

## Syllabus and Course Description

### Analysis of Algorithms (MSc.)

Prince Hussein bin Abdullah for Information Technology College

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Course title and reference number or code	Analysis of Algorithms 090740
<b>12. Aims of the Course</b>	
By the end of the semester, the student should be able to: (1) recognize the use of several design techniques (greedy, divide-and-conquer, dynamic programming) and use these methods to solve simple Problems. (2) Write and solve recurrence relations for recursive algorithms. (3) Determine asymptotic growth rates for algorithms. (4) Prove correctness of simple algorithms.(4) expose to advance topics in algorithm design and analysis.	

#### Assessment of Learning Outcomes:

Learning outcomes are assessed by examination and research project work.

#### Modes of Assessment:

Mid-term Exam (30%)  
Research paper (documentation) (15%)  
Project Presentation (10%)  
Documentation (5%)  
Final Exam (40%)

#### Syllabus:

The course covers : Asymptotic notation. Algorithm analysis methods. Greedy algorithms and divide-and-conquer algorithms. Dynamic programming. Probabilistic algorithms. Applications to sorting, scheduling, and graphs. Theoretical models for computing computational complexity. NP-complete and NP hard problems. Approximation algorithms. Details as follows:

<b>1. Introduction</b>	
1	- Analyzing algorithms and problems
2	- Asymptotic analysis
<b>2. Algorithm techniques</b>	
1	- Greedy method
2	- Divide and conquer
<b>3. Amortized analysis methods</b>	

	<ul style="list-style-type: none"> <li>-Aggregate Method</li> <li>-Accounting Method</li> <li>-Potential method</li> </ul>
4.	<b>Recurrence equations analysis</b> <ul style="list-style-type: none"> <li>1 - Iteration method</li> <li>2 - Substitution method</li> <li>3 - Recursion tree</li> <li>4 - Master theorem</li> </ul>
5.	<b>Dynamic sets and searching</b> <ul style="list-style-type: none"> <li>1 - Array doubling</li> <li>2 - Amortized time analysis</li> <li>3 - Red-black trees</li> <li>4 - Hashing</li> </ul>
6.	<b>String matching algorithms</b> <ul style="list-style-type: none"> <li>7.1 a straightforward solution</li> <li>7.2 the Knuth-morris- patt algorithm</li> <li>7.3. the Boyer-Moore algorithm</li> <li>7.4 Approximation string matching</li> </ul>
7.	<b>Mid-Term Exam</b>
8.	<b>Probabilistic algorithms</b>
9.	<b>Maximum Flow</b> <ul style="list-style-type: none"> <li>- Flow_networks</li> <li>- Positive flow</li> <li>- Networks with multiple sources and sinks</li> <li>- Max Flow problem</li> <li>- Ford-Fulkerson algorithm</li> </ul>
10.	<b>NP-Complete and NP-hard</b>
11.	<b>Approximation algorithms</b>
12.	<b>Special topics and Research papers presentations</b>

**Attendance policy**

Lecture attendance is compulsory. The course notes and the textbook are not comprehensive and additional material will be covered in lectures. You are responsible for all material covered in lectures.

**Expected Workload**

On average you should expect to spend about 6 hours per week on this module.

**Practical Submissions**

The assignments that have work to be assessed will be given to the students in separate documents including the due date and appropriate reading material.

**Textbook and Supporting Material:**

1. Computer Algorithms: Introduction to Design and Analysis

By Sara Baase, 3<sup>rd</sup> Edition, Addison-Wesley Publishing Company

2. Introduction to Algorithms

By Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest  
1997, McGraw-Hill Book Company

### 3. Journal papers and articles in Algorithm analysis and Design.

#### Documentation and academic honesty

Submit your home work covered with a sheet containing your name, number, course title and number, and type and number of the home work (e.g. tutorial, assignment). Any completed homework must be handed in to my office by 15:00 on the due date. After the deadline “zero” will be awarded. You must keep a duplicate copy of your work because it may be needed while the original is being marked.

For the research report, you are required to write a report similar to a research paper. It should include:

- o **Abstract:** It describes the main synopsis of your paper.
- o **Introduction:** It provides background information necessary to understand the research and getting readers interested in your subject. The introduction is where you put your problem in context and is likely where the bulk of your sources will appear.
- o **Methods (Algorithms and Implementation):** Describe your methods here. Summarize the algorithms generally, highlight features relevant to your project, and refer readers to your references for further details.
- o **Results and Discussion (Benchmarking and Analysis):** This section is the most important part of your paper. It is here that you demonstrate the work you have accomplished on this project and explain its significance. The quality of your analysis will impact your final grade more than any other component on the paper. You should therefore plan to spend the bulk of your project time not just gathering data, but determining what it ultimately means and deciding how best to showcase these findings.
- o **Conclusion:** The conclusion should give your reader the points to “take home” from your paper. It should state clearly what your results demonstrate about the problem you were tackling in the paper. It should also generalize your findings, putting them into a useful context that can be built upon. All generalizations should be supported by your data, however; the discussion should prove these points, so that when the reader gets to the conclusion, the statements are logical and seem self-evident.
- o **Bibliography:** Refer to any reference that you used in your assignment. Citations in the body of the paper should refer to a bibliography at the end of the paper.

#### ● **Protection by Copyright**

1. Coursework, reports, and essays submitted for assessment must be your own work, unless in the case of group projects a joint effort is expected and is indicated as such.
2. Use of quotations or data from the work of others is entirely acceptable, and is often very valuable provided that the source of the quotation or data is given. Failure to provide a source or put quotation marks around material that is taken from elsewhere gives the appearance that the comments are ostensibly your own. When quoting word-for-word from the work of another person quotation marks or indenting (setting the quotation in from the margin) must be used and the source of the quoted material must be acknowledged.
3. Sources of quotations used should be listed in full in a bibliography at the end of your piece of work.