



University: *Fayoum University*  
 Faculty: *Computers and Information*  
 Department: *Computer Science*



### Course Specification

1- Basic Information		
<b>Code:</b> CSC 340	<b>Course Title:</b> Analysis and Design of Algorithms	<b>Year/Level:</b> Third year – First term
<b>Programme:</b> B.Sc degree in Computer Science	<b>Number of units:</b>	<b>Lecture:</b> 3 hrs/ week
		<b>Tutorial:</b> 2 hrs/ week
		<b>Practical:</b> 2 hrs/ week

<b>2- Aims of Course:</b>	This course builds on skills gained in preliminary programming courses in C programming languages and gives students an in-depth understanding of a wide range of fundamental algorithms and data structures used in developing structured, efficient, reusable, and practical software. This course also improves the ability of the student to optimize algorithms solutions such as optimizing the search and cluster algorithms outputs.
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3- Intended Learning Outcomes	
<b>A- Knowledge and Understanding:</b>	<p>A9) Identify programming fundamentals and languages, algorithms analysis, and data structures.</p> <p>a1) This course improves the students' ability to design and implement efficient software solutions for various application areas using appropriately selected algorithms and data structures.</p> <p>a2) This course improves the students' ability to analyze data structures and algorithms to compare and evaluate them with respect to time and space requirements, in order to make the most appropriate design choices for various application areas.</p> <p>A12) Selects advanced topics to provide a deeper understanding of some aspects of the subject.</p> <p>a3) This course introduces advanced topics to optimize the algorithms solutions such as optimizing the searching and clustering algorithms outputs.</p> <p>A13) Define the mapping of real-world problems to algorithmic solutions</p> <p>a4) This course introduces some new topics that help in solving some real-world problems by simulating the real time behaviors of some organisms such as ants, bees, and fishes using algorithms such as Particle Swarm Optimization (PSO).</p>

<b>B- Intellectual Skills:</b>	<p>B1) Analyze real problems, and appropriate problem solving methods that satisfy commercial or industrial constraints and analyze results.</p> <p>b1) This Course Proves the correctness and analyzes the running time of the basic algorithms for those classic problems in various domains and applies the algorithms and design techniques to solve real problems in different domains.</p>
<b>C- Professional and Practical Skills:</b>	<p>C9 Deploy different modeling techniques to model and analyze real life computing problems.</p> <p>c1) This course handles different approaches and techniques to solve real life problems such as:</p> <ol style="list-style-type: none"> <li>1) The concept of Abstract Data Types – separation of definitions of data types from implementations.</li> <li>2) The basic ADTs such as stacks, queues, and trees.</li> <li>3) Investigate Algorithm Design Techniques, including – greedy algorithms, divide-and-conquer algorithms, Dynamic programming, Randomized Algorithms and Back-tracking.</li> <li>4) Graph representations and algorithms, terminology, graph traversal, and graph applications.</li> <li>5) Analyze the space and time complexity of these data structures and their access algorithms.</li> <li>6) Advanced sorting algorithms – Quick sort, Merge sort, and Heap sort. The performance characteristics of advanced sorting algorithms.</li> <li>7) The study of elementary sorting algorithms – Selection sort, Bubble sort, Insertion sort, and Shell sort. The performance characteristics of elementary sorting algorithms</li> <li>8) Optimization Algorithms, Natural Language Processing Algorithms, and Security Algorithms.</li> </ol>
<b>D- General and transferable Skills</b>	<p>D4) Demonstrate independent critical thinking and problem solving skills.</p> <p>d1) This course provides a set of new problems to students. For a subset of new problems, hints for solving the problems will be given. At least one assignment contains new problems that the students must try to solve using their own ideas.</p>

<b>4-Course Content:</b>	<ol style="list-style-type: none"> <li>1. Algorithm concept.</li> <li>2. Analysis and complexity.</li> <li>3. Design methods: Divide and conquer: The general method,</li> <li>4. Binary search, merge sort, quick sort, selection, matrix multiplication.</li> <li>5. Greedy method: The general method, minimum spanning Trees.</li> <li>6. Dynamic programming: The general method, shortest paths. traveling salesman problem.</li> <li>7. Backtracking: The general method, the 8-queens Problem.</li> <li>8. NP-hard and NP-complete problems: Cooks theorem, NP-</li> </ol>
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	<p>hard graph problems.</p> <p>9. Optimization Algorithms: Particle Swarm Optimization (PSO).</p> <p>10. NLP (Natural Language Processing) Algorithms: Global, Local, Semi-Global Alignment Algorithms.</p> <p>11. Security Algorithms: Symmetric and Asymmetric Encryption Algorithms.</p> <p>12. Probabilistic and Stochastic Algorithms: Markov Model (MM), Hidden Markov model (SVM).</p>
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<b>5- Teaching and Learning Methods:</b>	<ol style="list-style-type: none"> <li>1. Lectures</li> <li>2. Tutorials</li> <li>3. Computer-lab Sessions</li> <li>4. Practical lab work</li> <li>5. Class discussions</li> <li>6. Internet searches</li> <li>7. Independent Work</li> <li>8. Group projects</li> <li>9. Problem-based Learning</li> </ol>
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**6- Teaching and Learning Methods for handicapped students :**

<b>7- Student Assessment</b>	
<b>A- Assessment Methods:</b>	<ol style="list-style-type: none"> <li>1. Assignments and Quizzes</li> <li>2. Midterm written exam</li> <li>3. Oral exam</li> <li>4. Practical exam</li> <li>5. Final written exam</li> </ol>
<b>B- Assessment schedule:</b>	<p>Midterm Examination: Week 7</p> <p>Practical examination Week 13</p> <p>Oral Examination: Week 14</p> <p>Final Examination: Week 15</p>
<b>C- Weighting of assessments:</b>	<p>Assignments and Quizzes: 0%</p> <p>Mid-Term Examination: 10%</p> <p>Oral Examination: 10%</p> <p>Practical Examination: 15%</p> <p>Final-term Examination: 65%</p>

<b>8- Books and References</b>	
<b>A- Notes:</b>	-
<b>B- Essential Books (Text Books):</b>	<ul style="list-style-type: none"> <li>▪ T.H. Cormen, C.E.Leiserson and R.L.Rivest: "Introduction to Algorithms", MIT Press, Cambridge, MA. 3rd edition (2014)</li> </ul>
<b>C- Recommended Books:</b>	

<b>D- Periodicals, Web sites, ... etc</b>	-
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**Course Professor: Hesham Kholidy**

**Department Head: Dr. Amira Edress**

**Course Content Intended Learning Outcomes Matrix****Course Title:** Analysis and Design of Algorithms**Course Code:** CSC 340

Course Content	Week	Knowledge & Understanding				Intellectual Skills	Professional & Practical Skills	General & Transferable Skills
		a1	a2	a3	a4	b1	c1	d1
1. Algorithm concept.	1	x			x			
2. Analysis and complexity.	2	x			x	x	x	x
3. Design methods: Divide and Conquer algorithms	3		x		x	x	x	x
4. Binary search, merge sort, quick sort, selection, matrix multiplication.	4		x		x	x	x	x
5. Greedy method: The general method, minimum spanning Trees.	5		x		x	x	x	x
6. Dynamic programming: The general method, shortest paths, traveling salesman problem.	6		x		x	x	x	x
7. Backtracking: The general method, the 8-queens Problem.	8		x		x	x	x	x
8. Optimization Algorithms: Particle Swarm Optimization (PSO).	10		x	x	x	x	x	x
9. NLP (Natural Language Processing) Algorithms: Global, Local, Semi-Global Alignment Algorithms.	11		x	x	x	x	x	x
10. Security Algorithms: Symmetric and Asymmetric Encryption Algorithms.	12		x	x	x	x	x	x
11. Probabilistic and Stochastic Algorithms: Markov Model (MM), Hidden Markov model (SVM).	13		x	x	x		x	x

Course coordinator: Dr.Hesham Kholidy

Head of Department: Dr. Amira Edress