Arab Academy for Science and Technology & Maritime Transport

College of Computing and Information Technology

Department of Computer Science

Master of Science in Computer Science

Program Specification

(Year 2013- 2014)

A. Basic Information

1. Program title: Master of Science in Computer Science
2. Program type: Single
3. Department responsible for the program: Computer Science
4. Date of program approval: 2007

B. Professional Information

Computer science is the scientific and practical approach to computation and its applications. It is the systematic study of the feasibility, structure, expression, and mechanization of the algorithms that underlie the acquisition, representation, processing, storage, communication of, and access to information.

Computer science can be divided into a variety of theoretical and practical disciplines, such as computational complexity theory, which is theoretical, and computer graphics, which emphasize real-world visual applications. Other fields focus on the challenges in implementing computation. For example, programming language theory considers various approaches to the description of computation, while the study of computer programming itself investigates various aspects of the use of programming language and complex systems. Human-computer interaction considers the challenges in making computers and computations useful, usable, and universally accessible to humans.

1. Program General Aims

The Computer Science program is designed to provide the student with the advanced concepts of the discipline as well as the opportunity for specialization. After successfully completing the Computer Science M.Sc. program, the graduate students should be able to:

O1. Use and utilize advanced research and development environments by extending their knowledge and skills in advanced areas of computer science.
O2. Make a critical evaluation of the theories, techniques, tools and systems used in their chosen areas of specialization.
O3. Contribute to future developments in their field by understanding of recent and current advances in research specialization.
O4. Conduct research by having appropriate and sufficient resources and guidance in their use.
O5. Make an effective contribution to team-based activities.
O6. Adopt investigative approaches and develop autonomous study skills in order to assist their continuing professional development.
O7. Define and interpret complex problems using qualitative and quantitative methods.
O8. Act to reflect a commitment to integrity, credibility and commitment to the professional rules.

O9. Show awareness in community development and environmental conservation in the light of the global and regional variables.
O10. Communicate effectively with specialized knowledge and integrate them with the relevant knowledge in professional practice.

2. Intended Learning outcomes (ILOs)

a. Knowledge and Understanding

The graduates of the computer science program should be able to demonstrate knowledge and understanding of:

K1. Understand the essential facts, concepts, principles and theories relevant to advanced topics in Computer Science beyond undergraduate level and at the forefront of research.
K2. Have a sound knowledge and critical understanding of gathering, organizing and evaluating information needed to formulate and solve problems.
K3. Have a knowledge & understanding of research methodology & practice.
K4. Understand, apply and develop leading-edge technologies in one or more of: distributed systems, formal foundations of programming languages, image processing and pattern recognition techniques, dynamic programming, computer graphics, the design of compilers, computer architectures.
K5. Understand moral and legal principles of professional practice in the area of specialization and identify the fundamentals of scientific research and its ethics.
K6. Mutual influence between the Professional Practice and its reflection on the society and the environment.
K7. Outline the quality principles of professional practice in Computer Science.
K8. A critical awareness of current problems and research issues in selected areas of Computer Science.

b. Intellectual Skills

The graduates of the computer science program should be able to:

I1. Use methodologies for development of computational systems at an advanced level.
I2. Perform problem-solving in academic and industrial environments and linking different knowledge areas to solve professional problems.
I3. Interpret the contents of articles and other sources, and form a critical judgment of their relative importance and relevance to an area of study.
I4. Analysis and evaluation of information and measurements in the field of computing to solve problems and to solve specialized problems without enough inputs.

I5. Assessment the risk practices in the field of computing.

I6. Develop original ideas in a research context.

I7. Carry out a research study and write a thesis around a research problem in Computer Science.

I8. Plan to develop the performance in Computer Science.

I9. Recognize the need for, and show ability for, dealing with constantly changing technology and continuing professional development.

c. Practical and Professional Skills

The graduates of the computer science program should be able to:

P1. Master basic and modern professional skills in Computer Science.

P2. Evaluate current methods and tools in Computer Science.

P3. Use and implement basic and modern computing algorithms.

P4. Deal with complex issues at the forefront of the academic discipline of Computer Science in a manner, based on sound judgments, that is both systematic and creative; and be able to communicate conclusions clearly to both specialists and non-specialists.

P5. Demonstrate self-direction and originality in tackling and solving problems within the domain of Computer Science, and be able to act autonomously in planning and implementing solutions in a professional manner.

P6. Generate and apply appropriate solutions to solve problems based on reasoned rationale.

P7. Develop applications to satisfy given requirements.

P8. Use, manipulate and develop large computational systems.

P9. Propose, plan, undertake and report a self-directed individual skills of investigation, design and implementation.

d. General and Transferable Skills

The graduates of the computer science program should be able to:

G1. Communicate efficiently by different means.

G2. Use different recourses to obtain information and knowledge.

G3. Long-life self-learning.

G4. Effectively present ideas, designs and solutions in a logical framework in a variety of forms with proper language structure and mechanics, and to produce appropriate written documentation.

G5. Work effectively as a team member.
G6. Prepare and present seminars to a professional standard.
G7. Write thesis and reports to a professional standard.
G8. Use mathematical techniques in the processes of analysis and design.
G9. Analyze complex problems and design effective solutions.
G10. Perform independent and efficient time-management.
G11. Performing self-assessment and identifying their personal educational needs.
G12. Show the efficient use of general computing facilities.

3. Program Academic Standards

1- National Academic Reference Standards (NARS) for Computing and Information, October 2010.

2- Standards of Higher Supreme Education Council for the Egyptian Universities.

3- Standards of ACM/IEEE CS curricula 2013 (Ironman report) .

4. Reference indices (Benchmarks)

1. Handbook for Academic Review (QAA 2000): Users Guide to the Academic Review of Subjects in Higher Education Institutions in the Transitional Period, 2002-2005.

2. Handbook of Institutional Audit, England, 2002.

3. Collaborative Provision Audit: Supplement to the Handbook for Institutional Audit : England, December, 2004.

4. Nick Harris, Quality Assurance and Accreditation, Report of Visit, March 2008, U.K.

5. Curriculum structure and contents of program

5.A Program duration: 4 -10 semesters.

5.B Program structure:

Total Credits : 36 credit hours

Mandatory Credits: 27 credit hours

1- **Mandatory Major specialization Requirements: (41.67%)**
   - 15 mandatory credit hours.
2- **Elective Major specialization Requirements: (25%)**
   - 9 mandatory credit hours.
3- **MsC. Thesis (33.33%)**
   - 12 mandatory credit hours.

5.C Program levels (in credit-hours system):

Not applicable

5.D Program courses

5.D.1. Mandatory Major specialization Requirements (15 Credit Hours = 41.67%)

Code	Title	Contact Hours			Hours
		Lecture	Tutorial	Lab	
CS 701	Distributed Systems	3			3
CS 702	Advanced Artificial Intelligence	3			3
CS 703	Theory of Programming Languages	3			3
CS 704	Complexity Theory and Applications	3			3
CS 700	Selected Topics in Computer Science	3			3

5.D.2. Elective Major specialization Requirements (9 Credit Hours = 25%)

Code	Title	Contact Hours			Hours
		Lecture	Tutorial	Lab	
CS 710	Design and Analysis of Parallel Algorithms	3			3
CS 711	Advanced Software Engineering	3			3
CS 712	Algorithmic Graph Theory	3			3

CS 713	Compiler Construction	3			3
CS 714	Advanced Operating Systems	3			3
CS 715	Image Analysis and Pattern Recognition	3			3
CS 716	Data Security	3			3
CS 717	Advanced Database Management	3			3
CS 718	Advanced Computer Graphics	3			3
CS 719	Contemporary Computer Architectures	3			3

5.D.3. College Requirements (12 Credit Hours = 33.33%)

Code	Title	Contact Hours			Hours
		Lecture	Tutorial	Lab	
CS 730	Master's Thesis Part (I)				3
CS 731	Master's Thesis Part (II)				9

6. Contents of Courses

Course Code: **CS701**

Course Title: **Distributed Systems**

Course Content:

Characterization of distributed systems. Distributed systems models. Inter-process communication. Distributed objects and remote invocation. Distributed file systems. Name services. Time and global state. Coordination and agreement. Transactions and concurrency control. Distributed transactions. Replication. Fault-tolerance. Distributed multimedia systems. Distributed shared memory. CORBA case study

Course Code: **CS 702**

Course Title: **Advanced Artificial Intelligence**

Course Content:

This course allows the introduction of material relating to current artificial intelligence research topics, and current advances in artificial intelligence technology. It will thus provide a foundation for understanding advanced topics, such as Fuzzy Logic, Neural Networks, Genetic Algorithms, Machine Learning, Intelligent Mobile Agents, Planning,

Natural Language Processing, and Hybrid Intelligent Systems.

Course Code: **CS703**

Course Title: **Theory of Programming Languages**

Course Content:

Theory of programming languages describes the fundamental concepts of programming languages by presenting design issues, examining design choices, and critically comparing design alternatives.

The topics to be covered are context-free grammars, static and dynamic semantics, variable and type declarations, pointers, expression and assignment statements, objects, classes, inheritance and polymorphism. Exception handling and concurrency are also discussed. Functional and logic programming languages are demonstrated with in depth comparisons.

This course examines various contemporary topics in the theory of programming languages.

Course Code: **CS704**

Course Title: **Complexity Theory and Applications**

Course Content:

This is a first course in complexity theory, with emphasis on the hardness and intractability of problems. Tools for identifying NP-complete problems as well as polynomial reductions between problems are given. Different strategies for dealing with NP hard problems are presented; this includes approximation techniques as well as randomization methods. Other complexity classes such as NC, BPP, RP will be defined and explained.

Course Code: **CS710**

Course Title: **Design and Analysis of Parallel Algorithms**

Course Content:

This is a one semester course in parallel computing. It covers basic concepts of parallel computer architectures and parallel algorithms for a variety of applications. Different models of parallel computers, their performance and scalability are investigated. The design and analysis of algorithms, on different parallel architectures, are studied for several widely used problems.

Course Code: **CS711**

Course Title: **Advanced Software Engineering**

Course Content:

This course introduces students to problems that occur in large scale software production. The course examines technical aspects of software development life cycle and stresses a model driven approach to software engineering. Formal (mathematical and logic based) approaches to software modeling are covered and emphasized. A number of advanced software engineering topics will be studied.

This course shows how to apply the main Software Engineering Models in real software projects through a number of case studies. The student will study the latest models in software engineering and how could it be used in his research work. The latest in cost estimation, productivity, quality, reuse and software reengineering models are studied and discussed.

Course Code: **CS712**

Course Title: **Algorithmic Graph Theory**

Course Content:

The course introduces classical concepts of pure and applied graph theory with emphasis on algorithms and their complexity. A wide variety of the most commonly used graph algorithms are given. Intractable graph problems with no known efficient solutions are identified and efficient approximation algorithms for their solution are studied. Topics will include connectivity, planarity, matchings, network flows, graph colourability, Turan's theorem and Ramsey numbers.

Course Code: **CS713**

Course Title: **Compiler Construction**

Course Content:

Theoretical and practical aspects of complier design and implementation. Lexical analysis, parsing, translation, code generation, optimization, and error handling. Students will design and implement a working complier for a simple language.

Course Code: **CS714**

Course Title: **Advanced Operating Systems**

Course Content:

Synchronization mechanisms. Process deadlocks. Architectures of distributed systems.

Distributed mutual exclusion. Distributed deadlock detection. Agreement protocols. Distributed file systems. Distributed shared memory. Distributed scheduling. Cluster operating systems. Multiprocessor system architectures. Multiprocessor operating systems. Multiprocessor scheduling. Database Operating Systems. Case Studies: Unix, Linux, and Windows XP operating systems

Course Code: **CS715**

Course Title: **Image Analysis and Pattern Recognition**

Course Content:

This course provides students with a sound background in digital image processing and also in pattern recognition. Topics include image processing and analysis in the spatial and frequency domains, image restoration and compression, image segmentation, morphological image processing, representation and description. Fundamentals of pattern recognition are also covered like: Bayes decision theory, parametric and non-parametric classifiers, feature extraction, and selection techniques.

Main concepts used in structural and statistical pattern recognition are also covered. Many applications in image analysis are also presented during the course like: object recognition, signature verification, face recognition, document analysis and many others.

Course Code: **CS716**

Course Title: **Data Security**

Course Content:

The course is targets computer and network security. The course encompasses the study of security policies, models, and mechanisms for secrecy, integrity, and availability. Topics include basic cryptography and its applications, security in computer networks and distributed systems and control and prevention of viruses and other rogue programs, concepts and mechanisms for database security. In addition, hands-on experience will be provided where appropriate using Java security extensions.

Course Code: **CS717**

Course Title: **Advanced Database Management**

Course Content:

This course allows the introduction of material relating to current database research topics, and current advances in database technology. It will thus provide a foundation for understanding advanced topics, such as Distributed Database Systems, Data Warehouse and OLAP, Data Mining, Web Databases and XML, Object Database, Active, Temporal, Intelligent and Deductive Databases, Heterogeneous Databases, Digital Library,

Multimedia Databases, and Mobile Databases.

Course Code: **CS718**

Course Title: **Computer Graphics**

Course Content:

This course is based on current research in computer graphics and modeling. Topics include techniques for generating high quality images of massive geometric models in a short time, surface modeling, physically based modeling, surface visualization, visibility computation, levels of detail, texture based simplification, animation. The course will also survey recent rendering techniques in computer graphics.

Course Code: **CS719**

Course Title: **Contemporary Computer Architectures**

Course Content:

This course provides a foundation for understanding and evaluating the design principles incorporated in contemporary computer systems. Although the field of computer architecture is constantly changing, this course stresses design ideas embodied in many machines, the techniques to evaluate these ideas, and the means to achieve balance and efficiency in the context of any device technology.

Course Code: **CS700**

Course Title: **Selected Topics in Computer Science**

Course Content:

This course is divided into four parts:

First, the student is introduced to research methodologies in which proposal, paper, and thesis writing as well as mechanisms of conducting successful research are reviewed in details.

Second, a section is dedicated to ethics in computer science where the students understand moral and legal principles of professional practice in the area of specialization and identify the fundamentals of scientific research and its ethics.

Third, a section is dedicated to highlight the main techniques used in statistical analysis and its application in Computer Science

Fourth, a section is dedicated to a topic that varies each semester such as: soft-computing, HW/SW system-level describtion languages, Natural Language Processing,

etc.

7. Program admission requirements

Upon accepting the request submitted by the Board of the College of Computing and Information Technology, the Academy awards Master's Degree by the credit hours system in Computer Science and Information Systems.

In September and February of every year, the board of postgraduate studies at the College of Computing and Information Technology reviews the proposals submitted by the boards of the educational departments to determine the number of students to be accepted in Spring and Autumn of every year, the study courses and the schedule of final examinations.

I. Master's Degree Registration Regulations:

1) To register for the Master's degree, the student should be a holder of B.Sc. in the relevant major from Arab Academy for Science & Technology & Maritime Transport, or from any of the corresponding recognized and accredited colleges with cumulative grade point average of "Good" at least, or a holder of Diploma degree with "Very Good" grade at least from the College of Computing and Information Technology or any of the corresponding colleges in the same major.
2) A student may register for a major other than the major of his B. Sc. Degree upon a proposal submitted by the board of postgraduate studies. The student can study the required supplementary pre-master courses, in the case of which the student will not be allowed to register for Master's degree except after successfully passing the supplementary courses determined by the educational department board with at least "Good" grade.
3) The board of postgraduate studies may accept the transfer of credits of equivalent higher studies the student has already completed in corresponding colleges. Provided he passed the said courses with at least "Good" grade, and with a maximum of two courses, i.e., 6 credit hours, and provided no more than two years lapsed since he passed the said courses.

4) The student is not allowed to register for postgraduate studies in any other college or educational institute at the time his application for registration for Master's degree is accepted.

5) Registration may be suspended for one year, whether running or not, upon the request of the student, provided the consent of the board of postgraduate studies is granted.

II. Conditions of accepting Master's dissertation:

The Master's dissertation is equivalent to 12 credit hours, three of which are registered in one semester, and nine in the next semester. The process of accepting a Master's dissertation is as follows:

1) The student will be allowed to register for Master's dissertation after successful completion of five courses (15 credit hours) at least with cumulative grade point average of not less than 2.8.
2) The board of postgraduate studies will nominate the supervisors of the students meeting the set requirements and stipulations with a view to selecting the field and topic of research dissertations, as well as the required optional programmes the students will study which are of relevance to the field and topic of research.

   M.Sc. Candidates will be supervised by professors (senior lecturers) or assistant professors (second lecturers). Teachers (third lecturers) may participate in supervision. An expert or two experts at most from outside the Academy may also participate in supervising the M.Sc. Candidate. In case either of them is absent for four months and more, supervision will be entrusted to a corresponding counterpart to be nominated by the Educational Department concerned.

3) The M.Sc. Candidate will - in cooperation with the supervision committee - makes a presentation with a view to expounding the topic of his research within six months from the date of registration for Master's degree.
4) The supervision committee will submit a report to the board of postgraduate studies every year to describe the progress of the candidate's research.
5) Upon completion of dissertation the supervision committee will submit to the Educational Department concerned the viva voce examination form. A report to the effect that the dissertation meets the viva voce examination requirements, together with copies of published papers, will be attached to the viva voce examination form. The

report will also include the proposed date of the viva voce examination, the names of the members of the viva voce examination board, provided one of them is external.

6) The board of postgraduate studies will contact the examiners (after getting the consent of the educational department and the college board) who will assess the dissertation. Each examiner will submit his own individual assessment report.
7) To begin the procedures of the viva voce examination, all the individual assessment reports must be to the effect that the dissertation is accepted.
8) The viva voce examination board will comprise the assessment committee (a vote for each examiner) and the supervision committee (one vote). The viva voce examination board will have the right to return the dissertation to the M.Sc. candidate to make whatever changes the board may deem necessary within a specified period.
9) When the M. Sc. Candidate has successfully defended his research in the viva voce examination, the members of the examination board will write and sign a collective report and submit it to the Postgraduate Studies Department. The decision of the examination board will be by majority vote.
10) After the candidate has completed the modifications, the viva voce examination board required, the supervisors will submit the final version of the dissertation to the Postgraduate Studies Department; it will be signed by all the members of the committees.
11) The result of the viva voce examination will be approved by the board of postgraduate studies. The report of the board of postgraduate studies will be submitted to the College Board to be approved. The College Board will review the educational standing of the candidate and recommend awarding the degree to the candidate with effect from the date of the meeting of the College Board following the date of approving the dissertation by the board of postgraduate studies.
12) Five copies of the dissertation will be submitted.
13) The M. Sc. Degree will be awarded by a decree issued by the President of the Academy with effect from the date of the meeting of the College Board.

III. Canceling the Candidate's Registration for M. Sc. Degree:

The candidate's registration for M. Sc degree will be cancelled by a decree issued by the College Board after the board of postgraduate studies issues its approval Cancellation will be effected in the following cases.

1) If the candidate fails to obtain the degree within five years starting from the date of registration, taking into consideration registration suspension cases.
2) If the candidate fails to meet the requirements of the study courses, i.e., if his final cumulative grade point average is less than "Very Good (75%) or GPA = 3.0", or if the number of the courses in which the candidate's grade is "Good (60%) or C" exceeds two courses, or if he failed twice in any of the courses.
3) If the supervisor or supervisors submit a report requesting cancellation of registration for reasons accepted by the board of postgraduate studies and the College Board, in which case the candidate will be officially notified.
4) If the candidate's dissertation is absolutely rejected by the assessment committee or the viva voce examination board.
5) If the candidate requests cancellation of registration in writing or does not pay the tuition fees.

IV. *Evaluation:*

The student's performance is assessed in all postgraduate programs according to the following table:

A	90 % and more
A^-	85 % and more
B^+	80% and more
B	75 % and more
B^-	70 % and more
C^+	65 % and more

C	60 % and more

The student will fail in a course if he gets less than 60% of the final mark of the course.

8. Graduation Requirements:

I. Time of Graduation:

Degrees are conferred in March and August.

II. Requirements of Awarding Master's Degree:

1) The duration of study for Master's degree is two calendar years at least and five calendar years at most.
2) The student will successfully complete eight postgraduate courses. i.e., 24 credit hours, with cumulative grade point average of not less than 3.00 at least provided the number of the courses in which he gets "good" grade does not exceed two courses.
3) The student will successfully complete the requirements of preparing Master's thesis (12credit hours).
4) The student will fail in a course if his grade in this course is less than "Good or C", or if his absenteeism percentage exceeds 20% without an acceptable excuse.
5) The student will be allowed to re-sit only once for the examinations of the courses he failed in and will get "Good" grade if he succeeds in the second trial even if the grade he got in the second trial was higher.

III. Awarding M.Sc. Degree:

The degree of Master in Science will be awarded with both Educational Department indicated and the title of the thesis.

IV. Time Limits:

Candidate in the master's program is allowed a maximum of five calendar years to complete all degree requirements, from the date of first registration as a degree candidate in prerequisite or graduate courses.

Candidates who do not complete degree requirements within the allowed time will have their degree candidate status terminated.

9. Evaluation of Program ILOs

Method	Evaluated ILOS
Written exams including short Quizzes Assignments and course term work	Knowledge and understanding Intellectual Skills
Mini projects (single student or team work)	Professional, Practical Skills, General and Transferable Skills
Practical Work	Professional, Practical Skills, General and Transferable Skills
Graduation Thesis	Professional, Practical Skills, General and Transferable Skills

10. Methods of Program evaluation:

	Evaluator	Method
1	Students	Questionnaires, surveys, checklists
2	Alumni	Questionnaires, surveys, checklists
3	Employers	Individual interviews, Questionnaires, Meetings
4	External auditors and Examiners	Documentation review, Observation
5	Instructors	Focus groups, Course surveys, Meetings

Head of Department

Name: Prof. Dr. Samah Ahmed Senbel

Sign:

Date: / /