Republic of Yemen
Minster of Higher Education
and Scientific Research
Sana'a University
Faculty of Computer & IT
Quality Assurance Unit

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
جامعة - صنعاء
كلية الحاسوب وتكنولوجيا المعلومات
وحدة ضمان الجودة

Course Specification of Data Structures and Algorithms

Course No (.....)

2020/2021

Head of Department	Vise Dean for Qulity Assurance	Dean of the Faculty	Dean of Development center and Quality Assurance
Assoc. Prof. Mansour N. Ali	Dr. Anwar Al-Shamiri	Dr. Nagi Al-Shibani	Assoc. Prof. Dr.Huda Al.Emad

Rector of Sana'a University

Prof. Dr. Qassim Mohammed Abbas

I. Course Identification and General Information:

1	**Course Title:**	Data Structures and Algorithms				
2	**Course Code & Number:**					
3	**Credit hours:**	C.H				TOTAL
		Th.	Seminar	Pr	Tr.	
		2	-	2	-	3
4	**Study level/ semester at which this course is offered:**	2nd Level -2nd Semester				
5	**Pre –requisite (if any):**	Programming Fundamentals				
6	**Co –requisite (if any):**	None				
7	**Program (s) in which the course is offered:**	IS, CS, IT				
8	**Language of teaching the course:**	English/Arabic				
9	**Study System**	Term based system				
10	**Mode of delivery:**	Full Time				
11	**Location of teaching the course:**	Faculty of Computer and Information Technology				
12	**Prepared By:**	Dr. Mansour N. Ali				
13	**Date of Approval**					

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II. Course Description:

This course covers the analysis, design, and implementation of data structures and algorithms to solve computing problems. Topics include subtyping, abstract base class, lists, stacks, queues, trees, graphs, hash tables, strategies for choosing appropriate data structure, the algorithms used to manipulate these structures, and their application to solving practical computing problems.

III. Course Intended learning outcomes (CILOs) of the course (maximum 8CILOs)		Referenced PILOs (Only write code number of referenced Program Intended learning outcomes
a.1	Define basic data structures (such as an array-based list, linked list, stack, queue, binary search tree) and algorithms.	A1, A3
a.2	Explain how to use a specific data structure in modelling a given problem.	A1, A3
b.1	Analyze the asymptotic time complexity of the algorithm or code segment.	B1, B2
b.2	Formulate new solutions for programing problems or improve existing code using learned algorithms and data structures.	B1, B2, B3
c.1	Apply appropriate data structures for solving computing problems	C1, C2
c.2	Develop computer programs to implement different data structures and related algorithms.	C1, C2
d.1	Evaluate algorithms and data structures in terms of time and memory complexity of basic operations.	D2
d.2	Work in a team to analyze, design, and implementation of data structures and algorithms to solve practical problems.	D1

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(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1- Define basic data structures (such as an array-based list, linked list, stack, queue, binary search tree) and algorithms. **a2-** Explain how to use a specific data structure in modelling a given problem.	–Lecture and presentation –Dialogue and discussion. –Self and cooperative learning –Brainstorming. –Problem Solving. –Labs	– Quizzes – Homework Assessment – Midterm Exam – Final Exam

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Analyze the asymptotic time complexity of the algorithm or code segment. **b2-** Formulate new solutions for programing problems or improve existing code using learned algorithms and data structures.	– Lecture and presentation –Dialogue and discussion –Self and cooperative learning –Brainstorming. –Problem Solving. –Labs	– Quizzes – Homework Assessment – Midterm Exam – Final Exam

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(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
C1- Apply appropriate data structures for solving computing problems **C2-** Develop computer programs to implement different data structures and related algorithms.	– Lecture and presentation – Discussion – Self and cooperative learning. – Brainstorming. – Problem Solving. – Labs – Project	– Practical Exam and performance observation. – Midterm Exam – Final Exam – Project Assessment – Report Assessment

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1- Evaluate algorithms and data structures in terms of time and memory complexity of basic operations **d2-** Work in a team to analyze, design, and implementation of data structures and algorithms to solve practical problems.	–Discussion –Self and cooperative learning – Project –Labs	– Performance observation. – Project and report assessment

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IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Algorithm Analysis	a1, a2,b1,d1	▪ Mathematical background ▪ Big-O notations ▪ Running time calculation	2w	4
2	Abstract Data Types	a1, a2,b2,c1, c2,d1,d2	▪ Stacks ▪ Queues ▪ Linked Lists	3w	6
3	Trees	a1, a2,b2,c1, c2,d1,d2	▪ Binary trees (traversals, insertion, deletion, searching) ▪ AVL-trees	3rd	6
4	Hashing	a1, a2,b2,c1, c2,d1,d2	▪ Hash function ▪ Separate chaining ▪ Open addressing ▪ Rehashing	1w	2
5	Priority Queues (Heaps)	a1, a2,b2,c1, c2,d1,d2	▪ Binary heaps ▪ Applications of priority queues	1w	2
6	Sorting	a1, a2,b2,c1, c2,d1,d2	▪ Insertion sort ▪ Heap sort ▪ Merge sort ▪ Quick sort	2w	4
7	Graph Algorithms	a1, a2,b2,c1, c2,d1,d2	▪ Topological sort ▪ Shortest-path algorithms	2w	4

			▪ Minimum-span tree		
Number of Weeks /and Units Per Semester				**14w**	**28**

B - Practical Aspect: (if any)

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	Stack	**1w**	**2**	a1,a2,b2,**c2,d2**
2	Queue	**1w**	**2**	a1,a2,b2,**c2,d2**
3	Linked Lists	**2w**	**4**	a1,a2,b2,**c2,d2**
4	Binary Tree	**3w**	**6**	a1,a2,b2,**c2,d2**
5	Project	**4w**	**8**	All
Number of Weeks /and Units Per Semester		**11**	**22**	**All**

V. Teaching strategies of the course:

- **Lectures**
- **Discussion**
- **Brainstorming**
- **Problem solving**
- **Practical in computer (lab)**
- **Projects**
- **Self-learning**
- **Cooperative learning**

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VI. Assignments:

No	Assignments	Aligned CILOs (symbols)	Week Due	Mark
1	Project	All	3rd -12th	15
2	Homework	All	2nd ,3rd ,5th ,8th	7

VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Homework /Projects/ Assignment	2nd -12th	22	22%	All
2	Midterm Exam	9th	10	10%	a1, a2, b1, b2,c1,c2
3	Labs	2nd-12th	8	8%	All
4	Final Exam	16th	60	60%	a1, a2, b1, b2,c1,c2

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VIII. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. Michael T. Goodrich , Roberto Tamassis, and David Mount, 2011,"Data structures & Algorithms in C++", second edition, USA, Wiley
2. Weiss, Mark A., 2014, "Data Structures and Algorithm Analysis in C++", 4th Edition, USA, Pearson.

2- Essential References.

1- Malik, D S. Data Structures in C++, 2010, 2nd Edition, Cengage Learning.
2- Clifford A. Shaffer, Data Structures and Algorithm Analysis in C++, 2013, 3rd edition, Dover Publications.

3- Electronic Materials and Web Sites *etc*.

1- http://people.cs.vt.edu/~shaffer/Book/

IX. Course Policies:

Unless otherwise stated, the normal course administration policies and rules of the Faculty of Computer and Information Technology apply. For the policy, see: ----------

The University Regulations on academic misconduct will be strictly enforced. Please refer to ----------

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he will be considered as absent.
3	**Exam Attendance/Punctuality:**

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	A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.
4	**Assignments & Project** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
5	**Cheating:** For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6	**Plagiarism:** Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments my given directly to students using soft or hard copy

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Faculty of Computer & Information Technology

Department of Computer Science

Program of Computer Science

Course syllabus of Data Structures and Algorithms

Course No (.....)

2020/2021

Head of Department	Vise Dean for Qulity Assurance	Dean of the Faculty	Dean of Development center and Quality Assurance
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I. - Information about Faculty Member Responsible for the Course:							
Name of Faculty Member		Office Hours					
Location& Telephone No.		SAT	SUN	MON	TUE	WED	THU
E-mail							

II. Course Identification and General Information:						
1	Course Title:	Data Structures and Algorithms				
2	Course Code & Number:					
3	Credit hours:	C.H				TOTAL
		Th.	Seminar	Pr	Tr.	
		2	-	2	-	3
4	Study level/ semester at which this course is offered:	2nd Level -2nd Semester				
5	Pre –requisite (if any):	Programming Fundamentals				
6	Co –requisite (if any):	None				
7	Program (s) in which the course is offered:	IS, CS, IT				
8	Language of teaching the course:	English/Arabic				
9	Study System	Term based system				
10	Mode of delivery:	Full Time				

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11	**Location of teaching the course:**	Faculty of Computer and Information Technology

III. Course Description:

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IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop:

a1- Define basic data structures (such as an array-based list, linked list, stack, queue, binary search tree) and algorithms.

a2- Explain how to use a specific data structure in modelling a given problem.

b1- Analyze the asymptotic time complexity of the algorithm or code segment.

b2- Formulate new solutions for programing problems or improve existing code using learned algorithms and data structures.

c1- Apply appropriate data structures for solving computing problems

c2- Develop computer programs to implement different data structures and related algorithms.

d1- Evaluate algorithms and data structures in terms of time and memory complexity of basic operations.

d2- Work in a team to analyze, design, and implementation of data structures and algorithms to solve practical problems.

V. Course Content:

- Distribution of Semester Weekly Plan of Course Topics/Items and Activities.

A – Theoretical Aspect:

Order	Topics List	Week Due	Contact Hours
1	Algorithm Analysis	1st ,2nd	4
2	Abstract Data Types	3rd -5th	6
3	Trees	6th -8th	6
4	Midterm Exam	9th	2

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5	Hashing	10th	2
6	Priority Queues (Heaps)	11th	2
7	Sorting	12th -13th	4
8	Graph Algorithms	14th -15th	4
9	Final Exam	16th	2
Number of Weeks /and Units Per Semester		**16**	**32**

B – Practical Aspect: ***(if any)***

Order	Topics List	Week Due	Contact Hours
1	Stack	2nd	2
2	Queue	3rd	2
3	Linked Lists	4th ,5th	4
4	Binary Tree	6th -8th	6
5	Project	9th -12th	8
Number of Weeks /and Units Per Semester		**11**	**22**

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VI. Teaching strategies of the course:

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VIII. Schedule of Assessment Tasks for Students During the Semester:

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4	Final Exam	16th	60	60%

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اللجنة الإشرافية

م.	الاســـم	الصـــــفة	التوقيع
١	أ.م.د. عبد الماجد الخليدي	نائب عميد الكلية للشؤون الأكاديمية	
٢	أ.م.د. احمد مجاهد	نائب عميد مركز التطوير الأكاديمي وضمان الجودة	
٣	د. حسين الأشول	ممثل المركز في الكلية	
٤	أ.د. إبراهيم المطاع	نائب رئيس الجامعة للشؤون الأكاديمية	