

Data Visualization Course Syllabus

1	Course title	Data Visualization
2	Course number	1915441
3	Credit hours	3
	Contact hours (theory, practical)	3
4	Prerequisites	Machine Learning and Neural Networks (1915370)
5	Program title	Data Science
6	Program code	15
7	Awarding institution	The University of Jordan
8	School	King Abdullah II School for Information Technology
9	Department	Artificial Intelligence
10	Level of course	Undergraduate (UG)
11	Year of study and semester (s)	2024 - Spring (2 nd)
12	Final Qualification	BSc
13	Other department(s) involved in teaching the course	None
14	Language of Instruction	English
15	Teaching methodology	<input checked="" type="checkbox"/> Face-to-Face <input type="checkbox"/> Blended <input type="checkbox"/> Online
16	Electronic platform(s)	<input checked="" type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input type="checkbox"/> Zoom <input checked="" type="checkbox"/> Others http://omar.alkadi.net/
17	Date of production/revision	18 February 2024

18 Course Coordinator:

Name: Prof. Omar Al-Kadi
Office number: 308
Phone number: 22623
Email: o.alkadi@ju.edu.jo

19 Other instructions:

- **Textbook:** Principles of Data Visualization: A Primer on Making Informative and Compelling Figures, by Claus Wilke; 1st edition, 2019 can be downloaded from [here](#).
- **Programming environment:** R programming language and [RStudio](#) (with [R packages for Data Science](#)).

20 Course Description:

This course presents a comprehensive exploration of data visualization essentials, covering techniques from transforming raw data to creating engaging visualizations using R programming language. Topics include Quantity Visualization, Dispersion Visualization, Relative Representation, Multivariate Visualization, Time Series Visualization. Students will gain proficiency in visualizing patterns, trends, geospatial data, uncertainty, and proportional representation. The curriculum also covers figure design principles, and hands-on implementation using R programming software.

21 Course aims and outcomes:

A- Aims:

On completion of this course, students should be able to:

- Understand principles and techniques for transforming raw data into visualizations, covering Relative Representation, Quantity, Dispersion, and Multivariate Visualization
- Develop practical skills in data visualization using R, including the implementation of figure design principles.
- Apply theoretical understanding to real-world problem-solving, exploring techniques for visualizing amounts, distributions, proportions, and associations among quantitative variables.
- Demonstrate competence in solving problems through teamwork and communication skills in R programming.

B- Intended \ Students Learning Outcomes (ILOs \ SOs):

Label	ABET Student Learning Outcomes (SOs)
SO1	Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
SO2	Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
SO5	Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

On successfully completing the module, the students are expected to have gained good knowledge of:

Descriptor	Label	Course Intended Learning Outcomes Description (ILOs)
Knowledge	A	Understanding principles and techniques of transforming raw data into visualizations. [SO1]
	B	Understanding principles of figure design and creating effective multi-panel figures. [SO1]
Skills	C	Developing practical skills in data visualization, from mapping data onto aesthetics to implementing figure design principles. [SO2]
	D	Applying different techniques to data visualization. [SO2]
	E	Explore real-world problems in the context of data visualization for effective representation. [SO2]
Competencies	F	Demonstrating competence in solving real-world problems in R programming. [SO2]
	G	Demonstrating teamwork and communication skills through group work activities. [SO5]

22 Topic Outline and Schedule:

Week	Lecture	Topic	ILO/SO	Evaluation Methods	References
1	1.1	Introduction to Data Visualization	A/SO1	Class participation	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	1.2				
	1.3				
2	2.1	Data Visualization Essentials	A/SO1	Class participation	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	2.2				
	2.3				
3	3.1	Quantity Visualization	C,F/SO2	Assignment 1	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	3.2				
	3.3				
4	4.1	Dispersion Visualization	C,F/SO2	Quiz 1	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	4.2				
	4.3				
5	5.1	Relative Representation	C,F/SO2	Class participation	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	5.2				
	5.3				
6	6.1	Multivariate Visualization	D,F/SO2	Quiz 2	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	6.2				
	6.3				
7	7.1	Time Series Visualization	D,F/SO2	Class participation	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	7.2				
	7.3				
8	8.1	Patterns and Trends Visualization	D,F/SO2	Assignment 2	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	8.2				
	8.3				
9	9.1	Geospatial Data Visualization	D,F/SO2	Class participation	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	9.2				
	9.3				
10	10.1	Uncertainty Visualization	D,F/SO2	Class participation	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	10.2				
	10.3				
11	11.1	Proportional Representation	D,F/SO2	Quiz 3	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	11.2				
	11.3				
12	12.1	Handling Overlapping	B/SO1	Class participation	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	12.2				
	12.3				
13	13.1				

	13.2	Precision in Data Visualization	B/SO1	Quiz 4	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	13.3				
14	14.1	Best Practices in Data Visualization	E,F/SO2	Class participation	Moodle (http://elearning.ju.edu.jo) and subject webpage (http://omar.alkadi.net/2847-2)
	14.2				
	14.3				
15	15.1	Course wrap-up and project presentations	G/SO5	Final project submission	-
	15.2				
	15.3				

23 Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	Period (Week)	Platform
Assignment 1	1 mark		Week 2	Moodle (E-learning platform)
Quiz 1	2 marks	Data Visualization Essentials	Week 3	Moodle (JUExams platform)
Assignment 2	1 mark		Week 4	Moodle (E-learning platform)
Quiz 2	2 marks	Quantity, Dispersion & Relative Representation	Week 5	Moodle (JUExams platform)
Midterm exam	30 marks	-	Week 7	Moodle (JUExams platform)
Assignment 3	1 mark		Week 8	Moodle (E-learning platform)
Quiz 3	2 marks	Multivariate, Time Series, Patterns and Trends Visualization	Week 9	Moodle (JUExams platform)
Assignment 4	1 mark		Week 10	Moodle (E-learning platform)
Quiz 4	2 marks	Geospatial Data, Uncertainty & Proportional Representation	Week 11	Moodle (JUExams platform)
Assignment 5	1 mark		Week 12	Moodle (E-learning platform)
Project Submission	7 marks		Week 15	In-class

24 Course Requirements (e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform...etc.):

PC/laptop, R programming language and RStudio (with R packages for Data Science).

25 Course Policies:

A- Attendance policies: Students are responsible for attending online lectures and downloading and viewing all material covered uploaded to the LMS (<http://elearning.ju.edu.jo>) and the subject webpage at (<http://omar.alkadi.net/2847-2>).

B- Absences from exams and submitting assignments on time: It is the students' responsibility to turn in their homework assignments to their instructors by the announced due date/time. Not attending exams without a valid excuse is not accepted.

C- Health and safety procedures: Students should adhere to the University of Jordan health and safety rules and procedures

D- Honesty policy regarding cheating, plagiarism, misbehavior: For more details on University regulations please visit <http://www.ju.edu.jo/rules/index.htm>

E- Grading policy: 50% semester work comprising of assignments, quizzes and programming project to be submitted at the end of the semester, and 50% for final exam.

F- Available university services that support achievement in the course: <http://elearning.ju.edu.jo>

26 References:

A- Required books, assigned reading and audio-visuals:

Principles of Data Visualization: A Primer on Making Informative and Compelling Figures, by Claus Wilke; 1st edition (O'Reilly Media, 2019)

B- Recommended books, materials and media:

- *Statistics and Data Visualization Using R: The Art and Practice of Data Analysis, by David S. Brown; 1st edition (SAGE Publications, 2021)*
- *Information Visualization: Perception for Design (Interactive Technologies), by Colin Ware; 4th edition (Morgan Kaufmann, 2020)*
- *Data Visualisation: A Handbook for Data Driven Design, by Andy Kirk, 2nd edition (SAGE Publications, 2019)*
- *Graphics Cookbook: Practical Recipes for Visualizing Data, by Winston Chang, 2nd edition (O'Reilly Media, 2018)*
- *ggplot2: Elegant Graphics for Data Analysis, by Hadley Wickha, 2nd edition (Springer, 2016)*

27 Additional information:

For additional information, student can refer to the lecturer's website at <http://omar.alkadi.net/teaching>