COURSE SYLLABUS

DATA STRUCTURES AND ALGORITHMS

Course code: 220041

1. General information:

Course type		Number of credits	Number of learning periods
General ☐ Basic ☑ Specialized ☐ Required ☑ Elective ☐		Theory: 02 Exercise: Practice: 04	Theory: 30 Exercise: Practice: 60

*Learners***:**

Level	Bachelor
Discipline	Information Technology

Course requirements:

Prerequisites	Programming Techniques
Parallels	None
Other requirements	None

2. Learning resources:

Books	[1] Lôi, Đ. X. (1995). *Cấu trúc dữ liệu và giải thuật*. Nhà xuất bản Khoa học và kỹ thuật. Hà nội. [1] Đinh, M. T. (2001). *Cấu trúc dữ liệu và thuật toán*. Nhà xuất bản Khoa học và kỹ thuật. Hà nội. [3] Wirth, Niklaus (1976*). Algorithms + Data Structures = Programs*. Prentice-Hal
References	[4] Rosen, K. H. (2003). *Toán học rời rạc ứng dụng trong tin học*. Nhà xuất bản Khoa học và kỹ thuật. Hà nội. [5] Trường, L.X (1999). *Giáo trình cấu trúc dữ liệu bằng ngôn ngữ C++*. Nhà

	xuất bản Thống kê	
	[6] Trực, N. T. (1990). *Cấu trúc dữ liệu. BK TP HCM*.	
Other learning materials	[7] Websites: 1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm 2. https://www.geeksforgeeks.org/algorithms-design-techniques/ 3. https://www.youtube.com/channel/UCEBb1b_L6zDS3xTUrIALZOw	

3. Course description:

The course provides students basic knowledge of data structures and algorithms. The course also aims to provide opportunities to practice professional skills including designing and evaluating algorithm design techniques, analytical and problem-solving skills. Also, the course develops students' appropriate awareness and attitudes on the role of data structures and algorithms to be applied in information technology industries.

4. Course learning outcomes (CLOs):

After finishing the course, students will be able to:

		Satisfy LOs of the program	*Satisfy LOs of the ABET*
❖ **Topic 1: Disciplinary Knowledge and Reasoning**			***B.1.1*** ***B.1.2*** ***B.1.3*** ***B.1.4*** ***B.1.5*** ***B.1.6***
L1.	Presenting an overview of algorithms and analyze time complexity of algorithms	*1.2.1* *1.2.2*	
L2.	Utilizing searching and sorting algorithms		
L3.	Utilizing and implementing operations on linked list, stack, and queue data structures.		
L4.	Utilizing and implementing of operations on binary tree, binary search tree, and B-tree		
L5.	Utilizing and implementing operations on hash		
L6.	Utilizing and evaluating algorithm design techniques		
❖ *Topic 2: Personal and Professional Skills and Attributes*			
L7.	Analytic Reasoning and Problem Solving	*2.1.1, 2.1.2, 2.1.3, 2.1.4*	

L8.	Creative Thinking	*2.4.3*	
L9.	Ethics, Integrity and Social Responsibility	*2.5.1*	
❖ *Topic 3: Interpersonal Skills: Teamwork and Communication*			
L10.	Technical and Multidisciplinary Teaming	*3.1.5*	
L11.	Written Communication	*3.2.2*	
L12.	Communications in Languages of Regional Commerce and Industry	*3.3.2*	
❖ *Topic 4: Conceiving, Designing, Implementing and Operating Systems in The Enterprise, Societal and Environmental Context – The Innovation Process*			
L13.	Roles and Responsibility of IT Engineers	*4.1.1*	
L14.	The Impact of IT Engineering on Society and the Environment	*4.1.2*	
L15.	Understanding Needs and Setting Goals	*4.2.1*	
L16.	Utilization of Knowledge in Design	*4.3.3*	
L17.	Disciplinary Design	*4.3.4*	
L18.	Multidisciplinary Design	*4.4.2*	
L19.	Verification of requests	*4.5.1*	
L20.	Verification of individual or whole projects	*4.5.2*	

5. Course content:

Course content	*CLOs*	*Number of learning periods*		
		Theory	*Practice*	*Others*
Chapter 1. Overview of Algorithm and Complexity	**L1, L7, L8, L9, L11, L12, L13, L14, L15**	**4**	**0**	
1.1. Modeling of real-world problems		1	0	
1.2. Basic concepts of algorithms		0,5	0	

1.3. Pseudocode		1	0	
1.4. Algorithmic complexity		0,5	0	
1.5. Algorithm complexity analysis		1	0	
☑ *Personal and Professional Skills and Attributes*	*L6(T)* *L8(I)* *L9(I)*			
☑ *Interpersonal Skills: Teamwork and Communication*	*L11(I)* *L12(I)*			
☑ *CDIO in the enterprise, societal and environmental context*	*L13(I)* *L14(I)* *L15(T)*			
Chapter 2. Searching and Sorting Algorithms	***L2, L7, L8, L9, L11, L12, L15, L16, L17, L18, L19, L20,***	**8**	**15**	
2.1. Overview		1	0	
2.2. Searching algorithms		1	2	
2.3. Internal sorting algorithms		3	8	
2.4. External sorting algorithms		3	5	
☑ *Personal and Professional Skills and Attributes*	*L6(T)* *L8(I)* *L9(I)*			
☑ *Interpersonal Skills: Teamwork and Communication*	*L11(I)* *L12(I)*			
☑ *CDIO in the enterprise, societal and environmental context*	*L15(T)* *L16(U)* *L17(T)* *L18(T)* *L19(T)* *L20(T)*			

Chapter 3. Linked List, Queue, and Stack.	*L3, L7, L8, L9, L11, L12, L15, L16, L17, L18, L19, L20*	**4**	**10**	
3.1. Concepts		1	0	
3.2. Linked list operations		2	8	
3.3. Queue and Stack.		2	2	
☑ *Personal and Professional Skills and Attributes*	*L6(T)* *L8(I)* *L9(I)*			
☑ *Interpersonal Skills: Teamwork and Communication*	*L11(I)* *L12(I)*			
☑ *CDIO in the enterprise, societal and environmental context*	*L15(T)* *L16(U)* *L17(T)* *L18(T)* *L19(T)* *L20(T)*			
Chapter 4. Tree, Binary Tree, and Binary Search Tree	*L4, L7, L8, L9, L11, L12, L15, L16, L17, L18, L19, L20*	**4**	**10**	
4.1. Tree		1	0	
4.2. Binary Tree		1,5	0	
4.3. Binary Search Tree		1,5	10	
☑ *Personal and Professional Skills and Attributes*	*L6(T)* *L8(I)* *L9(I)*			
☑ *Interpersonal Skills: Teamwork and Communication*	*L11(I)* *L12(I)*			
☑ *CDIO in the enterprise, societal and environmental context*	*L15(T)* *L16(U)*			

	L17(T)			
	L18(T)			
	L19(T)			
	L20(T)			
Chapter 5. B-Tree	***L4, L7, L8, L9, L10, L11, L12, L15, L16, L17, L18, L19, L20***	**4**	**10**	
5.1. B-Tree definition		1	0	
5.2. B-Tree operations		3	10	
☑ *Personal and Professional Skills and Attributes*	*L6(T)* *L8(I)* *L9(I)*			
☑ *Interpersonal Skills: Teamwork and Communication*	*L11(I)* *L12(I)*			
☑ *CDIO in the enterprise, societal and environmental context*	*L15(T)* *L16(U)* *L17(T)* *L18(T)* *L19(T)* *L20(T)*			
Chapter 6. Hashing Data Structure	**L5, L7, L8, L9, L10, L11, L12, L15, L16, L17, L18, L19, L20**	**2**	**10**	
6.1. Concepts of Hashing		0,5	0	
6.2. Hash function		0,5	0	
6.3. Hash table collision handling		1	10	
☑ *Personal and Professional Skills and Attributes*	*L6(T)* *L8(I)* *L9(I)*			
☑ *Interpersonal Skills: Teamwork and Communication*	*L11(I)* *L12(I)*			

	L15(T) L16(U) L17(T) L18(T) L19(T) L20(T)			
☑ *CDIO in the enterprise, societal and environmental context*				
Chapter 7: Algorithm Design Techniques	**L6, L7, L8, L9, L10, L11, L12, L15, L16, L17, L18, L19, L20**	**4**	**5**	
7.1. Overview		0,5	0	
7.2. Divide and conquer technique		0,5	0	
7.3. Dynamic Programming		1	2	
7.4. Greedy algorithm		0,5	0	
7.5. Backtracking		1	3	
7.6. Local search		0,5	0	
☑ *Personal and Professional Skills and Attributes*	L6(T) L8(I) L9(I)			
☑ *Interpersonal Skills: Teamwork and Communication*	L11(I) L12(I)			
☑ *CDIO in the enterprise, societal and environmental context*	L15(T) L16(U) L17(T) L18(T) L19(T) L20(T)			
Summary of skills in course level				
☑ *Personal and Professional Skills and Attributes*	L6(T) L8(I) L9(I)			

☑ *Interpersonal Skills: Teamwork and Communication*	*L10(I)*
	L11(I)
	L12(I)
☑ *CDIO in the enterprise, societal and environmental context*	*L13(I)*
	L14(I)
	L15(T)
	L16(U)
	L17(T)
	L18(T)
	L19(T)
	L20(T)

6. Teaching and learning methods:

ID	Teaching method/technique		Description
M1.	Lecturing	☑	
M2.	Questions – Answers	☑	
M3.	Group-based Learning	☑	
M4.	Problem-based Learning	☑	
M5.	Project-based Learning	☐	
M6.	Case studies	☐	
M7.	Roleplay	☐	
M8.	Demo	☑	
M9.	Simulations	☑	
M10.	Debate	☐	
M11.	Game	☐	
M12.	Brainstorming	☐	
M13.	Think-Pair-Share	☐	

7. Course assessment:

ID	Assessment activity		Quantity	Weight	LOs assessed
T1.	Text-based midterm exam	☑	01	25%	L1, L2, L3
T2.	Text-based final exam	☐			
T3.	Practice midterm exam	☐			
T4.	Practice final exam	☑	01	25%	L4, L5, L6
T5.	Report	☐			
T6.	In-class exercises	☐			
T7.	Homework assignments	☐			
T8.	Question – Answer	☐			
T9.	Term Project	☐			
T10.	Final Exam	☑	01	50%	L1, L2, L3, L4, L5, L6
Formula for Overall score		**T1*0.25+T4*0.25+T10*0.5**			

8. Course requirements and expectations:

8.1. Requirements on attendance

- Students are responsible for attending in all classes. In case of absence due to force majeure circumstances, there must be sufficient and reasonable evidence.
- Students who do not attend more than 20% of the class sections, whether for reason or not, are deemed not to have completed the course and must re-enroll in the following semester.

8.2. Requirements and expectations on student behaviors

- Students must show their respects for teachers and other learners.
- Students must be on time. Students who are late more than five minutes will not be allowed to attend the class.
- Students should not make noise and interfere with others in the learning process.
- Students should not eat, chew gum, and use devices such as cell phones, music players during class hours.
- Laptops and tablets can only be used in class for the purpose of learning.

- Students who violate the above principles will be asked to leave the class and considered absent from the class.

8.3. Requirements on learning issues

Issues related to applying for score reservation, scoring complaints, scoring, exam disciplines are done according to the Learning Regulation of Tra Vinh University.

9. Tentative course instructor:

Le Minh Tu

DEAN	**DEPARTMENT HEAD**	**LECTURER**
		Le Minh Tu