



Cairo University
Institute of Statistical Studies &
Research

Computer Science Ph.D.
Program Handbook
Computer Sciences Department

ISSR Established 1947

Computer and Information Sciences Department Established 1973



Computer Science Ph.D. Program Handbook

Handbook Teamwork

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TO WHOM IT MAY CONCERN

This is an approved copy of the courses specifications of the computer science Ph.D. program offered by Computer Sciences Department of the Institute of statistical studies and research , Cairo University, during the academic year 201^o-201^٦.

Vice Dean
For Teaching and studies Affairs

Dean

Prof. HeshamHefny

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Title	Code
Advanced Mathematics for Computer Sciences	CS704 <u>8</u>
Advances in Computer Sciences	CS702 <u>10</u>
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Doctorate of Computer Sciences

Program Specification

Cairo University

Institute of Statistical Studies and Research (ISSR)

A. Basic Information

- Program title: *Doctorate of Computer Sciences*
- Program type: *Single (Pure)*
- Department: *Computer And Information Sciences.*
- Coordinator: *Head of Department*
- External Evaluator(s): *N/A*
- Last date of program specifications approval: *28-2-2016*

B. Professional Information:

1. Program Aims

Prepare qualified persons to achieve contributions in computer sciences to enhance the national research's share among other countries as well as to have a role in the development of our society.

2. Intended Learning Outcomes (ILOs)

a. Knowledge and Understanding

a1-Knowledge of advanced topics in computer sciences.

a2-Knowledge of advanced topics in computer mathematics.

b. Intellectual Skills

b1-Advanced computational skills in solving real life problems.

b2-Advanced intellectual skills in integrating ideas from different disciplines .

c. Professional and Practical Skills

c1- The ability to criticize the work of other researchers.

c2-Practical skills in preparing a PhD research.

d- General and Transferable Skills

d1-Enhancing the criticism thinking.

d2- The ability of self learning of new computational methodologies.

3. Academic Standards

3a External References for Standards: N/A

3b Comparison of Provision to External References: N/A

4. Curriculum Structure and Contents

4.a- Program duration: 2 semesters (One Academic Years)

4.b- Program Structure:

4.b.i- No. of hours / week: Lectures...15. Lab/Exercise N/A TotalN/A

4.b.ii- No. of credit hours: **Compulsory**...9.**Elective**...3

4.b.iii- No. of credit hours of **basic** courses: 9 75 %.

4.b.iv- No. of credit hours of **specialized** courses: 3 25 %

4.b.v- No. of credit hours of **other** courses: N/A

4.b.vi- Practical / Field Training: N/A

4.b.vii- Program Levels (in credit-hours system): N/A

5. Program Courses

5.1- Level / Year of Program: 1 Semester: 1

a-Compulsory

Code No.	Course Title	PRE.	No. of Units	No. of hours/week			Program ILOs covered (By No.)
				Lec.	Lab.	Exe.	
CS703	Directed Reading		3	3			c2,d1-d2
CS704	Advanced Mathematics for Computer Sciences		3	3			a2,b1,c1-c2,d1-d2

5.2- Level / Year of Program: 1 Semester: 2

a. Compulsory

Code No.	Course Title	PRE.	No. of Units	No. of hours/week			Program ILOs covered (By No.)
				Lec.	Lab.	Exe.	
CS701	Advanced Topics in Computer Sciences		3	3			a1,b2,c1-c2,d1-d2
CS702	Advances In Computer Sciences		3	3			a1,b2,c1-c2,d1-d2

6. Program Admission Requirements

1. Students having the ISSR's Master of CS..

2. Students having equivalent Master degree in CS from other universities.

7. Regulations for Progression and Program Completion

Student must successfully complete (12) credit hours structured as follows:

(9) compulsory, (3) specialized elective.

8. Evaluation Program Intended Learning Outcomes

Evaluator	Tool	Sample
1- Senior students	Questionnaire	N/A
2- Alumni	Annual Department Conference	N/A
3- Stakeholders (Employers)	Annual Department Conference	N/A
4-External Evaluators(s) External Examiner(s)	Prof. Said Seliem Prof. Abdel Aziz Khamis	N/A
5- others		

Course Specifications

A. Basic Information

Program(s) on which the course is given : Doctorate of Computer Sciences

- Major or Minor element of program : Major
- Department offering the program : Computer and Information Sciences
- Department offering the course : Computer and Information Sciences
- Academic year / level : Pre-PhD

Date of Specification approval : 28-2-2016

Title: Advanced Mathematics for Computer Sciences Code: CS704

- Credit Hours : Three Lectures: 3 Hours (one/Week)
- Tutorial: N/A Practical: N/A Total: N/A

B. Professional Information

1. Overall Aims of Course

The aim of this course is to introduce students to advanced topics of the theory of computation and formal languages design.

2. Intended Learning Outcomes (ILOs)

a. Knowledge and Understanding

a1- Knowledge of interrelationship between automata models and formal languages design.

a2- Knowledge and Understanding of fractal theory.

b. Intellectual Skills

b1- Formulating problems in mathematical and structure model.

b2- Design appropriate automata for a given language and vice versa.

c. Professional and Practical Skills

c1- Constructing & implementing algorithms for generating given languages

c2- Selecting the minimal grammar for a given language.

d. General and Transferable Skills

d1- Enhancing the algorithmic way of thinking.

d2- The ability of self learning

3. Contents

Topic	No. of hours	No. of Lectures	Tutorial/Practical
Automata Theory	9	3	N/A
Languages & Grammars	12	4	N/A
Relationship between automata & languages	12	4	N/A
Fractal Theory	9	3	N/A

4. Teaching and Learning Methods

4.1- Lectures

4.2- Projects

5. Student Assessment Methods

5.1. Projects to assess ILOs (b & c)

5.2. Mid-Term Exam to assess ILOs (a, b & c)

5.3. End of term Exam to assess ILOs (a, b, c &d).

Assessment Schedule

Assessment 1: Project I Week 4

Assessment 2: Project II Week 7

Assessment 3: Mid-Term Exam Week 9

Assessment 4: End of term Exam Week 15

Weighting of Assessment

Semester Work 15 %

Mid-Term Examination 15 %

Final- Term Examination: 70 %

Total 100%

6. List of References6.1- Course Notes

Lectures Notes

6.2- Essential Books (Text Books)

1. I. L. Hein, "Theory of Computation",

7. Facilities Required for Teaching and Learning

Printed Materials / Whiteboards / Overhead Projectorss

Course Coordinator: Prof. Atef Abdel Moeim

Head Department: Dr. Hesham A. Hefny

Date: 2015/2016

Course Specifications

B. Basic Information

Program(s) on which the course is given : Doctorate of Computer Sciences

- Major or Minor element of program : Major
 - Department offering the program : Computer and Information Sciences
 - Department offering the course : Computer and Information Sciences
 - Academic year / level : Second level
- Date of Specification approval : 28-2-2016

- Title: Advances in Computer Sciences Code: CS702
- Credit Hours : Three Lectures: 1.5 Hours (Two/Week)
- Tutorial: N/A Practical: N/A Total: N/A

B. Professional Information

1. Overall Aims of Course(Introduction Computational Biology)

The aim of this course is to introduce computational biology which used to be cottage industry and become an attractive interdisciplinary field. Via this course we attract the attention and imagination as well as try to build quantitatively-minded scientists. Different algorithms and tools of scientific thinking will amongst the tools adopted.

2. Intended Learning Outcomes (ILOs)

a. Knowledge and Understanding

- a1- The use of the Extraction-Maximization algorithm in maximal distribution and maximal likelihood functions.
- a2- The paradigm of comparative and its utilization.
- a3- The potential bioinformatics and computational biology have in speeding up and trimming the course of drug discovery.
- a4- The building blocks of the nucleic acids (DNA and RNA) , and their 3D-Schafolds.
- A5- The Structural features of proteins and the effect of mutations on their folding .

b. Intellectual Skills

- b1- Looking at discoveries ,in biology , from an analytic perspective.
- b2- Adopting a concrete approach to furnish more flourish in biotechnology.
- b3- building and refining an imagination of how the huge number of biomolecules react and interact: formation of dynamic network.

b4- Analyze and design simple algorithms in an attempt to simulate biological processes.

b5- A bacterium divides nearly every hour, how does it know where its middle is and how sequence of events of division is controlled.

c. Professional and Practical Skills

c1-Usage of microorganisms in drugs development .

c2-Gene gates; mechanism of gene interactions and how to control.

c3- The asymptotic behavior of resources usage in biological mechanisms.

d- General and Transferable Skills

d1- The ability to evaluate and estimate the efficiencies among different biological systems and same system in different organisms.

3. Contents

Topic	No. of hours	No. of Lectures	Tutorial/Practical
The Extraction- Maximization algorithm and the rise of computational biology	3	2	N/A
Computational biology and drug discovery.	3	2	N/A
Biomolecules :Molecule, code and representation of DNA, RNA and Protein	3	2	N/A
Networks structure ,fluctuation, and deterministic	3	2	N/A
Introduction to computational biology; compatibility model.	3	2	N/A
Algorithms and applications in computational biology	3	2	N/A
Physical mapping of DNA	3	2	N/A
Genome Rearrangements	3	2	N/A
Algebraic statistics for computational biology	3	2	N/A
Parametric inference	3	2	N/A
Equations defining Hidden Markov models	3	2	N/A
Extending tree models to split networks	3	2	N/A

4. Teaching and Learning Methods

4.1- Lectures

4.2- Examples

4.3- Discussions.

4.4- Discussions of Quizzes thereafter.

5. Student Assessment Methods

- 5.1. Quizzes to assess ILOs (b)
- 5.2. End of term Exam to assess ILOs (a, b, c &d).

Assessment Schedule

Assessment 1: Quiz I	Week 4
Assessment 2: Quiz II	Week 8
Assessment 3: End of term Exam	Week 13

Weighting of Assessment

Semester Work	30 %
<u>Final- Term Examination:</u>	<u>70 %</u>
Total	100%

6. List of References

6.1- Course Notes
Lectures Notes

6.2- Essential Books (Text Books)

1. Tuan Pham' Computational Biology: Issues and Applications in Oncology ', Springer Science and Business Media , 2009
- 2- Xingdon Wu, and VIPIN Kumar 'The top ten algorithms in data mining ',Taylor & Francis Group, 2009

7. Facilities Required for Teaching and Learning

Printed Materials / Blackboards / Overhead Projectors / Data shows

Course Coordinator: Dr. Hesham A. Hefny

Dr. Ashraf E.khodier

Head Department: Dr. Hesham A. Hefny

Date: 2015/2016

Course Specifications

Cairo University Institute of Statistical Studies and Research

C. Basic Information

Program(s) on which the course is given : *Master of Computer Sciences*

- Major or Minor element of program : *Major*
- Department offering the program : *Computer and Information Sciences*
- Department offering the course : *Computer and Information Sciences*
- Academic year / level : *Pre-Master*

Date of Specification approval : *28-2-2016*

- Title: *Selected Topics in Computer Science* Code: *CS701*
- Credit Hours : *Three* Lectures: *1.5 Hours (Two/Week)*
- Tutorial: *N/A* Practical: *N/A* Total: *N/A*

B. Professional Information

1. Overall Aims of Course

The aim of this course is to introduce students to the fuzzy logic approach for handling inherently imprecise concepts. Fuzzy logic represents the mathematical form of the human decision making approach based on common sense. Understanding of fuzzy sets and fuzzy logic is essential for building fuzzy models real life phenomena. The course covers the following topics: Fuzzy logic vs. Standard logic, Crisp Sets vs. Fuzzy Sets, Operations on Fuzzy Set, Fuzzy Membership Functions, Linguistic variables and linguistic Hedges, Possibility Measure, Fuzzy Relations, Projection and Cylindrical Extension Operations, Fuzzy Rule-Based Model, Mamdani Fuzzy Model, Fuzzy Arithmetic, and adaptive fuzzy systems.

2. Intended Learning Outcomes (ILOs)

a. Knowledge and Understanding

- a1-*Identify various types of uncertainty.*
- a2-*State the limitations of classical logic.*
- a3-*Understanding the concepts of fuzzy set and fuzzy membership function.*
- a4-*Understanding the concepts of linguistic variables and linguistic values.*
- a7-*Illustrate the effect of linguistic modifiers on fuzzy sets.*
- a8-*Understanding the concept of fuzzy relations*
- a9-*Understanding the reasoning mechanism in fuzzy logic based system.*

b. Intellectual Skills

b1-Perform fuzzy set operations on compound linguistic expressions.

b2-Perform operations on fuzzy relations.

b3-Compute the output of fuzzy rule.

b4-Compute the output of a fuzzy rule based model.

b5-Perform arithmetic operations on fuzzy numbers.

b6-Design of an adaptive fuzzy model.

c. Professional and Practical Skills

c1-Apply the concepts of fuzzy sets and fuzzy logic in real life problems.

c2-Using Mamdani model to construct fuzzy systems.

c3-Apply the concept of alpha-cut to perform fuzzy arithmetic operations.

d- General and Transferable Skills

d1- The ability to apply fuzzy approach to manipulate uncertainties.

d2- The ability of self learning

3. Contents

Topic	No. of hours	No. of Lectures	Tutorial/Practical
<i>Basic concepts: precision and imprecision - exact and inexact knowledge - fuzzy logic vs. crisp logic</i>	3	2	N/A
<i>Crisp sets vs. fuzzy sets - fuzzy logic for system modeling - fuzziness vs. randomness</i>	3	2	N/A
<i>Fuzzy sets representations and properties.</i>	3	2	N/A
<i>Operations on fuzzy sets – computing T-norm and S-norm pairs- Examples</i>	3	2	N/A
<i>Features of fuzzy membership Functions – Linguistic hedges</i>	3	2	N/A
<i>Possibility measure-Fuzzy relations</i>	3	2	N/A
<i>Operations on fuzzy relations</i>	3	2	N/A
<i>Fuzzy IF-THEN rule – Defuzzification techniques.</i>	3	2	N/A
<i>Fuzzy Graph model-Mamdani model</i>	3	2	N/A
<i>Fuzzy arithmetic</i>	4.5	3	N/A
<i>Adaptive Fuzzy Modeling</i>	3	2	

4. Teaching and Learning Methods

4.1- Lectures

4.2- Examples

4.3- *Discussions.*

4.4- *Discussions of Quizzes thereafter.*

5. Student Assessment Methods

5.1. *Quizzes* to assess *ILOs (b)*

5.2. *End of term Exam* to assess *ILOs (a, b, c &d).*

Assessment Schedule

Assessment 1: *Quiz I* Week 4

Assessment 2: *Quiz II* Week 8

Assessment 3: *End of term Exam* Week 13

Weighting of Assessment

Semester Work 30 %

Final- Term Examination: 70 %

Total 100%

6. List of References

6.1- Course Notes

Lectures Notes

6.2- Essential Books (Text Books)

1. *Kwang H. Lee, "First Course on Fuzzy Theory and Applications", Springer-Verlag Berlin Heidelberg , 2005*
2. *John Yen and Reza Langari , "Fuzzy Logic : Intelligence, control , and Information", Prentice hall, 1998*
3. *Timothy J. Ross, "Fuzzy Logic With Engineering Applications", McGraw-Hill, Inc., 1995.*

7. Facilities Required for Teaching and Learning

Printed Materials / Whiteboards / Overhead Projectors / Data shows

Course Coordinator: *Dr. Hesham A. Hefny*

Head Department: *Dr. Hesham A. Hefny*

Date: 2015/2016

Course Specifications

A. Basic Information

Program(s) on which the course is given: *Doctorate of Computer Sciences*

- Major or Minor element of program: *Major*
- Department offering the program: *Computer and Information Sciences*
- Department offering the course: *Computer and Information Sciences*
- Academic year / level: *Second Level*
- Date of Specification approval: *28-2-2016*
- Title: *Directed Reading* Code: *CS703*
- Credit Hours: *Three* Lecture: *1.5 hours (Two/week)*
- Tutorial: *N/A* Practical: *N/A* Total: *Three*

B. Professional Information

1. Overall Aims of Course

The intent of the course is to present a fairly broad graduate-level introduction to Natural Language Processing (NLP, a.k.a. computational linguistics), the study of computing systems that can process, understand, or communicate in human language. The primary focus of the course will be on understanding various NLP tasks as listed on the course syllabus, algorithms for effectively solving these problems, and methods for evaluating their performance. There will be a focus on statistical learning algorithms that train on (annotated) text corpora to automatically acquire the knowledge needed to perform the task. Class lectures will discuss general issues as well as present abstract algorithms. Implemented versions of some of the algorithms will be provided in order to give a feel for how the systems discussed in class "really work" and allow for extensions and experimentation as part of the course projects.

□

2. Intended Learning Outcomes (ILOs)

- 1 Demonstrate a systematic understanding of knowledge and a critical awareness of current problems and/or new insights much of it at or informed by the forefront of the computer science discipline
- 2 Use originality in the application of knowledge in a professional environment, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in the discipline of computer science
- 3 Evaluate and critique methodologies and practices within the field of computer science
- 4 Demonstrate self-direction, originality and creativity in tackling and solving practical computer science related problems which have been

planned and implemented within a global professional, legal, social and ethical framework

- 5 Exercise initiative and personal responsibility in dealing with complex and unpredictable situations, making sound judgements, communicating their conclusions clearly to specialist and nonspecialist audiences

3. Contents

Topic	No. of hours	No. of Lectures	Tutorial/ Practical
	3	2	N/A
	3	2	N/A
	6	4	N/A
	3	2	N/A
	3	2	N/A
	6	4	N/A
	4.5	3	N/A
	4.5	3	N/A
	3	2	N/A
	6	4	N/A

4. Teaching and Learning Methods

4.1- Lectures

4.2- Examples

4.3- Discussions

4.4- Discussion of Quizzes thereafter

5. Student Assessment Methods

5.1. Quizzes to assess ILOs (b&c)

5.2. End of term Exam to assess ILOs (a, b, c &d).

Assessment Schedule

Assessment 1: Quiz I Week 5

Assessment 2: Quiz II Week 10

Assessment 3: End of term Exam Week 15

Weighting of Assessment

Semester Work	25 %
Final- Term Examination	75 %
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Total	100 %

6. List of References

6.1- Course Notes

Lectures Notes

6.2- Essential Books (Text Books)

6.3- Recommend Books

7. Facilities Required for Teaching and Learning

Printed Materials / Whiteboard / Projector / Data show

Course Coordinator: *prof. Hesham A. Hefny*

Head Department: *prof. Hesham A. Hefny*

Date 2015/2016