COURSE OUTLINE TEMPLATE

	SULTAN QABOOS UNIVERSITY COLLEGE OF SCIENCE BACHELOR OF SCIENCE IN COMPUTER SCIENCE COURSE OUTLINE	Other logo

I. COURSE INFORMATION	
COURSE CODE	COMP3602
COURSE TITLE	DATA ANALYSIS AND VISUALIZATION
OMAN QUALIFICATION FRAMEWORK (OQF) LEVEL	**6**
CREDIT HOURS	3
CONTACT HOURS	4
PRE-REQUISITES	COMP2101
CO-REQUISITES	
EQUIVALENT COURSES	
INCOMPATIBLE COURSES	

COURSE CATEGORY	□ University Requirement	□ University Elective
	□ College Requirement	□ College Elective
	□ Department Requirement	□ Department Elective
	□ Specialization Requirement	□ Specialization Elective
	X Other (specify):	Major Elective

COURSE OWNER	College: Science	Department: Computer Science
	Center:	Unit:

DELIVERY MODE	X Face to Face	□ Blended	□ Online

COURSE TYPE	□ Lecture	X Lecture/Lab
	□ Lecture/Seminar	□ Lecture/Studio
	□ Lecture/Tutorial	□ Lecture/Lab/Tutorial or Seminar
	□ Tutorial	□ Laboratory (Practical)
	□ Field or Work Placement	□ Studio

	□ Seminar	□ Internship
	□ Workshop	□ Project
	□ Thesis	□ Other (specify):
LANGUAGE OF INSTRUCTION		
COURSE DESCRIPTION	The course introduces students to manipulating, processing, cleaning, and crunching data using Python. Students will be exposed to Python libraries (such as NumPy, Pandas, and Matplotlib) needed to effectively solve a broad set of data analysis problems. It includes practical case studies. This course is suitable for data analysts who are new to Python and for Python programmers who are new to data science and scientific computing.	
TEACHING AND LEARNING STRATEGIES	□ Augmented Reality	**X** Flipped Classroom
	□ Blended Learning	**X** Problem-Based Learning
	□ Discovery-Based Learning	□ Project-Based Learning
	□ Student-Led Learning	□ Team-Based Learning
	□ Work-Based Learning	□ Other (specify):

ASSESSMENT COMPONENT AND WEIGHT	**X** In-term examination(s) (15%)	**X** Quizzes (10%)	□ Other (specify): (%)
	X Homework assignments (20%)	□ Project (%)	
	X Final examination (40%)	**X** Practical/ Lab (15%)	

TEXTBOOKS AND EDUCATIONAL MATERIAL			
GRADING METHOD	□ A-F Scale	□ Pass/Not Pass	□ Other (specify):

GRADING METHOD DESCRIPTION

	Range	Letter Grade	Description
A-F GRADING SCALE:	90 - 100	A	**Exceptional performance:** All course objectives achieved and met in a consistently outstanding manner.
	86 – 89.9	A-	
	81 – 85.9	B+	**Very Good Performance:** The majority of the course objectives achieved (majority being at least two-thirds) and met in a consistently thorough manner.
	77 – 80.9	B	
	73 – 76.9	B-	
	68 – 72.9	C+	**Satisfactory Performance:** At least most of course objectives have been achieved and met satisfactorily.
	64 – 67.9	C	
	60 – 63.9	C-	
	55 – 69.9	D+	

	50 – 54.9	D	**Minimally Acceptable Performance:** The course objectives met at a minimally acceptable level.
	0 - 49.9	F	**Unacceptable performance:** The course objectives not met at a minimally acceptable level.
PASS/NOT PASS:			
OTHER:			

II. SEMESTER INFORMATION

SEMESTER/YEAR	Spring 2025	**SECTION(S)**	01
DAY AND TIME	Sunday, 16:15-18:05 Tuesday, 16:15-18:05	**VENUE(S)**	Lab 18
COURSE COORDINATOR	Abdelhamid Abdessalem	**COURSE TEAM**	-
COORDINATOR OFFICE	0008	**OFFICE HOURS**	
COORDINATOR EXTENSION	2462	**COORDINATOR EMAIL**	ahamid@squ.edu.om

III. ALIGNMENT OF COURSE LEARNING OUTCOMES (CLO), PROGRAM LEARNING OUTCOMES (PLO), GRADUATE ATTRIBUTES (GA), AND OMAN QUALIFICATION FRAMEWORK (OQF) CHARACTERISTICS

CLO	PLO	SQU Graduate Attributes	OQF Characteristics
1. DEMONSTRATE AN UNDERSTANDING OF THE MAIN DATA ANALYSIS CONCEPTS.	1	A1	1
2. USE ADEQUATE TOOLS TO LOAD, PREPROCESS, AND TRANSFORM DIFFERENT TYPES OF DATA.	2	B1	2
3. CONDUCT STATISTICAL ANALYSIS OF A GIVEN DATASET.	1, 2	A1, B1	1, 2
4. IDENTIFY AND PRODUCE AN ADEQUATE PLOT OR CHART FOR VISUALIZING A GIVEN DATASET.	2	B1	2
5. CONDUCT BASIC DATA REGRESSION, CLASSIFICATION, AND CLUSTERING.	1, 2	A1, B1	1, 2
6. CONDUCT DATA ANALYSIS ON A SMALL SCALE REAL-LIFE PROBLEM	1, 2	A1, B1	1, 2

IV. COURSE LEARNING OUTCOMES (CLOS) AND ASSESSMENT CRITERIA AND METHODS (FOR EACH CLO)

CLO1: DEMONSTRATE AN UNDERSTANDING OF THE MAIN DATA ANALYSIS CONCEPTS.

ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		ASSESSMENT METHODS
A)	Discuss the importance of data analysis and visualization in scientific methods	Quizzes, MT
B)	Recognize different categories of data	
C)	Differentiate between descriptive, exploratory, and confirmatory data analysis and visualization	Quizzes, MT, Final

CLO2: : USE ADEQUATE TOOLS TO LOAD, PREPROCESS, AND TRANSFORM DIFFERENT TYPES OF DATA

ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		ASSESSMENT METHODS
A)	Use Adequate tools for reading datasets	HWs, LT
B)	Use adequate data presentation methods	
C)	Present a dataset in a tidy form adequate to the application	
D)	Perform adequate data cleaning	
E)	Perform Adequate data Integration	
F)	Perform adequate Data Normalization	
G)	Conduct basic statistical-based feature selection	

CLO3: CONDUCT STATISTICAL ANALYSIS OF THE DATA.

ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		ASSESSMENT METHODS
A)	Perform Dataset summarization	Quizzes, HWs, LT, MT, Final
B)	Estimate Dataset distribution	
C)	Estimate dataset skewness	
D)	Approximate samples and estimate mean, variance and standard scores and related confidence intervals	
E)	Conduct proper hypothesis testing	

CLO4: IDENTIFY AND PRODUCE AN ADEQUATE PLOT OR CHART FOR VISUALIZING A GIVEN DATASET.

ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		ASSESSMENT METHODS
A)	Use matplotlib API to display various plots and charts	HWs, LT
B)	Use seaborn API to display various plots and charts	

C)	Use adequate graphic representation of data	
D)	Recognize issues related to data visualization	Quizzes, MT and Final
CLO5: CONDUCT BASIC DATA REGRESSION, CLASSIFICATION, AND CLUSTERING.		
A)	Correctly apply simple Linear Regression	
B)	Correctly Apply multiple Linear Regression	
C)	Correctly Apply various common classification models	HWs, LT
D)	Correctly apply k-means algorithm	
E)	Properly evaluate applied regression, classification and clustering models	
CL6: CONDUCT DATA ANALYSIS ON A SMALL SCALE REAL–LIFE PROBLEM.		
A)	Define the problem	
B)	Collect the data	
C)	Clean the Data	HWs, LT
D)	Implement the solution	
E)	Visualize the results	

V. COURSE CONTENT AND SCHEDULE				
WEEK	**LECTURES #**	**TOPICS/ SUBJECTS**	**READINGS/ CHAPTERS**	**REMARKS (e.g., ASSESSMENTS)**
1	Lecture 1	Introduction to Data Science No Lab		Quiz1, MT, and Final
2	Lecture 2 Lab1	Data Collection & Sampling		Quiz1, HW1, MT, LT, and Final
3	Lecture 3 Lab2	Data Presentation **HW1 out**		Quiz1, HW1, MT, LT, and Final
4	Lecture 4 Lab3	Data Cleaning		Quiz1, HW1, MT, LT, and Final
5	Lecture 5 Lab4	Data Exploration and Visualization **HW2 out**		Quiz1, HW2, MT, LT, and Final
6	Lecture 6 Lab5	Data Transformation and Reduction **Quiz1**		Quiz2, HW2, MT, LT, and Final

7	Lecture 7 Lab6	Regression Analysis		Quiz2, HW2, MT, LT, and Final
8	Lecture 8 Lab7	Time Series Analysis **HW3 out**		Quiz2, HW3, MT, LT, and Final
9	Lecture 9 Lab 8	Basic Classification Techniques		Quiz2, HW3, MT, LT, and Final
10	Lab9	**MT**		Quiz2, HW3, LT and Final
11	Lecture 10 Lab10	Basic Classification Techniques **HW4 out**		Quiz2, HW4, LT, and Final
12	Lecture 11 Lab11	Basic Clustering Techniques **Quiz2**		HW4, LT, and Final
13	Lecture 12 Lab12	More on Data Visualization		LT, Final
14	Lab13 Lab14	Case Studies **LT**		Final
15	Lecture 13	General Revision		-
16				

VI. ADDITIONAL INFORMATION (e.g., RUBRICS, etc.)

Department's Late Submission Policy:

(a) 1-24 hours: 25% of the mark will be deducted.
(b) > 24 hours: Not accepted.

Department's Policy for Dealing with Cheating:

It is essential that each student solves all programming assignments, lab tests and exams individually unless instructed otherwise, e.g., for group projects. Copying, plagiarism, collusion, switching, and falsification are violations of the university academic regulations. Students involved in such acts will be severely penalized. The department has adopted a firm policy on this issue. A zero mark will be assigned the first time a student is caught involved in copying and his/her name will be added to a watch list maintained by the Head of Department. Further repeated involvements in copying will cause the student to get an F grade in that course. This is in line with the university academic regulations.

VII. STUDENTS RESPONSIBILITIES

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include attendance requirements and student academic code of conduct.

ACADEMIC INTEGRITY	The University expects the students to approach their academic endeavors with the highest academic integrity. Please refer to the **Undergraduate Academic Regulations**.
ADD AND DROP	Students who wish to drop or add the course should review the **Undergraduate Academic Regulations**.
ATTENDANCE	Sultan Qaboos University has a clear requirement for students to attend courses, detailed in the **Undergraduate Academic Regulations**.
ASSESSMENT AND GRADING	To ensure the provision of a sound and fair assessment and grading, please review the **Undergraduate Academic Regulations**.
GRADE APPEAL	Students who wish to appeal their grades should review the **Undergraduate Academic Regulations**.
CLASSROOM POLICIES	Students are expected to dress professionally during class time as required by the University. Use of phones or any other electronic devices in the classroom during class time is strictly prohibited. Unauthorized use may lead to faculty member confiscation of the device for the remainder of the class. Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. A student responsible for disruptive behavior may be required to leave the class.
LATE AND MAKE-UP WORK	Students are required to meet the course objectives by submitting coursework no later than the assigned due date. Students may be allowed to submit late work if approved by the course coordinator. Assignments submitted after the due date may be penalized.
MISSED EVALUATIONS	All quizzes, tests, clinical evaluations, and exams must be completed by the date they are assigned. If a quiz, test, or exam is missed due to a documented emergency situation (e.g., medical emergency, death in the immediate family), it is the student's responsibility to contact the instructor.
OTHER	

Course Outline Appendix

1. **PROGRAM LEARNING OUTCOMES**

   SO1: Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify possible 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

   SO3: Communicate effectively in a variety of professional contexts

   SO4: Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

   SO5: Work in a team to solve real-life problems requiring Pattern Recognition-based solutions

   SO6: Apply computer science theory and software development fundamentals to produce computing-based solutions

2. **SQU GRADUATE ATTRIBUTES AND COMPETENCIES FOR UNDERGRADUATE STUDIES**

GRADUATE ATTRIBUTES	GRADUATE COMPETENCIES FOR UNDERGRADUATE STUDIES
A. Cognitive Capabilities: The graduate has sufficient general and specialized theoretical knowledge that enables him/her to deal well with his/her specialty and other related fields.	1. Demonstrates familiarity and works with advanced specialized knowledge in the area of specialization.
	2. Demonstrates a general understanding of the relationship of advanced specialized knowledge with knowledge in other relevant professional fields and aspects.
	3. Demonstrates a comprehensive understanding of the theories, principles, and methods used in his/her specialty, and how to create and apply new knowledge.
	4. Demonstrates general knowledge of the legal environment and necessary relevant regulatory frameworks.
	5. Shows awareness of contemporary literature and research.

B. Skill and Professional Capability: The graduate has sufficient skill and practical experience that enables him/her to perform all tasks related to the specialization and other related fields.	1. Applies concepts, theories, and investigative methods to synthesize and interpret information to evaluate conclusions.
	2. Applies appropriate research methods and techniques and employs digital knowledge
	3. Evaluates and critiques information independently
	4. Uses cognitive and technical skills to analyze complex issues and develop appropriate solutions.
	5. Initiates new ideas or processes in the professional, educational or research context.
C. Effective Communication: The graduate has the ability to communicate effectively with others to achieve the desired results	1. Explains, presents, and adapts information to suit the recipients.
	2. Employs appropriate information and communication technology to collect and analyze information.
D. Autonomy and Leadership: The graduate has the ability to lead, make decisions and take responsibility for decisions.	1. Performs advanced professional activities independently.
	2. Demonstrates leadership skills.
	3. Takes professional responsibility.
	4. Assumes full accountability for the tasks and their output.
E. Responsibility and Commitment: The graduate appreciates the importance of available resources and deals with them effectively and is committed to the ethics of the profession and society.	1. Manages time and other resources assigned to accomplishing tasks effectively and responsibly.
	2. Demonstrates effective practices when working in teams.
	3. Demonstrates advanced levels of understanding of values and ethics relevant to the specialization, profession and local and international society and

	promotes them among others.
	4. Works within the professional, institutional, and specialization guiding frameworks and strategic plans.
	5. Interacts with community affairs positively and preserves national identity.
F. Development and Innovation: The graduate has a passion for development and innovation in the field of specialization.	1. Demonstrates the ability to independently manage learning tasks, with an awareness of how to develop and apply new knowledge.
	2. Utilizes specialized knowledge and skills for entrepreneurship.
	3. Utilizes creative and innovative skills in the field of specialization.

3. **OQF Characteristics**
   1. Knowledge
   2. Skills
   3. Communication, Numeracy, and Information and Communication Technology Skills.
   4. Autonomy and Responsibility
   5. Employability and Values
   6. Learning to learn