![Isra University Logo]

جامعة الإسـراء

ISRA UNIVERSITY

Course Syllabus

According to JORDAN National Qualification Framework (JNQF)

Course Name: Data Visualization

Course Number: 06023254

General Course Information:

Course title	**Data Visualization**
Course number	**06023254**
Credit hours	**3**
Education type	**3**
Prerequisites/corequisites	**Visual Programming (06033113)**
Academic Program	**Computer Science\Computer Multimedia Systems**
Program code	**602**
Faculty	**Isra University**
Department	**Information Technology**
Level of course	**Computer Science\Computer Multimedia Systems**
Academic year /semester	**3**
Awarded qualification	**2021/2022**
Other department(s) involved in teaching the course	**BSc.**
Language of instruction	**None**
Date of production/revision	**English**
	March 2022

Course Coordinator:

Coordinator's name	**Venus W. Samawi**
Office No	**4113**
Office Phone extension number	
Office Hours	**10-11 Sun., 9:30-11 Mon., 12:30-2:00 Wed., 12-1 Tues.**
Email	**Venus. samawi@iu.edu.jo**

Other Instructors:

Instructor name	
Office No	
Office Phone extension number	
Office Hours	
Email	

Course Description *(English/Arabic)*:

English	Define data visualization, and how to re-represent data in clear graphics. Design and create data scenarios using available and essential data to be achieved. Explain data modelling and processing (e.g. aggregation and filtering), visual coding, and data mapping of graphic features. How to evaluate the effectiveness of perception scenarios and criticism of design decisions (colour selection and visual coding) will be illustrated. Practical part: Use data visualization tools (can be Excel, R, or D3.js) to solve problems.
Arabic	تعريف تصوير البيانات، وكيفية إعادة تمثيل البيانات في رسومات واضحة. تصميم وإنشاء تصورات بيانات باستخدام البيانات المتاحة والمهمة المراد تحقيقها. شرح نمذجة البيانات ومعالجتها (مثل التجميع والتصفية) والتشفير المرئي ورسم خرائط البيانات للسمات الرسومية. سيتم توضيح كيفية تقييم فعالية تصورات التصور وانتقاد قرارات التصميم (اختيار اللون والتشفير المرئي). الجزء العملي: استخدام أدوات تصور البيانات (يمكن أن يكونExcel, R, or D3.js) لحل المشاكل.

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Textbook: *Author(s), Title, Publisher, Edition, Year, Book website.*

1.	Andy Kirk, Data Visualisation: A Handbook for Data Driven Design 2ⁿᵈ Edition**,** SAGE Publications Ltd; 2ⁿᵈ edition (September 11, 2019)

References: *Author(s), Title, Publisher, Edition, Year, Book website.*

1.	Nathan Yau, Data Points: Visualization That Means Something 1st Edition, Wiley; 1st edition (April 15, 2013).
2.	Kieran Healy, Data Visualization (A Practical Introduction), Princeton University Press; 1st edition (January 1, 2019)
3.	Storytelling with Data: A Data Visualization Guide for Business Professionals Paperback – Illustrated, November 2, 2015
4.	Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition, O'Reilly Media, 2017 https://r4ds.had.co.nz/

Course Educational Objectives (CEOs):

1.	Introduce the concepts of data visualization including both the principles and techniques
2.	Describe categories of data visualization, graph types, and role of perception
3.	Explain the concept of collecting data and datasets, data cleaning, and data pre-processing
4.	Explain data manipulation, analysis, and mining data
5.	Use Excel and R tools to clean the dataset and perform data visualization
6.	Use Excel and R tools to visualize data

Intended Learning Outcomes (ILO's):

	Subject Intended learning outcomes (ILOs) describe what students are expected to know and be able to do at the end of the course. These outcomes are related to the knowledge, skill and competence that students acquire:	Relationship to CEOs	Contribution to PLOs	Bloom Taxonomy Levels*	Descriptors**
A	**Knowledge and Understanding:**				
1.	**Explain the concepts of data visualization including both the principles and techniques (ILO1)**	1	**PLO1**	**2**	**k**
B	**Intellectual skills:**				
1.	**Apply data preprocessing to solve dataset problems (ILO2)**	**3**	**PLO2**	**3**	**S**
2.	**Critique graphs visualizations based on data visualization theory and principles (ILO3)**	**4**	**PLO5**	**5**	**C**
C	**Subject specific skills:**				
1.	**Categorize data visualization and graph types (ILO4)**	**2**	**PLO2**	**4**	**S**
2.	**Develop a graph to visualize data utilizing the role of perception (ILO5)**	**6**	**PLO6**	**6**	**S**
D	**Transferable skills:**				
1.	**Practice data visualization (ILO6)**	**5,6**	**PLO6**	**3**	**S**

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*Bloom Taxonomy Levels

Level #	1	2	3	4	5	6
Level Name	Knowledge	Comprehension	Application	Analysis	Evaluation	Synthesis

** Descriptor (National Qualification Framework Descriptors): K : Knowledge, S: Skill, C: Competency.

Program Learning Outcome (PLOs):

Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviours that students acquire as they progress through the program. A graduate of the (CIS) program will demonstrate:		Descriptors**		
		K	S	C
1.	Analyse a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	✔		
2.	Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.		✔	
3.	Communicate effectively in a variety of professional contexts.			✔
4.	Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.			✔
5.	Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.			✔
6.	Apply computer science theory and software development fundamentals to produce computing-based solutions. [CS]		✔	

** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)

Weekly Schedule *(please choose the type of teaching)*

■ **Face to Face**

☐ **Hybrid** *(2 Lectures Face – To - Face +1 Lecture Asynchronous)*

☐ **Hybrid (***1 Lectures Face – To - Face +1 Lecture Asynchronous)*

☐ **Online** *(2 Lectures Synchronous +1 lecture Asynchronous)*

Week	First Hour (synchronous)	Second Hour (synchronous)	Third Hour (synchronous)	Ach. ILOs	Ach. PLOs	Descriptors *
1	**Introduction to data Visualization (part1)** -Data Visualization: Definition -Types of Visualization	Information Visualization	-Why is Visualization Important? -Visualization Aims	A1	PLO1	K
2	**Introduction to data Visualization (part2)** -Visualization Pipeline -Software Used in Data Visualization	- Visualization and Vision -Data Visualization -Data Presentation	-Visualization in the Data Analysis Process -Skills in Data Visualization -Charts Vs Diagrams	A1	PLO1	K
3	**Datasets and Data Processing (part1)** -Data and Attributes	-Dataset	-Excel (*practical-1*)	B1 D1	PLO2 PLO6	S
4	**Datasets and Data Processing (part2)** -Data Processing **Missing values and Data cleaning**	-Normalization -Segmentation - Sampling	-Sub-setting & expanding -Dimension reduction	B1	PLO2	S
5	Mapping nominal dimensions to. numbers	-Aggregation & summarization	- Smoothing -Filtering	B1	PLO2	S
6	**Basic graphs. Geospatial visualization (part1)** Types of Data Visualization Categories -Temporal Data	-Multidimensional Data Visualization, -Geospatial Data Visualization	-Visualization, -Hierarchical Data Visualization -Network Data Visualization	C1	PLO2	S
7	**Basic graphs. Geospatial visualization (part2)** Most Common Graph Types **-Bar chart, Line Chart**	**Scatterplot, Sparkline, Pie Chart, Gauge,**	**Funnel Chart, Histogram, Box Plot, Maps, Area Chart**	B2	PLO5	C
8	Excel (*practical-2*)	Excel (*practical-3*)	Excel (*practical-4*)	D1	PLO6	S
9	**Mid exam**	**Basic graphs. Geospatial visualization (part3)** Role of Perception - Colours	-Improve vision, -Improve understanding	B2	PLO5	C
10	**Data Mining** -First step in DataMining: Data Preprocessing -Major Tasks in Data preprocessing	-Data Quality and Data Warehouse -Mining Data Descriptive Characteristics	-Measurement in Data preprocessing -Symmetric Vs Skewed Data	B1	PLO2	S

Week	First Hour (synchronous)	Second Hour (synchronous)	Third Hour (synchronous)	Ach. ILOs	Ach. PLOs	Descriptors *
11	**Data Visualization Using –R (Part1)** • Introduction to R • Install R and Rstudio	Comments Functions In R • print() • cat() • Variables and operators and functions in R	• First program in R (read and write)	C2	PLO6	S
12	**Datasets in R :** mean() and median()	Packages and libraries	Handling missing data	C2	PLO6	S
13	**Data Visualization Using –R (Part2)** R: Data visualization (Histogram, and)	Pie chart, plot, Boxplot	R: Practical	C2	PLO6	S
14	**Data Visualization Using –R (Part3)** How to read dataset from Excel file Matrices	R: Practical	R: Practical	C2	PLO6	S
15	Project in R- illustration and discussion	Project in R- illustration and discussion	Project in R- illustration and discussion	D1	PLO6	S
16	**Final exam**					

* **K: Knowledge, S: Skills, C: Competency**

Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:
- **Interactive videos**
- **Practice Labs**
- **Discussion Forums**
- **Quizzes**
- **Other Interactive online activities**
- **Reports**

Course Policies:

A- Attendance policies:

    The maximum allowed absences is 15% of the lectures.

B- Absences from exams and handing in assignments on time:

    Midterm exam can be retaken based on approval of excuse by the instructor's discretion.

    Not handing assignment on time will incur penalties.

C- Academic Health and safety procedures

D- Honesty policy regarding cheating, plagiarism, and misbehaviour:

    Cheating, plagiarism, misbehaviour will result in zero grade and further disciplinary actions may be taken.

E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.
- Online Activities (Course Videos, Practice labs, Discussion Forums, Quizzes) **20%**
- Midterm **30%**
- Final Exam **50%**

F- Available university services that support achievement in the course: **E-Learning Platform, Labs, Library.**

Required equipment:

- **PC / Laptop with webcam and mic**
- **Internet Connection**
- **Access to the IU E-Learning Platform at: https://elearn.iu.edu.jo/**
- **E-learning plan**
- Satisfaction questionnaires for online and face-to-face learning
- Software for e-learning
- Training

Assessment Tools implemented in the course:

- **Final Exam**
- **Midterm Exam**
- **Quizzes**
- **Homework**
- Practice Labs
- Discussion Forums
- Periodic reports for learning assessment
- Improvement plans for online or face-to-face teaching
- Others:….

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Responsible Persons and their Signatures:

Course Coordinator	Venus W. Samawi	Completed Date	2022/ 3 / 10
		Signature	

Received by (Department Head)	Faisal Alzyoud	Received Date	2022/ 3 / 10
		Signature	