Data Structures

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Data structures: What and Why?

- Data structure is a particular way of storing and organizing information in a computer so that it can be retrieved and used most productively.

- Different kinds of data structures are meant for different kinds of applications, and some are highly specialized to specific tasks.

- The data structure is not any programming language like C, C++, java, etc. It is a set of algorithms that we can use in any programming language to structure the data in the memory.

Why Data structures?

- To store data on hard disks.

- For managing large datasets (e.g. databases or internet indexing services)

- For design of efficient algorithms.

Program = Algorithm + Data structure

- Data use and easier data processing on a software system.

Which Data structures?

- Stack - LIFO

- Queue- FIFO, Queue, Circular queue, Dequeue, Priority queue

- Linked lists- singly linked list, doubly linked list, circular linked list

- Graph

- Trees – General trees, binary trees, binary search trees, B tree, B+ tree, heaps, AVL trees

Data structures are widely applied in the following areas:

- Compiler design
- Operating System
- Statistical analysis package
- DBMS
- Numerical analysis
- Simulation
- Artificial intelligence
- Graphics

Data structures in real life?

- A Queue for bus
- Waiting in clinic or office
- Maps, geographical or railway maps etc
- Social networks
- Operating system processes
- Evaluate an equation
- Undo operation in any s/w or app
- Games like chess, tic-tac-toe
- Family history

Course outcomes

CO1	Explain the different data structures used in problem solving
CO2	Apply linear and non-linear data structure in application development.
CO3	Describe concepts of advance data structures like set, map & dictionary
CO4	Demonstrate sorting and searching methods.

Course outline

1	Introduction to Data Structures- Types, ADT
2	Linear data structure – linked list, stack and queue
3	Non-Linear data structures: Trees, Graph
4	Non-Linear data structures: Set, Map, Dictionary
5	Searching and Sorting

Books

1	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed	*Fundamentals Of Data Structures In C*
2	Richard F. Gilberg & Behrouz A. Forouzan	*Data Structures :A Pseudocode Approach with C*
3	Jean Paul Tremblay, Paul G. Sorenson	*An introduction to data structures with Applications*
4	Aaron M Tanenbaum ,Yedidyah Langsam, Moshe J Augentstein	*Data structure Using C*
5	Michael T Goodrich Roberto Tamassia, David Mount	*Data Structure and Algorithm in C++*

Modes of Content Delivery

- Blackboard Teaching
- Visual Aids
- Seminar
- NPTEL Video Lectures
- Quiz
- Guest Lecture
- Test

Evaluation Scheme

- Number of credits – 04 (TH – 03 , PR – 01)
- Term Test/ISE – 30 marks
- Internal Assessment – 20 marks
- End Sem. Exam – 100 converted to 50 marks

Course Code	Course Title						
116U04C302	Data Structures						
	TH			P		TUT	Total
Teaching Scheme(Hrs.)	03			–		–	03
Credits Assigned	03			–		–	03
Examination Scheme	Marks						
	CA		ESE	TW	O	P&O	Total
	ISE	IA					
	30	20	50	--	--	--	100

Evaluation Scheme

- Term work – 25 marks
- Prac/Oral – 25 marks

Lab assessment Rubrics

Timely Execution (05)

Timely Writeup Submission (10)

Individual Performance (10)

Lab assessment Rubrics

Criteria	Excellent (AA)	Good (AB)	Average (BB)	Poor(BC)
	5/10	4/8	3/6	2/4
Timely Execution (05)	The activity was shown on same day as suggested by Laboratory Faculty.	The activity was shown after one week of the lab.	The activity was shown after 2 weeks of the lab	The activity was shown after more than 2 weeks of the lab.
Timely Writeup Submission (10)	The Writeup was submitted in the next lab session. Post lab questions answered perfectly No Plagiarism.	The Writeup was submitted after two turns of the lab session. Post lab questions fairly answered No Plagiarism.	The Writeup was submitted after three turns of the lab session. Post lab questions poorly answered No Plagiarism.	The Writeup was submitted after a month lab session. Post lab questions are not answered No Plagiarism.
Individual Performance (10)	All the features / functionalities implemented / demonstrated.	All the features / functionalities implemented / demonstrated but not in detail	Partial coverage of the features / functionalities implemented / demonstrated.	Implementation not up to the mark / negligible performance.

Programming language

- C language

Distribution of 20 Marks	The student will be evaluated based on two tasks of 20 marks each which will be averaged later for all IA tasks. If any of the tasks given is not completed / submitted then the marks assigned for that task will be zero.			
Sr. No.	Task	Description of task	Schedule	Weightage
1	One Quiz (No re-exam will be conducted.)	Module 1,2,3	After Test	50%
2	Peer grading Programming assignment using a data structure to develop solution for a small application	This can be done in a group of 2-3 students. 1. Small applications will be assigned to each group. 2. The presentation screencast video should- explain the problem statement, logic, code and output. 3. The video duration will be max 10mins 4. All students must participate in presentation 5. Students would choose a problem statement and suggest one of the data structure for developing the solution, and how the solution will be implemented. Upon teacher's approval, students would work on the chosen problem and submit their work.	Oct First week	50%

Test

- Module 1,2 and 3.1
- Module 1- Introduction , Types of Data Structures, ADT (Abstract data type)
- Module 2 – Linear data structure (linked list, stack and queue)
- Module 3.1 – Nonlinear data structure (Tree)

Data structures Implementation

Variables, arrays and Pointers

- Variable
- Pointer variable
- Memory allocation
- Array allocations
- Dynamic memory allocation

Memory

- Memory – Main memory, Secondary memory
- RAM, main memory, Primary memory, secondary memory, HDD???
- Main memory and program execution
- Can a user have access to entire main memory space?
- Can a program be larger than main memory?