

SULTAN QABOOS UNIVERSITY COLLEGE OF SCIENCE DEPARTMENT OF COMPUTER SCIENCE BACHELOR OF SCIENCE IN COMPUTER SCIENCE COURSE OUTLINE

I. COURSE INFORMATION						
COURSE CODE	COMP4205					
COURSE TITLE	Competitive Programming					
OMAN QUALIFICATION	7 OP 8					
FRAMEWORK (OQF) LEVEL						
CREDIT HOURS	3	3				
CONTACT HOURS	4					
PRE-REQUISITES	COMP3203					
Co-Requisites	-					
EQUIVALENT COURSES	-					
INCOMPATIBLE COURSES	-					
	□ University Requirement		□ University	y Elective		
	□College Requirement		□ College Elective			
	Department Requirement		□ Department Elective			
COURSE CATEGORY	□ Major Requirement		🛛 Major Ele	ective		
	□ Specialization Requirement		🗆 Specializa	ation Elective		
	\Box Other (specify):					
COUDSE OWNED	College: Science		Department:	Computer Science		
COURSE OWNER	Center:		Unit:			
DELIVERY MODE	\boxtimes Face to Face	\Box Ble	nded	□ Online		
			⊠ Lecture/La	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			
	□ Thesis		□ Other (specify):			

LANGUAGE OF	English					
Course Description	This course introduces the concepts and techniques of the competitive programming environments. The course aims to strengthen the students' abilities to analyze problems effectively, design and implement solutions using available resources, and employ data structures and algorithms learned previously to produce efficient solutions for some real- life problems. In particular, the course uses hands-on approach to emphasize the understanding of basic mathematics, data-structures, dynamic programming, graphs algorithms, search algorithms, string manipulation algorithms, and computational geometry.					
		ted Reality		□ Flipped C	Classroom	
	□ Blended	Learning		⊠ Problem-	Based Lear	ning
TEACHING AND LEARNING	□ Discover	y-Based Learning		□ Project-B	ased Learn	ing
SIKALEGIES	□ Student-I	Led Learning		🖾 Team-Ba	sed Learnin	ıg
	□ Work-Ba	sed Learning		\Box Other (sp	ecify):	
	⊠In-term e	xamination(s) (30%	%)	🗆 Quizzes ((10%)	□Other
ASSESSMENT COMPONENT	⊠ Homewo	ork assignments (30	0%)	□Project (%)	(specify)
AND WEIGHT	\boxtimes Final examination (40%)			$\Box \text{ Practical/ Lab (\%)} : $: (%)
TEXTBOOKS AND Educational Material	 Textbook: Competitive Programming, 3rd Edition, Steven Halim and Felix Halim, 20 ISIN: B00FG8MNN8 Reference: Programming Challenges: The Programming Contest Training Manu Steven S. Skiena and Miguel A. Revilla, Publisher: Springer, 2003, ISBN: 90 038700163 			Halim, 2013, ing Manual, ISBN: 978-		
GRADING METHOD	⊠ A-F Scale [□ Pass/Not Pass □ Other (specify):		(specify):
GRADING METHOD DESCRIP	TION					
	Range	Letter Grade		Desc	cription	
	90 – 100 86 – 89.9	A A-	object cons	Exceptional performance: All course objectives achieved and met in a consistently outstanding manner.		n a ner.
	81 - 85.9	B+	Very	Good Perfo	rmance: Th	ne
	77 - 80.9	В	majo	prity of the cou	urse objectiv	ves
	73 – 76.9	В-	achie	eved (majority	being at le	ast two-
A-F GRADING SCALE:			thore	bugh manner.	a consistent	lly
	68 - 72.9	C+	Satis	sfactory Perfe	ormance: A	At least
	64 - 67.9	С	most	of course obj	ectives hav	e been
	60 - 63.9	C-	achie	eved and met	satisfactoril	у.
	55 50.0			Minimally Acceptable Performance:		
	55 – 59.9	D+	Min	imally Accep	table Perfo	rmance:
	55 - 59.9 50 - 54.9	D+ D	Min The	imally Accept course objecti	table Perfo ves met at a	ermance:

0-49.9	F	Unacceptable performance: The
		course objectives not met at a
		minimally acceptable level.

II. SEMESTER INFORMATION				
SEMESTER/YEAR	Spring 2020	SECTION(S)	1	
DAY AND TIME	MON/WED 8:00-9:50	VENUE(S)	SCI/0019B	
COURSE COORDINATOR	Dr. Abir Al Hajri	COURSE TEAM		
COORDINATOR OFFICE	0232	OFFICE HOURS	SUN 10:00-11:00	
COORDINATOR EXTENSION	2400	COORDINATOR	abir@squ.edu.om	
		EMAIL		

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
Participate productively in local, regional, and international programming contests.	1, 2, 5, 6	B, D, E	2, 4, 5
Design and implement efficient algorithms to solve problems.	2,6	A, B	1,2
Apply techniques to work out fast, efficient and cost- effective solutions.	2,6	B, F	2,6
Employ different concepts and algorithms to design solutions for real-life problems.	2,6	A, B	1,2
Collaborate effectively in a teamwork.	5	B, C, E	2, 3, 5
Manage work-stress.	4	D, E	4,5
Acquire self-development skills.	6	E, F	4,6

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

CLO1: Participate productively in local, regional, and international programming contests.

ASSESSM STUDENT	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST)	ASSESSMENT METHODS
A)	Demonstrates effective problem-solving skills in a competitive environment.	Participation in mock group programming contests (Course exams as
B)	Applies algorithms and data structures efficiently under time constraints.	mock contest).

C)	Collaborates with team members to optimize			
	solutions.			
CLO2: 1	Design and implement efficient algorithms to solve pr	oblems.		
ASSESSM	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS		
STUDENT	MUST)			
A)	Designs algorithms that meet specified	Coding assignments focused on		
	performance criteria.	algorithm design.		
B)	Implements algorithms using appropriate	Practical exams or assignments		
(\mathbf{C})	Tests and refines algorithms to ensure correctness	Code reviews and debugging everyises		
C)	and efficiency	code reviews and debugging excretses.		
CLO3: A	Apply techniques to work out fast, efficient and cost-e	ffective solutions.		
ASSESSN	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS		
STUDENT	MUST)			
A)	Identifies and applies optimization techniques to	Case studies analyzing different solution		
)	improve solution efficiency.	approaches or optimization challenges in		
B)	Evaluates the cost-effectiveness of different	lab settings.		
	approaches.			
C)	Demonstrates the ability to balance trade-offs			
AT A A	between speed and resource usage.			
CLO4: Employ different concepts and algorithms to design solutions for real-life problems.				
ASSESSM	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	Assessment Methods		
ASSESSM STUDENT	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST)	Assessment Methods		
ASSESSM STUDENT A)	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Integrates multiple algorithms and concepts to	ASSESSMENT METHODS Mock contest involving real-life problem conneries		
ASSESSM STUDENT A)	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Integrates multiple algorithms and concepts to address complex problems.	ASSESSMENT METHODS Mock contest involving real-life problem scenarios.		
ASSESSM STUDENT A) B)	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Integrates multiple algorithms and concepts to address complex problems. Adapts solutions to meet real-world constraints and requirements	ASSESSMENT METHODS Mock contest involving real-life problem scenarios.		
ASSESSM STUDENT A) B) C)	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST) Integrates multiple algorithms and concepts to address complex problems. Adapts solutions to meet real-world constraints and requirements.	ASSESSMENT METHODS Mock contest involving real-life problem scenarios.		
ASSESSM STUDENT A) B) C) CLO5: (ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST) Integrates multiple algorithms and concepts to address complex problems. Adapts solutions to meet real-world constraints and requirements.	ASSESSMENT METHODS Mock contest involving real-life problem scenarios.		
ASSESSM STUDENT A) B) C) CLO5: (ASSESSM	Integrates multiple algorithms and concepts to address complex problems. Adapts solutions to meet real-world constraints and requirements. Collaborate effectively in a teamwork. ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS Mock contest involving real-life problem scenarios. ASSESSMENT METHODS		
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ASSESSM STUDENT A) B) C) CLO5: (ASSESSM STUDENT A)	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST) Integrates multiple algorithms and concepts to address complex problems. Adapts solutions to meet real-world constraints and requirements. Collaborate effectively in a teamwork. ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE CMUST) Contributes actively to team discussions and decision-making.	ASSESSMENT METHODS Mock contest involving real-life problem scenarios. ASSESSMENT METHODS Peer assessments of teamwork and collaboration.		
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ASSESSM STUDENT A) B) C) CLO5: C ASSESSM STUDENT A) B) C) CLO6: N	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Integrates multiple algorithms and concepts to address complex problems. Adapts solutions to meet real-world constraints and requirements. Collaborate effectively in a teamwork. ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Contributes actively to team discussions and decision-making. Manage work-stress.	ASSESSMENT METHODS Mock contest involving real-life problem scenarios. ASSESSMENT METHODS Peer assessments of teamwork and collaboration.		
ASSESSM STUDENT A) B) C) CLO5: (ASSESSM STUDENT A) B) C) CLO6: N ASSESSM	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Integrates multiple algorithms and concepts to address complex problems. Adapts solutions to meet real-world constraints and requirements. Collaborate effectively in a teamwork. ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Contributes actively to team discussions and decision-making. Manage work-stress. ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS Mock contest involving real-life problem scenarios. ASSESSMENT METHODS Peer assessments of teamwork and collaboration. ASSESSMENT METHODS ASSESSMENT METHODS		
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ASSESSM STUDENT A) B) C) CLO5: C ASSESSM STUDENT A) C) CLO6: N ASSESSM STUDENT A)	ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Integrates multiple algorithms and concepts to address complex problems. Adapts solutions to meet real-world constraints and requirements. Collaborate effectively in a teamwork. ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Contributes actively to team discussions and decision-making. Manage work-stress. ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Manage work-stress. ENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE TMUST) Maintains productivity and focus under pressure.	ASSESSMENT METHODS Mock contest involving real-life problem scenarios. ASSESSMENT METHODS Peer assessments of teamwork and collaboration. Peer assessment questionnaire Reflective self-assessment questionnaire on personal stress experiences and		
ASSESSM STUDENT A) B) C) CLO5: (ASSESSM STUDENT A) B) C) CLO6: N ASSESSM STUDENT A)	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST) Integrates multiple algorithms and concepts to address complex problems. Adapts solutions to meet real-world constraints and requirements. Collaborate effectively in a teamwork. IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST) Contributes actively to team discussions and decision-making. Manage work-stress. IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE MUST) Maintains productivity and focus under pressure.	ASSESSMENT METHODS Mock contest involving real-life problem scenarios. ASSESSMENT METHODS Peer assessments of teamwork and collaboration. Peer assessments of teamwork and collaboration. Reflective self-assessment questionnaire on personal stress experiences and strategies.		

C)		
CLO7: <i>A</i>	Acquire self-development skills.	
ASSESSM	IENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE	ASSESSMENT METHODS
STUDENT	TMUST)	
A)	Sets and achieves personal development goals.	Personal development plans with
		milestones.
B)		
C)		

V. COURS	V. COURSE CONTENT AND SCHEDULE				
WEEK	LECTURES #	TOPICS/ SUBJECTS	R EADINGS/ CHAPTERS	REMARKS (e.g.,	
1	#	Understand Competitive Programming environments, Tips to Compete, teaching & Learning tools, and setting-up own training environment.	chap. 1 of textbook	HW1, Exam 1, Exam 2, and/or Final	
2		Getting started with Easy Problems.		HW1, Exam 1, Exam 2, and/or Final	
3		Linear and non-linear data- structures, Built-in libraries, Hands-on programming: graphs, sets, trees, binary index	chap. 2 of textbook (2.2, 2.3)	HW1, Exam 1, Exam 2, and/or Final	
4		Complete Search, Divide & Conquer, Greedy: Complete search (Iterative, Recursive), binary search, greedy, Advanced search techniques	chap. 3 of textbook (3.1 – 3.4)	HW2, Exam 1, Exam 2, and/or Final	
5		Practical Exam 1			
6		Basics: Illustration, Classical & non-classical examples, Directed Acyclic Graph	chap. 2 of textbook (2.4.1)	HW2, Exam 2, and/or Final	
7		More Techniques: Combinatorics, Probability Theory, String processing with DP, Advanced DP techniques.	chap. 5 of textbook (5.2, 5.4) and chap. 6 of textbook	HW2, Exam 2, and/or Final	
8		Graph traversal, minimum spanning tree, shortest path algorithms	chap. 4 of textbook (4.1 – 4.5)	HW3, Exam 2, and/or Final	
9		Practical Exam 2			
10		Network flow algorithms,	chap. 4 of textbook (4.6)	HW3, and/or Final	

	special graphs			
11	Featured Data Combinatoric Theory, Proba game theory.	-types, ch s, Number bility Theory,	nap. 5 of textbook (5.2 - 5.4, 5.8)	HW3, and/or Final
12	Processing Sk matching: KM 2D grid match & Dynamic p Suffix tree/arm	ills, String IP algorithm, ing, Strings ch ogramming, ay.	nap. 6 of textbook (6.4, 6.6)	HW3, and/or Final
13	Basic geometr polygon proce (Problem Set	y objects, ssing ch	nap. 7 of textbook (7.3)	Final
14	Advanced sea advanced Dyn Programming decomposition 10&11&12)	ch algorithms, amic Problem ch a (Problem Set	nap.8 of textbook (8.1 – 8.4)	Final
15	Final Exam			

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

Assessment Plan:

Item	Date out	Due date	Weight
Hw1	Week 2	Week 4*	10%
Exam 1	Week 5 (Lab Contest, Group)		10%
Hw2	Week 6	Week 10*	10%
Exam 2	Week 9 (Lab Contest, Group)		20%
Hw3	Week 11	Week 13*	10%
Final (Lab Contest, Individual)	Week 15		40%

*The submission day/time for all assignments is Saturday 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

A. PROGRAM LEARNING OUTCOMES / STUDENT OUTCOMES

- 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.
- 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. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
- SO6. Apply computer science theory and software development fundamentals to produce computing-based solutions.

B. SQU Graduate Attributes and Competencies for Undergraduate Studies

GRADUATE ATTRIBUTES	GRADUATE COMPETENCIES FOR UNDERGRADUATE		
	STUDIES		
A. Cognitive Capabilities: The graduate	1. Demonstrates familiarity and works with advanced		
has sufficient general and specialized	specialized knowledge in the area of specialization.		
theoretical knowledge that enables him/her	2. Demonstrates a general understanding of the		
to deal well with his/her specialty and other	relationship of advanced specialized knowledge with		
related fields.	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:	1.	Applies concepts, theories, and investigative methods
The graduate has sufficient skill and		to synthesize and interpret information to evaluate
practical experience that enables him/her		conclusions.
to perform all tasks related to the	2.	Applies appropriate research methods and techniques
specialization and other related fields.		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	1.	Explains, presents, and adapts information to suit the
graduate has the ability to communicate		recipients.
effectively with others to achieve the	2.	Employs appropriate information and communication
desired results		technology to collect and analyze information.
D. Autonomy and Leadership: The	1.	Performs advanced professional activities
graduate has the ability to lead, make		independently.
decisions and take responsibility for	2.	Demonstrates leadership skills.
decisions.	3.	Takes professional responsibility.
	4.	Assumes full accountability for the tasks and their
		output.
E. Responsibility and Commitment:	1.	Manages time and other resources assigned to
The graduate appreciates the importance		accomplishing tasks effectively and responsibly.
of available resources and deals with them	2.	Demonstrates effective practices when working in
effectively and is committed to the ethics		teams.
of the profession and society.	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	1.	Demonstrates the ability to independently manage
graduate has a passion for development		learning tasks, with an awareness of how to develop
and innovation in the field of	i	and apply new knowledge.
specialization.	2.	Utilizes specialized knowledge and skills for entrepreneurship.
	3.	Utilizes creative and innovative skills in the field of specialization.

C. 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