Kurdistan Region Government
Ministry of Higher Education
and Scientific Research
Erbil Polytechnic University

Module (Course Syllabus) Catalogue

2022-2023

College/ Institute	Erbil Technical Engineering	
Department	ISED	
Module Name	Data structure	
Module Code		
Degree	Technical Diploma □ Bachelor √ High Diploma □ Master □ PhD □	
Semester	5	
Qualification		
Scientific Title	Lecturer	
ECTS (Credits)	6	
Module type	Prerequisite □ Core √ Assist. □	
Weekly hours	4	
Weekly hours (Theory)	(2)hr Class	(2)Total hrs Workload
Weekly hours (Practical)	(2)hr Class	(2)Total hrs Workload
Number of Weeks	16	
Lecturer (Theory)	Dr. Bzar khidir hussan	
E-Mail & Mobile NO.	Bzar.hussan@epu.edu.iq	
Lecturer (Practical)	Ahmad kakamin	
E-Mail & Mobile NO.		
Websites		

Course Book

Course Description	1. In this course we introduces for the student the Fundamental Principles of data structure. Explain many Data Structures Concepts and Types, can compare between Them to decide which is to be chosen! 2. The goal of the course is to teach fundamental data structures, which allow one to store collections of data with fast updates and queries. Key topics will definitely include: Java refresher and generics, analysis tools, sorting, linked lists and iterators, stacks and queues, search trees, maps, hashing, priority queues, and graphs. Please see the main course website for a more detailed schedule, which will be updated as the semester progresses
Course objectives	The objective of the course is to teach students how to design, write, and analyze the performance of Java programs that handle structured data and perform more complex tasks, typical of larger software projects. Students should acquire skills in using generic principles for data representation & manipulation with a view to efficiency, maintainability, and code reuse. Successful students will, at the end of the course, be able to demonstrate analytical comprehension of concepts such as abstract data types (vectors, lists, deques, trees, etc.), generic programming techniques (containers, adaptors, accessing data through the interface, iterators, etc.), algorithms (sorting, using stacks and queues, tree exploration algorithms, etc.), and efficiency analysis (which data structures allow efficient interfaces to particular forms of data access, such as random vs. sequential data access or insertion). The students should be able to demonstrate similar skills in related implementation tasks in the Java language, including extensive use of templates to allow for modularity and re-usability of code.
Student's obligation	I expect the student to come to class, study the materials and textbook and do the homework, activities, and exams. It is the student's responsibility to check what we covered in class and the announcements during class if he or she did not attend. The best way of learning a Programming Language is by practicing it. You can acquire a good programming level by doing all examples from the textbook. The course is very time demanding. Plan ahead all your activities and if you have any problem with your homework or your study, do not hesitate to ask questions to the Instructor. Do not wait until you have a bad grade. All homework assignments must be solved individually. You are encouraged to discuss problems with others and to work them out on the whiteboard, but when you sit down to write or code up your solution you must work on your own, without any further interaction. You are not allowed to share your solutions (literal code and theory solutions) with other students.
Required Learning Materials	Laptop-Projector, whiteboard,

	Task	Weight (Marks)	Due Week	Relevant Learning Outcome
Evaluation	Paper Review			

	Assignments	Homework	5		understanding subjects and solving problems of data structure
		Class Activity	2		Be active during class
		Report	5	1	Preparing and getting acknowledges about How to write data structure programming
		Seminar	5	1	How to present a topic about data structure
		Essay			
		Project	5		
	Quiz		8	3	
	Lab.(project)		5	1	using tools(Java)and writing code for data structure projects
	Midterm Exam		10+15	1	
	Final Exam		20+20	1	
	Total		100		
Specific learning outcome:	1. Ability to choose appropriate data structures to represent data items in real-world problems. 2. Ability to analyze the time and space complexities of algorithms. 3. Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees. 4. Able to analyze and implement various kinds of searching and sorting techniques.				
Course References:	1. Introduction to java Programming (10th Edition) by Y. Daniel Liang 2. Data structures and algorithm in Java , Michel T Goodrich, Roberto Tomssia. 3. Data structures abstraction and design using Java, ELLOTE b KOFFMAN and PAUAL AT 4. Principle of Data structure , VINU V DAS. 5. Data structures and Programming Design, Robert L. Kruse Alexander J. Ryba 6. Data Structures 3e by Jones and Bartlett 7. Data Structures Shahid Iqbal Lone				

Course topics (Theory)	**Week**	**Learning Outcome**
Introduction to Data Structures ✓ Definition Data Structure: ✓ Classification of Data structure; ✓ Type of Data structure; ✓ Why study data structures? ✓ Characteristics of a Data Structure; ✓ Type of Data structure;	1	Learning why we study data structure, define, type, Categories Characteristics, Operations of data structure

✓ Categories of Data Structure; 1. Linear Data Structure; 2. Non-linear Data Structure; ✓ Data Structures Operations; ✓ How to Choose the Right Data Structure.		
Array list: ✓ One-dimensional array. Declaring , initializing array Elements , Read/ write/ process. ✓ Two-dimensional arrays. Declaring, initializing array Elements, Read/ write/ processing with methods.	2	Learning how to create, declare, and initialize array Elements, an operation that can be implemented on an array
Stacks ✓ Definition; ✓ The most important stack applications ✓ Using the stack in the processing of arithmetic expressions; converting Infix to Postfix ✓ Representation of stack with array; ✓ Operations on Stack; ✓ Implementing a Stack with Java;	3 & 4 & 5	Learning the objectivity of why we use the stack, Operations on a Stack, how to write program code to implement push, pull, studding applications on the stack
Queues ✓ Definition; ✓ Representation of Queues with Array ✓ Types of Queues: Circular Queues, Deques ✓ Implementing a Queue with Java;	7 & 8	Learning objectivity why use using stack, Operations on a Stack, how to write program code to implement push, pull, studying applications on the stack
Linked Lists ✓ Storage Allocation: Static and Dynamic memory allocation ✓ Definition of Linked List ✓ Linked List Classes ✓ Types of Linked List ✓ Basic Operations on Linked list ✓ Advantages and Disadvantages of linked list ✓ Operation on the Linked list: Creating, adding, deleting an element and Finding and Deleting Specified Links ✓ Circular Linked Lists ✓ Doubly Linked Lists	9 & 10	Learn what does meaning of Linked Lists is, how it can be represented in memory, type, and a basic operation that can be executed by a linked list and with writing code for it ..
Performance Measurement in Algorithms ✓ Measuring the Performance of Algorithms ✓ Measuring Time Complexity ✓ Big O notation, Order notation with examples.	11	Learn to solve our time complexity problem, by learning three types of Asymptotic notation.1) Θ Notation 2) Big O Notation 3) Ω Notation. We looked at Big O as it is the most widely used asymptotic notation. And also, deals with the worst-case,
Sorting ✓ Definition, type of sorting ✓ Insertion Sort, Bubble, insertion, Selection, ✓ Merge Sort, Quicksort	12 &13	Learning the definition of sorting, the procedure of sorting, the uses of sorting, the type of sorting the

		differences between them, and writing code programming for each of then
Trees ✓ Definition: Basic Terminology, Types of Trees, General Trees ✓ Binary Trees: Binary Trees Searching ✓ Expression Trees ✓ Creating a Binary Tree from a General Tree ✓ Traversing a Binary Tree: Pre-order Traversal, In-order Traversal ✓ Searching Binary Trees ; ✓ What are the Operations on Binary Trees ✓ How to Inserting a New Node in a Binary	14 & 15	Learn the definition of a tree, knowing how we can use the tree to represent nonlinear data structure. Knowing terminology, type, binary tree, an expression that can be written with the tree, type of traversing, and operations on the tree..
Graphs ✓ Introduction ✓ Graph Terminology ✓ Directed Graphs ✓ Terminology of a Directed	16	Learn the definition of the graph, knowing how we can use Graph to represent non liner data structure, Terminology, and types

Practical Topics	**Week**	**Learning Outcome**
Introduction to Java programming	1&2	Writing program code for types of variables, operations, loops, conditional statement
Array list: ✓ One-dimensional array. Declaring , initializing array Elements , Read/ write/ process Array Elements. Array as passing parameters in function!!, Character Sequences. Example: Finding max, min element, sum, average	3&4	Writing code programs for Creation an array, declaration, and different operations like finding the average, max, min, separating an array, adding value to the odd elements…
✓ Two-dimensionalal l arrays. Declaring , initializing array Elements , Read/ write/ process Array Elements. ✓ Array as passing parameters in function	5	Writing code program for Creation an array. declaration and different operations like finding average,max, min, separating an array, add value to the odd elements…
Stacks ✓ Introduction to Stacks ✓ Operations on a Stack ✓ Push Operation ✓ Pop Operation	6 & 7	Writing code program for Creation stack, push pull operation
Queues ✓ Introduction to Queues ✓ Array Representation of Queues ✓ Types of Queues ✓ Circular Queues ✓ Deques	8 & 9	Writing code program for Creation stack, push pull operation

Linked Lists ✓ Introduction ✓ Linked List ✓ Doubly Linked Lists	10 & 11	Writing code program for Creation linked list and double linked list with finding and deleting an element from ..
Sorting ✓ Definition, type of sorting ✓ Insertion Sort, ✓ Bubble, ✓ insertion, ✓ Selection, ✓ Merge Sort, Quicksort	12 & 13	Writing code program for different type of sorting
Trees ✓ Introduction ✓ Basic Terminology ✓ Binary Trees ✓ Binary Search Trees ✓ Binary Search Trees ✓ Operations on Binary Search Trees ✓ Searching for a Node in a ✓ Binary Search Tree ✓ Inserting a New Node in a Binary	15	Writing code program for tree and operation add and delete and traversing
Graphs ✓ Introduction ✓ Graph Terminology ✓ Directed Graphs ✓ Terminology of a Directed	16	Writing code program for Graph

Questions Example Design

Q1/Multiple choices

1. Which if the following is/are the levels of implementation of data structure
A) Abstract level
B) Application level
C) Implementation level
D) All of the above
2. In the …………….. traversal we process all of a vertex's descendants before we move to an adjacent vertex.
A) Depth First
B) Breadth First
C) With First
D) Depth Limited
3. The number of comparisons done by sequential search is ………………
A) (N/2)+1
B) (N+1)/2
C) (N-1)/2
D) (N+2)/2

Q: Sort the following numbers(Descending) with type sorting when average No. comparison is:(n2/4) and average No of exchanges is (n^4/4). (Code required)

6,1,9,4,3,2

Q: Draw binary tree for expression (A-B/C) + ((D*E+F)/G)), Then Write Preorder traversal for it.

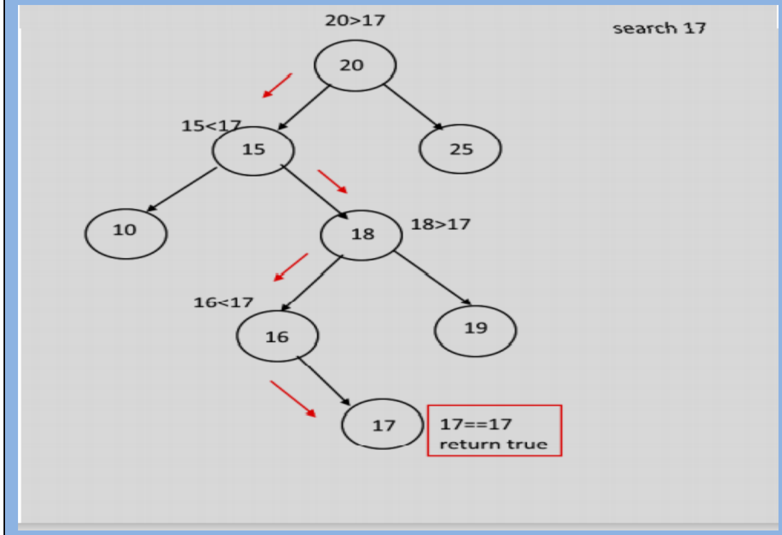
Q: What is the postfix form of the following infix:

K+4 - U^3 (D * 2) / M+7

Q: What are the components of the Linked List? Explain briefly and give an example then Write a method for the following:

1. public void insertFirst for class LinkList
2. public Link for class link

Q:Find an element in the tree below



Extra notes:

External Evaluator

Shahab

Dr.Shahab Wahhab Kareem