American University- Central Asia

SYLLABUS

THE THEORY of PROBABILITIES and MATHEMATICAL STATISTICS

Mat 307, ID 3215

Spring-2016

1. Lecturer:

Elena Sergeevna Burova, Assistant Professor, burova_e@auca.kg

Class meetings: 2 classes (75 minutes) per week, 15 working weeks.

Office hours: Tu: 12.20-13.40, Th: 12.20-13.40, office: NC 415, phone: 915000 (ext. 426).

2. Short course description:

This course will introduce the basic tools of theory of probability and statistics with applications to natural and social sciences, business. The course consists of the following topics: counting techniques; basic probability concepts and theorems; discrete and continuous probability distributions; statistical inference and sampling, the central limit theorem, confidence intervals for the mean of a normal population, hypothesis testing for the mean of a normal population.

3. Prerequisites: MAT131/ MAT 131.1/ MAT 131.2

4. Sources:

1. http://e-course.auca.kg
2. Alan H. Kvanli Introduction to business statistics. 1989.
3. Mario Triola Elementary statistics. 2002.
4. Alan Hoenig Applied finite mathematics. 1986.
5. Amir D. Azel Complete Business Statistics. 1986.
6. Lawrence L. Lapin Statistics for modern business. 1978.

7. Objectives:

- to develop abstract and logical (probative) thinking,
- understanding how to set and solve problems,
- acquiring as basic knowledge of probability and statistical analysis techniques,
- to use the knowledge of probability and statistics for the problems solving in majors.

8. Expected outcomes:

After completing MAT 307 the student will be able to:

- Understand arithmetic of events, distributive laws, de Morgan's laws.
- Use a general principle of counting, the multiplication principle, permutations, combinations.
- Understand the relationship between a question that arises in the natural, computer, economic, and social sciences and the nature of the numerical data that are needed in order to provide an answer to the question.
- Formulate the question in a mathematical context, set up the required mathematical procedure and carry out the required calculations, with appropriate use of a calculator, to answer the questions.
- Understand various types of descriptive measures, measures of dispersion, interpreting sample mean and sample standard deviation.
- Understand discrete probability distributions and continuous probability distributions.
- Understand hypothesis testing for the mean and variance of a population.
- Draw a valid inference from a collection of numerical data.

9. Method of Evaluating Outcomes:

Grading

Grades will be based on a total of 100 points**.** Students may appeal the grading of a test question on a designated appeal day (time and room to be announced). Only the grader determines whether any adjustment to the grade should be made. Students should discuss the appeal with the course instructor who will then make any necessary adjustment to the record and return the paper to the department office.

Quiz 1	The lecturer will announce day and time	10 points
Midterm Exam	The lecturer will announce day and time	30 points
Quiz 2	The lecturer will announce day and time	10 points
Final Exam	The lecturer will announce day and time	40 points
Home works	Every class	10 points

The total grade of the student is as follows:

$$0 \le F \le 40 < D \le 45 < C- \le 50 < C \le 60 < C+ \le 65$$

$$65 < B- \le 70 < B \le 80 < B+ \le 85 < A- \le 90 < A \le 100.$$

Attendance Requirements

It is important to attend classes to master the materials in the course. Attendance affects grades: students lose 1 point for any unexcused absence.

Make-up Exams and Make-up Quizzes

- If the reason for missing the midterm exam is valid, the student's final exam will be worth up to 60 points. In this case extra tasks can be included in the final test.

- If the reason for missing the Final Exam is valid, the student can apply for the grade of "I".
- If a student misses both exams, he/she will not be attested for the course.
- If the reason for missing a Quiz is valid, the professor sets day and time for this Quiz which will be worth up to 5 points.
- If the reason for missing any exam or quiz is not valid, then the grade 0 will be given for the missing exam or quiz.

Academic Honesty

The Applied Mathematics and Informatics Department has zero tolerance policy for cheating. Grade F is the minimal punishment in the cheating situation. Students who have questions or concerns about academic honesty should ask their professors or refer to the University Code of Conduct for more information.

Workbooks

Each student must maintain a math workbook with a clear record of completed homework. Workbooks will be assessed from time to time. Students should bring their workbooks to all classes as they are necessary for their class work. Workbooks must be submitted for assessment immediately upon request of the professor or full credit for homework may not be earned. The workbook must contain calculations completed by the student. Photo-copies of answers will not be accepted nor will answers that have been copied from the back of the text book or transcribed from the solution manual. We highly recommend working jointly with your fellow students on homework problems.

Calculators

Students will be advised whether calculators are needed for specific assignments. Graphic calculators may not be used during quizzes and exams.

Cell phones

We ask students to turn off their cell phones during math classes. Use of cell phones is entirely prohibited during the exams.

Syllabus change

Professors reserve the right to change or modify this syllabus as needed; any changes will be announced in class.

10. Tentative Academic Calendar:

1 week

- Combinatorial analysis. Permutations, combinations. A principle of multiplication and addition (Counting rules). [2]: Ch. 4.6, [4]: Ch. 5.4-5.6, [3]: Ch. 3.6.
- Space of events. Elementary events. Operations with random events. [4]: Ch. 6.1, [3]: Ch. 3.2.

2-4 weeks

- Probability. Definition of probability. [2]: Ch. 4.1-4.5, [4]: Ch. 6.2 - 6.4, [3]: Ch. 3.1-3.5.
- Operations with probabilities. [2]: Ch. 4.1-4.5, [4]: Ch. 6.2 - 6.4, [3]: Ch. 3.1-3.5.
- Conditional probability. The formula of complete probability. Bayes' theorem. [4]: Ch. 6.5, [3]: Ch. 3.4.

4-5 weeks

- Random variables. Representing probability distributions for discrete random variables. Mean and variance of discrete random variables. [2]: Ch. 5.1-5.3, [4]: Ch. 9.5, [3]: Ch. 4.1-4.5.
- Binomial Random variables. [2]: Ch. 5.4, [4]: Ch. 9.5, [3]: Ch. 4.1-4.5.
- The hypergeometric distribution. Using Binomial distribution to approximate the hypergeometric distribution. [2]: Ch. 5.5, [3]: Ch. 4.4, [6]: Ch. 17.1.
- The Poisson distribution. Poisson approximation to the Binomial. [2]: Ch. 5.6, [3]: Ch. 4.4.

9-10 weeks

- Continuous random variable. Normal random variables. Determining probability for normal random variables. [2]: Ch. 6.1-6.5, [3]: Ch. 5.1-5.4, [4]: Ch. 9.4.
- Random sampling and distribution of sample mean. The central limit theorem. [2]: Ch.7.1-7.2, [4]: Ch. 4.1-4.4, [3]: Ch. 5.6.
- Normal approximation to the Binomial. [2]: Ch. 6.6, [3]: Ch. 5.5, [6]: 3.7, 7.5.
- The confidence interval if mean of a normal population σ is known. [2]: Ch. 7.3, [4]: Ch. 5.1-5.2.
- Definition of necessary volume of sample. [2]: Ch. 7.4 -7.5, [3]: Ch. 7.1,7.2, [4]: Ch. 5.3.
- Hypothesis testing on the mean of a population: large sample. On tailed test for mean of a population: large sample. Reporting testing results using a p-value. [2]: Ch. 8.1-8.3, [5]: Ch. 6.1-6.3, 6.6-6.8, [3]: Ch. 6.3.
- Hypothesis testing on the mean of a normal population: small sample. [2]: Ch. 8.4, [5]: Ch. 6.4.
- Inference for the variance and standard deviation of a normal population. [2]: Ch. 8.4, [5]: Ch. 6.4.

11-13 weeks

- Independent versus dependent samples. Comparing two means using two large independent samples. [2]: Ch. 9.1-9.2, [3]: Ch. 8.3, [5]: Ch. 7.1-7.5.
- Comparison of two normal dependent populations [2]: Ch. 9.5, [3]: Ch. 8.3, [4]: Ch. 7.1-7.2, [6]: Ch. 6.10.
- Estimation and confidence interval for a population proportion. [2]: Ch. 10.1, [3]: Ch. 7.3, [4]: Ch. 5.4 -5.6, [6]: Ch. 5.1-5.2.
- Hypothesis testing for the population proportion [2]: Ch. 10.2, [3]: Ch. 6.5, [4]: Ch. 6.5, 6.6, [6]: Ch. 5.3, 5.4.

14-15 weeks

- Model of the linear regression. (13.2), (9.5). Statistical analysis of the linear regression. (13.3), (9.4-9.6), \8.2, 8.5.\.
- The coefficient of determination. (13.4), (9.7), \8.3\
- Estimations and predictions by the model linear regression. (13.5), (9.10), \8.4\.

Out-of class assignments

- Distribution function of discrete random variables. [5]: Ch. 2.2, [6]: Ch. 6.4.
- Distribution function of continuous variables. [4]: Ch. 2.6.
- Distribution function of continuous random variables. [5]: Ch. 2.6, [6]: Ch. 6.5.