

## Computational Statistics

|                          |                                      |   |                  |                   |
|--------------------------|--------------------------------------|---|------------------|-------------------|
| Course Name              | Course type (credit/hours)           | Required course(3/3)                              | Course code      | E096              |
|                          | Target students Division/major/grade | Environmental and safety Engineering/Sophomore    | Opening semester | 2019 1ST SEMESTER |
|                          | Class time and classroom             | Mon D(Pal107)Thu D(Pal107)                        | English Grade    | A(100%English)    |
| Reference to this course | Prerequisite courses                 |   |                  |                   |
|                          | Related basic courses                | 과학계산프로그래밍, 환경전산학 / MATLAB, Environmental computer |                  |                   |
|                          | Recommended concurrent courses       |   |                  |                   |
|                          | Related advanced courses             |   |                  |                   |

|                    |                       |                        |   |                  |        |                     |
|--------------------|-----------------------|------------------------|---|------------------|--------|---------------------|
| Instructor         | Name (title/division) |                        | Seungho Jung(Associate Professor, Environmental and safety Engineering) |                  |        |                     |
|                    | Office Room Number    | 서관312호                 | Office phone Number   | 2401             | e-mail |                     |
|                    | Office hours          | 금요일 9시~12시             |   | Homepage address |        |                     |
| Teaching Assistant | Name (title/division) |                        |   |                  |        |                     |
|                    | Office Room Number    | 서관137호<br>Westhall-137 | Office phone Number   | 2411             | e-mail | jujuhaha@ajou.ac.kr |

### 1. Introduction

Engineers practically deal with real world systems and have often to make decisions based on data which is characterized by considerable variabilities. In this introductory course for Environmental Engineers, students will learn fundamental concepts of statistics and probability and how to apply them to Environmental Engineering problems. While applications for Environmental Engineering will be focused, students will learn the statistical principles which are universal and can be applied to all engineering/science branches.

In addition, a big data analysis program, RAPID-miner will be taught by a guest-lecturer for a week.

### 2. Course Objectives

In the end of the course, students should be able to:

- Analyze engineering data
- Conduct hypothesis tests on statistical parameters such as the mean and the variance.
- Develop and evaluate simple and multiple linear regression models.
- Carry out basic statistical data analysis using Minitab or a spreadsheet software

### 3. Class types and activities

- Lecture for each class.
- English A (100%) class.
- Home works will be assigned in every 2 weeks (about 7 times overall)
- In the end of class, home works using MS Excel or statistical program (i.e. Minitab, SPSS) will be assigned.

### 4. Teaching Method

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> lecture                          | <input checked="" type="checkbox"/> discussion and debate   |
| <input type="checkbox"/> team project(presentation and case studies) | <input type="checkbox"/> experiments(role-playing,etc)      |
| <input type="checkbox"/> designing and production                    | <input type="checkbox"/> on-site learning(on-site training) |
| <input type="checkbox"/> others                                      |   |

### 5. Support Systems in Use

- |  |   |   |
|--|---|---|
| <input checked="" type="checkbox"/> AjouBb               | <input type="checkbox"/> automatic recording system | <input type="checkbox"/> web-based assignment |
| <input type="checkbox"/> cyber lecture                   | <input type="checkbox"/> online content             |   |
| <input type="checkbox"/> class behavior analyzing system | <input type="checkbox"/> others                     |   |

### 6. Teaching Tools

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> PBL(Problem Based Learning) | <input type="checkbox"/> CBL(Case Based Learning) | <input type="checkbox"/> TBL(Team Based Learning)           |
| <input type="checkbox"/> UR(Undergraduate Research)  | <input type="checkbox"/> FL(Flipped Learning)     | <input type="checkbox"/> DSAL(Data Science Active Learning) |
| <input type="checkbox"/> others                      |   |   |

### 7. Knowledge and ability required for taking this course

- Basic statistics in the level of highschool
- Basic mathematics
- MS Excel

## 8. Method of Evaluation

| Evaluation Item | The Number of Times | Evaluation Proportion | Remarks |
|-----------------|---------------------|-----------------------|---------|
| Attendance      |                     | 10%                   |         |
| midterm exam    |                     | 30%                   |         |
| final exam      |                     | 40%                   |         |
| quiz            |                     |                       |         |
| presentation    |                     |                       |         |
| discussion      |                     |                       |         |
| homework        |                     | 20%                   |         |
| etc             |                     |                       |         |
| study hours     |                     |                       |         |

## 9. Textbook and supplementary material

| Main/Sub | Title (Web-site)                       | Writer   | Publisher        | Publication year |
|----------|--|--|------------------|------------------|
| Main     | Engineering Statistics (5th ed)        | Douglas Montgomery,<br>George Runger and<br>Norma Hubele | WILEY            | 2012             |
| Sub      | Statistics for Environmental Engineers | P.Berthouex and<br>d                                     | Lewis Publishers | 1994             |

## 10. Class system and Class shedule

- Lectures for understanding basic concepts of probabilistic and statistical analysis
- Home work reports to further understand and get familiar with the theoretical aspects
  - Assignments must be Neat.
  - Underline the final numerical answer clearly.
  - Bi-weekly assignments will be gathered at the beginning of Fridays
  - Late assignments will not be accepted without documented medical evidence or another substantial reasons
- Written tests to evaluate and policies are as followings;
  - Midterm and final exams are closed book.
  - Only faculty approved non-programmable calculators will be allowed.

## < Class Schedule >

\* language : K-korean, E-English

| Weeks | Topics   | language | Instructor   | Teaching Method | Evaluation Method | Matter to be prepared   |
|-------|--|----------|--------------|-----------------|-------------------|---|
| 1     | Diagnostic Test  | E        | Seungho Jung |                 |                   |   |
| 2     | Role of Statistics in Engineering / Data Summary and Presentation  | E        | Seungho Jung |                 |                   |   |
| 3     | Probability rules / Conditional probability and independence   | E        | Seungho Jung |                 |                   |   |
| 4     | Big data analysis using Rapid-miner by guest lecturer  | K/E      | Seungho Jung |                 |                   | Half of the class on Monday / another half of the class on Thursday |
| 5     | Random Variables and Probability Distributions – Probability density and cumulative functions  | E        | Seungho Jung |                 |                   |   |
| 6     | / Normal and other continuous distributions / Normal probability plots / Discrete distributions (Binomial, Poisson)                    | E        | Seungho Jung |                 |                   |   |
| 7     | Random Variables and Probability Distributions – Properties of random variables / Sampling distributions and the central limit theorem | E        | Seungho Jung |                 |                   |   |
| 8     | Midterm exam   | E        | Seungho Jung |                 |                   | Calculator  |
| 9     | Decision Making for Single Samples – Case 1  | E        | Seungho Jung |                 |                   |   |
| 10    | Decision Making for Single Samples – Case 2  | E        | Seungho Jung |                 |                   |   |
| 11    | Decision for Two (or more) Samples – Comparing two independent means (variances known and unknown) / Pair comparison                   | E        | Seungho Jung |                 |                   |   |
| 12    | Decision for Two (or more) Samples – Comparing two variances / Comparing more than two means: Analysis of Variance                     | E        | Seungho Jung |                 |                   |   |
| 13    | Empirical Model Building with Linear Regression – Simple linear regression with least-squares  | E        | Seungho Jung |                 |                   |   |

## < Class Schedule >

\* language : K-korean, E-English

| Week<br>s | Topics  | lang<br>uag<br>e | Instructor   | Teaching<br>Method | Evaluation<br>Method | Matter to be<br>prepared |
|-----------|---|------------------|--------------|--------------------|----------------------|--------------------------|
| 14        | Empirical Model Building with Linear Regression – ?Testing a regression (residuals analysis, ANOVA) | E                | Seungho Jung |                    |                      |                          |
| 15        | Empirical Model Building with Linear Regression – ?Multiple linear regression and model building    | E                | Seungho Jung |                    |                      |                          |
| 16        | Final exam  | E                | Seungho Jung |                    |                      | Calculator               |

## 11. Other items of notification

서관 3층에 환경공학 PC실에 통계프로그램 MINITAB 라이선스 20개 구비되어 있음.  
별도의 실습 시간은 학기 말에 있을 예정이나 중간중간 과제 때 가끔 이용할 필요가 있을 때 개방하여 실습 및 과제를 할 수 있도록 할 예정.  
RAPID-miner 프로그램도 구매되어 수업에 이용될 예정.

There are 20 MINITAB (statistics software) license copies in Environment dep. PC lab located in West hall 3rd floor.  
Whenever students need, the lab will be open for practices and homeworks.  
In addition, 1 copy of RAPID-miner will be used for learning big-data analysis.