## 1. Course Identity

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|---|---|---|---|
| **Course name** (*Nama mata kuliah*) | Statistical Computing | | |
| **Faculty** (*Fakultas*) | Mathematics and Natural Science | **Study Program** (*Program Studi*) | Statistics |
| **Code** (*Kode*) | SST-606 | **Credit poin Sks** (*Bobot Sks*) | 2 |
| **Group** (*Grup*) | Study Program | **Enrollment obligatory** (*Sifat pengambilan*) | mandatory/ optional* |
| **Semester(s) in which the course is taught** (*Semester*) | 6 | **Availability** (*Ketersediaan*) | Limited |
| **Learning method** (*Bentuk pembelajaran*) | blended learning/online learning* | **Media** (*Media*) | Digital files (slides, video, sheet, etc) |
| **Course category** (*Rumpun mata kuliah/blok*) | university compulsory course/ SSP compulsory course/ practicum/ compulsory of scientific interest/ elective course* | **Requirements** (*Prasyarat*) | Database |
| **Lecture** (*Dosen pengampu*) | Dina Tri Utari, M.Sc. Rahmadi Yotenka, M.Sc. | **Semester/ Academic year** (*Semester/ Tahun Akademik*) | Even Semester 2020/2021 |

*) cross the unnecessary ones

## 2a. PROGRAM LEARNING OUTCOME (*CAPAIAN PEMBELAJARAN LULUSAN*)

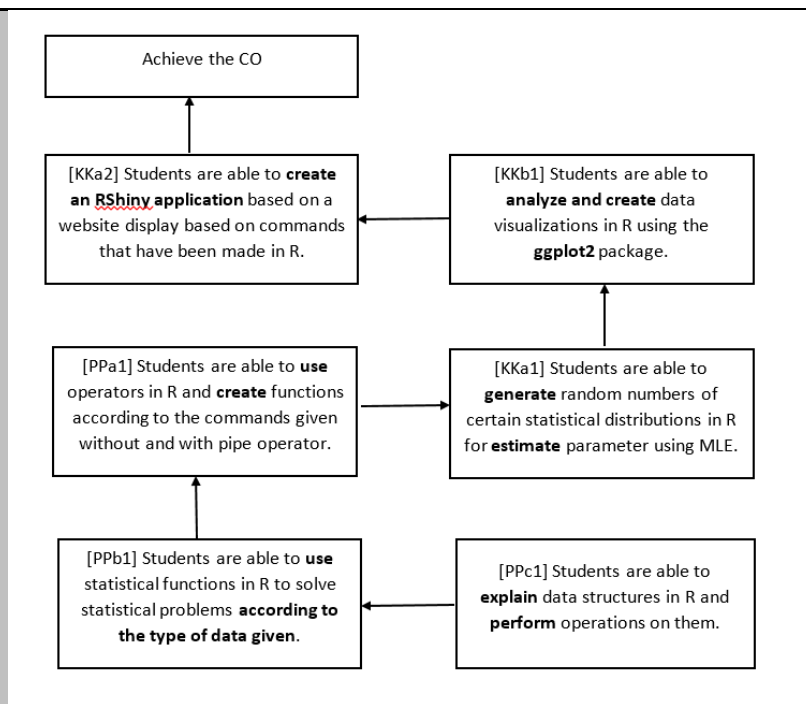| LO Code (*Kode CPL*) | LO Description (*Rumusan CPL*) |
|---|---|
| PPa (Intelligence) | Mastering the concepts of probability theory and statistics, mathematics, calculus, elementary linear algebra, statistical analysis methods, and elementary computer programming. |
| PPb (Science) | Mastering several statistical methodologies (methods and models) to be used in solving problems in several fields. |
| PPc (Software) | Mastering at least two statistical software, including software based on open source. |
| Kka (Technique) | Able to design experiments, including the collection and generation of data (in the form of surveys, experiments or simulations), organizing the data, analysis of the data using statistics techniques and the extraction of valid conclusions by utilizing a minimum of one device type of software statistics |
| Kkb (Communicative) | Able to solve the problem of estimation, hypothesis testing, prediction and forecasting in several fields, using data and several statistical methodologies (methods and models) and presenting them in the form of descriptions that are easily understood by users. |

## 2b. COURSE OUTCOME (*CAPAIAN PEMBELAJARAN MATA KULIAH*)

| Supported PLO Code (*Kode* | CO Code (*Kode CPMK*) | CO Descriptions and Indicators (*Rumusan CPMK dan Indikator*) | Learning Experience (*Pengalaman Pembelajaran*) | Assessment (*Asesmen/penilaian*) | Weight (*Bobot*) |
|---|---|---|---|---|---|

| *CPL yang didu-kung*) | | | | | |
|---|---|---|---|---|---|
| PPa | PPa1 | Students are able to **use** operators in R and **create** functions according to the commands given without and with pipe operator. | 1. Students are able to **use** operators that are already available in R correctly.<br>2. Students are able to **create** functions to solve a problem **without and with pipe operators**. | Assignment | 10 |
| PPb | PPb1 | Students are able to **use** statistical functions in R to solve statistical problems **according to the type of data given**. | 1. Students are able to **choose and use** statistical functions that are already available in R to solve problems related to qualitative and quantitative data correctly. | Assignment | 10 |
| PPc | PPc1 | Students are able to **explain** data structures in R and **perform** operations on them. | 1. Students are able to **explain the data structure** in R and the **operations** in it. | Quiz | 5 |
| KKa | KKa1 | Students are able to **generate** random numbers of certain statistical distributions in R for **estimate** parameter using MLE. | 1. Students are able to **generate** random numbers based on statistical distributions.<br>2. Students are able to **make parameter estimation** functions using the MLE method in R. | Assignment | 10 |
| | KKa2 | Students are able to **create an RShiny application** based on a website display based on commands that have been made in R. | 1. Students are able to **create functions** for data analysis in R.<br>2. Students are able to create a function to **convert** the results in R into an RShiny application based on a website display. | Assignment, Final Exam | 35 |
| KKb | KKb1 | Students are able to **analyze and create** data visualizations in R using the **ggplot2** package. | 1. Students are able to **use** functions and analyze data in R.<br>2. Students are able to **make** visualizations of the results of data analysis using R package ggplot2. | Midterm Exam | 30 |

| 3. Program Learning Outcome Analysis Map (*Peta Analisis Capaian Pembelajaran*) |
|---|
| |

Achieve the CO

[KKa2] Students are able to **create an RShiny application** based on a website display based on commands that have been made in R.

[KKb1] Students are able to **analyze and create** data visualizations in R using the **ggplot2** package.

[PPa1] Students are able to **use** operators in R and **create** functions according to the commands given without and with pipe operator.

[KKa1] Students are able to **generate** random numbers of certain statistical distributions in R for **estimate** parameter using MLE.

[PPb1] Students are able to **use** statistical functions in R to solve statistical problems **according to the type of data given**.

[PPc1] Students are able to **explain** data structures in R and **perform** operations on them.

## 4. Reference (*Referensi*)

Braun, W. J., & Murdoch, D. J. (2007). A First Course in Statistical Programming with R. Cambridge: Cambridge University Press.

Kabacoff, R. (2018). Data Visualization with R. Middletown: Wesleyan University.

Venables, W. N. (2009). An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. -: etwork Theory Ltd.

Wickham, H. (2020). Mastering Shiny. California: O'Reilly Media.

Utari, D. T. (2021). Komputasi Statistika dengan R. Yogyakarta: Universitas Islam Indonesia.

## 5. Detail of Learning Activities (*Rincian Aktivitas Pembelajaran*)

| Session (sesi) | LOC/Sub-LOC/Criterion (*CPMK/Sub-CPMK/ Kriteria*) | Study Material (*Bahan Kajian*) | Activity Design and Duration (*Rancangan Aktivitas dan Durasi*) | Mode | Learning Media/ Reference (*Media Pembelajaran/ Referensi*) |
|---|---|---|---|---|---|
| 1. | PPc1 | Data Structure in R | - Lecture gives quiz for knowing students' knowledge about data structures (10 minutes)<br>- Lecture explains data structure in R (duration 30-45 minutes);<br>- Students do example and task for each data structure (duration 45-60 minutes) | FFO | Slides 1<br>Quiz 1: knowledge of data stucture |
| 2. | PPb1 | Basic Statistics in R (qualitative data) | - Lecturer explains briefly the theory of method to solve qualitative data (30 minutes)<br>- Lecturer gives the problem and students solved using the theory that has been explained (70 minutes) | FFO | Slides 2 |

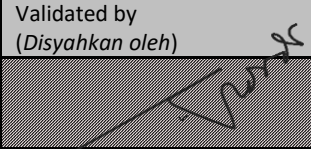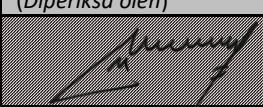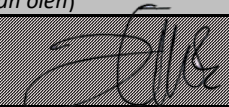| No. | | Topic | Activity | Mode | Reference |
|---|---|---|---|---|---|
| 3. | PPb1 | Basic Statistics in R (quantitative data) | - Lecturer explains briefly the theory of method to solve quantitative data (30 minutes)<br>- Lecturer gives the problem and students solved using the theory that has been explained (70 minutes) | FFO | Slide 3<br>Assignment 2: solve problems of qualitative and quantitative data using appropriate method |
| 4. | PPa1 | Function | - Lecture explains the structure and types of function<br>- Lecturer gives the problem and students solved using the theory that has been explained | FFO | Slide 4 |
| 5. | PPa1 | Pipe Operator | - Lecture explains how to create function using pipe operators<br>- Lecturer gives the problem and students solved using the theory that has been explained | FFO | Slide 5<br>Assignment 1: create function with and without pipe operator |
| 6. | KKb1 | Data Visualization Part 1 | - Lecture provides a trigger of data visualization<br>- Student follow the tutorial part 1 of using ggplot2 package | SSA | Lecture's book |
| 7. | KKb1 | Data Visualization Part 2 | - Lecture provides a trigger of data visualization<br>- Student follow the tutorial part 2 of using ggplot2 package | SSA | Lecture's book |
| 8. | | Midterm Exam | | | |
| 9. | KKa1 | MLE in R Part 1 | - Lecture explains briefly the theory of MLE<br>- Lecture and students solve the problem of estimation parameter using MLE in R | FFO | Slide 8 |
| 10. | KKa1 | MLE in R Part 2 | - Lecture and students solve the problem of estimation parameter using MLE in R (based on data) | FFO | Slide 9 |
| 11. | PPa1, KKa1 | Numerical Analysis | - Lecture provides a trigger of numerical analysis<br>- Student follow the tutorial of estimate parameter using Newton Raphson method | SAA | Lecture's book<br>Assignment 3: Estimation parameter of Gamma distribution |
| 12. | KKa2 | R Shiny | - Lecture explains an introduction of R Shiny | FFO | Slide 10 |
| 13. | KKa2 | R Shiny | - Lecture explains how to create UI/user interface in R Shiny and followed by students | FFO | Slide 11 |
| 14. | KKa2 | R Shiny | - Lecture explains how to create server in R Shiny and followed by students | FFO | Slide 12 |
| 15. | KKa2 | R Shiny | - Students create simple R Shiny application | SAA | Slide 11-12<br>Assignment 4: simple R Shiny application |
| 16. | KKa3 | Final Exam | | | |

Information:

For mode, enter one of the following codes

• FF = activities that require **face-to-face** meetings in class (*aktivitas yang memerlukan tatap muka (TM) langsung di kel*as);

• FFO = activities that require **face to face online** (*aktivitas yang memerlukan tatap muka secara daring (tatap maya/TMD)*);

• SAA = standalone asynchronous online activity (*aktivitas daring asinkron mandiri/ASM*);

• CAA = collaborative asynchronous online activities (*aktivitas daring asinkron kolaborasi/ASK*);

Learning / reference media can be in the form of (1) self-produced results, (2) curated results: media sourced from the internet or other sources chosen by the lecturer, and / or (3) students' own exploration results.

| 6. Assessment and Evaluation System (*Sistem Penilaian dan Evaluasi*) | |
|---|---|
| **Assessment System** (*Sistem Penilaian*) | The grading system uses one of these two systems: <br> • PAP (*Penilaian Acuan Patokan*/ Benchmark Reference Assessment) is an assessment using the University / Faculty / Study Program's standard values. <br> • PAN (*Penilaian Acuan Normal*/ Normal Reference Assessment) is an assessment based on relative class passing standards, for example based on a normal distribution. |
| **Evaluation System** (*Sistem Evaluasi*) | Evaluation is a decision taken after students finish lectures. <br> Each student must achieve a minimum grade / predicate of C for the overall average score. If it has not fulfilled it, then the student is obliged to carry out an examination / repair assignment. |

| Date: | Date: | Date: |
|---|---|---|
| Validated by (*Disyahkan oleh*) | Examined by (*Diperiksa oleh*) | Prepared by (*Disiapkan oleh*) |
| | | |
| Dr. Edy Widodo, M.Si. | Muhammad Muhajir, M.Sc. | Dina Tri Utari, M.Sc. |