k$.
5. Basel sum/series $\Sigma_{k=1..\infty} 1/k^2$.
6. Leibniz series $\Sigma_{k=0..\infty} (-1)^k/(2k+1)$.
7. Taylor series of arctangent.
8. Fibonacci numbers F_n and $\lim_{n\to\infty} F_{n+1}/F_n$.
9. A collocation/collocative polynomial in Stevin basis (with Vandermonde matrix), in Lagrange basis.
10. Least-square(d) approximation/fit.
11. Permutations (with and without repetition), variations (with and without repetitions), combinations.
12. Binomial theorem and Pascal triangle.
13. A sample/sequence ($y=(y_j)_{j=1..N}$), ordeence (ordered sequence, z = ord(y)), valuence (x=val(y), $x=(x_k)_{k=1..n}$) and multence ($m=(m_k)_{k=1..n}$), freqence (f, $f_k=m_k/N$), cumuence (F, $F_k=f_1+f_2+\ldots+f_k$).
14. Classical definition of the probability.
15. Geometric probability and Bertrand paradox.
16. The idea of Kolmogorov probability and of random variable (denoted below by X).
17. PDF (probability density function, aka mass function) $f_k := \Pr\{X=x_k\}$.
18. CDF (cummulative distribution function) $F(x) := \Pr\{X\le x_k\}$.
19. Distribution of the sum $X = c_1+c_2+c_3$ of randomly chosen numbers $c_1, c_2, c_3 \in \{1, 2, 3, 4\}$.
20. Paretto, or 80:20, distribution. Bernoulli(p) distribution, or Bernoulli(p) random variable.
21. The probability to find, among n persons, a person born on given day of a common year (this is: not of a leap/intercalary year) $\Pr\{X=n\}=1-\prod_{k=0..n-1} (365-k)/365^n$ for $n<365$, $=1$ for $n\ge 365$.
22. The probability that in a group of n persons at least there are two birthday-mates (=persons born on the same day of a, not necessarily the same, year), $\Pr\{X=n\}=1-(364/365)^n$.
23. Condensation of a sample (by forming classes; condence).
24. r-th (row) moment, and r-th central moment, of a sample (or discrete random variable) $\mu_r := \Sigma_{k=1..n} x_k^r \cdot f_k$, $\gamma_r := \Sigma_{k=1..n} (x_k-\mu_1)^r \cdot f_k$; in particular, the mean $\mu_1(y)$ (or expected value E(X)), the variance var(y)= γ_2 (=var(X)) and the standard deviation std(y), std(X).
25. $\gamma_2 = \mu_2-\mu_1^2$.
26. Binomial(n,p) distribution, its expected value and variance.
27. Ideas of Geometric(p) distribution and Poisson(λ) distribution.
28. Uniform(a,b) distribution, or the random variable $X \sim$ Uniform(a,b).
29. The idea of Normal(μ,σ) distribution.
30. The covariance $\mathrm{cov}(z,a)= \Sigma_{j=1..N} (z_j-\mu_1(z))\cdot (a_j-\mu_1(a))/N$. Pearson and Spearman correlation coefficients.
31. Anscombe quartet.
32. Linear regression and its interpretation for a time series (the trend line).
33. Lorenz line and Gini coefficient/index.

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<u>After 1st term.</u> On 5th of June, 2017, 23 students presented their answers to 3 problems (every one of them chose them out of 6 proposed: 8, 9, 15, 21, 25, 33; since each answer was evaluated up to 9 points, the maximum score was 27 points). In the range 00-03, 04-06, 07-09, 10-12, 13-15 (mark 3.0), 16-18 (mark 3.5), 19-21 (mark 4.0), 22-24 (mark 4.5) and 25-27 (mark 5.0) there are classified 0, 1, 4, 7 (it gives 12 persons who failed the test), 5, 4, 1, 1 and 0, resp.; it results with 12 persons who failed the test (grade 2.0) and 11 who passed positively. Due to a distinguishing activity during classes, I rised up one assessment by 0.5 (and this way this person finished the course with the grade 5.0, my congratulations).
The retake test is on 12th of June. A person who does not know complete and correct answers to problems already proposed (8, 9, …, 33) can not get credits for the course.