

I. COURSE INFORMATION				
COURSE CODE	COMP3203			
COURSE TITLE	Introduction to Data Structures and Algorithms			
OMAN QUALIFICATION	6			
FRAMEWORK (OQF) LEVEL	V			
CREDIT HOURS	3			
CONTACT HOURS	4	4		
PRE-REQUISITES	(COMP2202 or COMP3200) and M	ATH334(and LANC2058	
CO-REQUISITES	-			
EQUIVALENT COURSES	-			
INCOMPATIBLE COURSES	-			
	□ University Requirement		🗆 Universit	y Elective
	□College Requirement		🗆 College E	Elective
	⊠ Department Requirement		□ Department Elective	
COURSE CATEGORY	□ Major Requirement		🗆 Major Ele	ective
	□ Specialization Requirement		□ Specializ	ation Elective
	□ Other (specify):			
COUDSE OWNED	College: Science		Department:	Computer Science
COURSE OWNER	Center:		Unit:	
DELIVERY MODE	\boxtimes Face to Face	🗆 Ble	nded	□ Online
			□ Lecture/L	ab
	□ Lecture/Seminar		□ Lecture/Studio	
	⊠ Lecture/Tutorial		☐ Lecture/Lab/Tutorial or Seminar	
COURSE TYPE	□Tutorial		□ Laboratory (Practical)	
	□ Field or Work Placement		□ Studio	
	□Seminar		🗆 Internship	,
	□ Workshop		Project	
			□ Other (specify):	

LANGUAGE OF Instruction	English					
COURSE DESCRIPTION	This course introduces the basic data structures, and algorithms for processing data. It emphasizes how to specify, use, and implement Abstract Data Types (ADT). The course also covers algorithm complexity analysis techniques. Topics covered include ADTs (e.g. lists, stacks, queues, trees, hash tables), and basic sorting, and searching algorithms.					
	□ Augment	ed Reality		\Box Flipped C	Classroom	
T	□ Blended	Learning		⊠ Problem-	Based Lear	ning
TEACHING AND LEARNING	□ Discover	y-Based Learning		□ Project-B	ased Learni	ing
SIKALEGIES	□ Student-I	Led Learning		☑ Team-Based Learning		
	🗆 Work-Ba	sed Learning		□ Other (sp	ecify):	
	⊠In-term ex	kamination(s) (30%	ó)	🛛 Quizzes ((10%)	□Other
ASSESSMENT COMPONENT	🛛 4 Homew	vork assignments (2	20%)	□Project (%)	(specify)
AND WEIGHT	⊠ Final exa	mination (40%)			' Lab (%)	: (%)
TEXTBOOKS AND Educational Material	 Data Structures and Algorithm Analysis, online edition 3.2(Java Version), Clifford A. Shaffer, Department of Computer Science, Virginia Tech (http://people.cs.vt.edu/~shaffer/Book/) Reference: Algorithms in C++ (Parts 1-4), by Sedgewick, 3rd Ed, Addison Wesley 1998 			on), Clifford nia Tech, son Wesley,		
GRADING METHOD	\boxtimes A-F Scale	e	\Box Pas	s/Not Pass	\Box Other	(specify):
GRADING METHOD DESCRIP	TION		_			
	Range	Letter Grade	F	Description		11
	90 - 100	A	Exce	Exceptional performance: All course		Il course
	80 - 89.9	A-	cons	objectives achieved and met in a consistently outstanding manner		ll a Der
	81 - 85.9	B+	Very	Very Good Performance: The		ne
	77 – 80.9	B	majo	ority of the cou	urse objectiv	ves
	73 – 76.9	B-	achie	eved (majority	being at le	ast two-
			third	s) and met in	a consistent	ly
A-F GRADING SCALE:		~	thore	ough manner.		
	68 - 72.9	<u>C+</u>	Satis	sfactory Perf	ormance: A	At least
	64 - 67.9	<u> </u>	most	most of course objectives have been		e been
	00 - 03.9 55 - 59.9	 	Min		table Perfo	y. rmanca:
	50 - 54.9		The	course obiecti	ves met at a	
	50 5115	D	mini	mally accepta	ble level.	•
	0-49.9	F	Una	cceptable per	formance:	The
			cour	course objectives not met at a		
			mini	mally accenta	hle level	

II. SEMESTER INFORMATION			
SEMESTER/YEAR	Spring 2025	SECTION(S)	1, 2
DAY AND TIME	Sec 1: MON/WED 8:00-9:50 Sec 2: MON/WED 12:00-13:50	VENUE(S)	Sec 1: MON LET3, WED CMT/ D04 Sec 2: MON/WED CMT/D17
COURSE COORDINATOR	Dr. Farha Al Kharousi	COURSE TEAM	Sec 1: Dr. Abir Al Hajri Sec 2: Dr. Farha Al Kharousi
COORDINATOR OFFICE	0209	OFFICE HOURS	Dr. Abir: SUN 10:00-11:00 Dr. Farha: MON & TUE 10:30- 11:30
COORDINATOR EXTENSION	2228	COORDINATOR Email	farha@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 / SO	SQU Graduate Attributes	OQF Characteristics
Demonstrate a foundational understanding of data structures and algorithms, including their definitions, significance, and applications in computer science.	1	А	1
Apply algorithm analysis techniques to evaluate the time and space complexity of various algorithms, enabling comparisons of their efficiency.	1,3	A, C, D	1, 3, 4
Develop and implement elementary sorting methods (such as bubble sort, selection sort, and insertion sort) and searching methods (like linear and binary search) to solve practical problems.	2	А	1
Apply recursive techniques and the divide and conquer paradigm to design efficient algorithms, specifically implementing merge sort and quicksort.	1,2	A, D	1,4
Construct and manipulate fundamental data structures, including lists, stacks, queues, binary trees, binary search trees, and graphs, to understand their properties and operations.	1,2	А	1
Explain and implement hashing techniques to efficiently store and retrieve data, recognizing the importance of hash functions and collision resolution strategies.	1,2	A, D	1,4

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

CLO1: Demonstrate a foundational understanding of data structures and algorithms, including their definitions, significance, and applications in computer science.

ASSESSM	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS	
STUDENT	TMUST)		
A)	Define key terms related to data structures and algorithms accurately.	HW1, Midterm, and/or Final	
B)	Explain the importance of data structures and algorithms in solving computational problems.	HW1, Midterm, and/or Final	
C)	Differentiate between various types of data	HW1, Midterm, and/or Final	
	structures and algorithms based on their		
CI 02.	Apply algorithm analysis techniques to evaluate th	a time and anece complexity of various	
algorithm	Apply algorithm analysis techniques to evaluate the	e time and space complexity of various	
		A GERGAMENTE METHODG	
ASSESSM	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS	
STUDENT	MUST)	UW1 Midterm and/or Final	
A)	using Big O notation.	H w 1, Mildterm, and/or Final	
B)	Compare the space complexity of different	HW1, Midterm, and/or Final	
	algorithms and discuss trade-offs.		
C)	Evaluate the efficiency of algorithms through empirical analysis and theoretical justification.	HW1, Midterm, and/or Final	
CLO3: Develop and implement elementary sorting methods (such as bubble sort, selection sort, and			
insertion	sort) and searching methods (like linear and binary se	earch) to solve practical problems.	
ASSESSM	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS	
STUDENT	TMUST)		
A)	Write code to implement and test elementary sorting algorithms.	HW1, Midterm, and/or Final	
B)	Demonstrate the ability to implement and utilize elementary searching algorithms in practical scenarios.	HW2, Midterm, and/or Final	
C)	Analyze the performance of sorting and searching	HW1, HW2, Midterm, and/or Final	
	algorithms based on varying input sizes and types.		
CLO4: <i>A</i>	Apply recursive techniques and the divide and conque	er paradigm to design efficient algorithms,	
specifica	lly implementing merge sort and quicksort.		
ASSESSM	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS	
STUDENT	T MUST)		
A)	Solve problems using recursive algorithms and	HW2, HW3, Quiz, and/or Final	
	explain the base and recursive cases.		
B)	Implement and compare the efficiency of merge	HW2, HW3, Quiz, and/or Final	
<u>()</u>	Soft and quicksoft infough coding assignments.	HW2 HW3 Quiz and/or Final	
C)	recursion versus iterative solutions.	11112, 11113, Quiz, and of 1 mar	
CL05: (Construct and manipulate fundamental data structure	es, including lists, stacks, queues, binary	

trees, binary search trees, and graphs, to understand their properties and operations.		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE ASSESSMENT METHODS		
STUDENT	TMUST)	
A)	Create and manipulate lists, stacks, and queues, demonstrating understanding of their operations.	HW3, HW4, Quiz, and/or Final
B)	Implement binary trees and binary search trees, showcasing traversal methods (in-order, pre-order, post-order).	HW4, Quiz, and/or Final
C)	Solve problems using graphs, implementing appropriate graph algorithms (e.g., DFS, BFS)	HW4, Quiz, and/or Final
CLO6: Explain and implement hashing techniques to efficiently store and retrieve data, recognizing the		
importan	ce of hash functions and collision resolution strategie	S.
ASSESSM	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS
ASSESSM STUDENT	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST)	ASSESSMENT METHODS
ASSESSM STUDENT A)	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST) Explain the concept of hashing and the role of hash functions in data storage.	ASSESSMENT METHODS HW4, Quiz, and/or Final
ASSESSM STUDENT A) B)	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST) Explain the concept of hashing and the role of hash functions in data storage. Implement a hash table with collision resolution techniques (e.g., chaining, open addressing).	ASSESSMENT METHODS HW4, Quiz, and/or Final HW4, Quiz, and/or Final
ASSESSM STUDENT A) B) C)	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST) Explain the concept of hashing and the role of hash functions in data storage. Implement a hash table with collision resolution techniques (e.g., chaining, open addressing). Analyze the efficiency of different hashing strategies and their impact on data retrieval	ASSESSMENT METHODS HW4, Quiz, and/or Final HW4, Quiz, and/or Final HW4, Quiz, and/or Final

V. COURSE CONTENT AND SCHEDULE				
WEEK	LECTURES	TOPICS/ SUBJECTS	READINGS/ CHAPTERS	REMARKS (e.g.,
	#			ASSESSMENTS)
1		Introduction: Data Structures	chap. 1 of textbook 1 (1.1, 1.2,	HW1, Midterm, and/or
		and Algorithms	1.4)	Final
2		Algorithm analysis	chap. 3 of textbook 1	HW1, Midterm, and/or
				Final
3		Algorithm analysis	chap. 3 of textbook 1	HW1, Midterm, and/or
				Final
4		Elementary sorting methods	chap. 7 of textbook $1(7.1, 7.2)$	HW1, Midterm, and/or
5		Flementary searching	chap 12 of textbook 2 (121-124)	HW2 Midterm and/or
5		methods	chap. 12 of textbook 2 (12.1-12.4)	Final
6		ר י ר	chap. 2 of textbook 1 (2.5) and	HW2, Midterm, and/or
		Recursion	chap. 5 of textbook 2 (5.1)	Final
7		Divide & Conquer	chap. 5 of textbook 2 (5.2)	HW2, Midterm, Quiz,
		Divide & Conquer		and/or Final
8		Merge sort	chap. 7 of textbook 1 (7.4)	HW3, Quiz, and/or Final
9		Quicksort	chap. 7 of textbook 1 (7.5)	HW3, Quiz, and/or Final
10		Lists	chap. 4 of textbook 1 (4.1)	HW3, Quiz, and/or Final
11		Stacks	chap. 4 of textbook 1 (4.2)	HW4, Quiz, and/or Final
12		Queues	chap. 4 of textbook 1 (4.3)	HW4, and/or Final
13		Binary Trees and Binary Search Trees	chap. 5 of textbook 1 (5.1 – 5.4)	HW4, and/or Final
14		Graphs	chap.11 of textbook 1 (11.1 – 11.3)	HW4, and/or Final
15		Hashing	chap. 9 of textbook 1 (9.4)	HW4, and/or Final

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

Assessment Plan:

Item	Date out	Due date	Weight
Hw1	Week 3	Week 5*	5%
Hw2	Week 6	Week 8*	5%
Midterm	Week 7 (2:15 P.M., Thursday: 20 March)		30%
Hw3	Week 9	Week 11*	5%
Quiz	Week 12 (2:15 P.M., Thursday: 24 April)		10%
Hw4	Week 12	Week 14*	5%
Final	May 26st, 2025 MON 11:30-14:30		40%
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*The submission day/time for all assignments is Monday 11:55 P.M.

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	The University expects the students to approach their academic endeavors with
INTEGRITY	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	To ensure the provision of a sound and fair assessment and grading, please review
GRADING	the Undergraduate Academic Regulations.
GRADE APPEAL	Students who wish to appeal their grades should review the Undergraduate
	Academic Regulations.
CLASSROOM	Students are expected to dress professionally during class time as required by the
POLICIES	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	Students are required to meet the course objectives by submitting coursework no
WORK	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	All quizzes, tests, clinical evaluations, and exams must be completed by the date
EVALUATIONS	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 / STUDENT OUTCOMES

- 1. Analyze 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 computingbased solutions.

GRADUATE ATTRIBUTES	GRADUATE COMPETENCIES FOR UNDERGRADUATE
	STUDIES
A. Cognitive Capabilities: The graduate has	1. Demonstrates familiarity and works with
sufficient general and specialized theoretical	advanced specialized knowledge in the area of
knowledge that enables him/her to deal well	specialization.
with his/her specialty and other related fields.	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

2. SQU Graduate Attributes and Competencies for Undergraduate Studies

	frameworks.
	5. Shows awareness of contemporary literature and
	research.
B. Skill and Professional Capability: The	1. Applies concepts, theories, and investigative
graduate has sufficient skill and practical	methods to synthesize and interpret information
experience that enables him/her to perform all	to evaluate conclusions.
tasks related to the specialization and other	2. Applies appropriate research methods and
related fields.	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	1. Explains, presents, and adapts information to suit
has the ability to communicate effectively with	the recipients.
others to achieve the desired results	2. Employs appropriate information and
	communication technology to collect and analyze
	information.
D. Autonomy and Leadership: The graduate	1. Performs advanced professional activities
has the ability to lead, make decisions and take	independently.
responsibility for decisions.	2. Demonstrates leadership skills.
	3. Takes professional responsibility.
	4. Assumes full accountability for the tasks and their
	output.
E. Responsibility and Commitment: The	1. Manages time and other resources assigned to
graduate appreciates the importance of	accomplishing tasks effectively and responsibly.
available resources and deals with them	2. Demonstrates effective practices when working in
	teams.

effectively and is committed to the ethics of	3. Demonstrates advanced levels of understanding
the profession and society.	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	1. Demonstrates the ability to independently manage
graduate has a passion for development and	learning tasks, with an awareness of how to
innovation in the field of specialization.	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