



Department of Computer Science and  
Information Systems

**MSc in Computer Science  
Programme Arrangements  
2019–2020**

Version of September 17, 2019

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# 1 General Information

## 1.1 Contacts

Programme Director:	Szabolcs Mikulás, <a href="mailto:szabolcs@dcs.bbk.ac.uk">szabolcs@dcs.bbk.ac.uk</a>
Programme Administrators:	Kat Miao Yu, Stacey Hine, <a href="mailto:pg@dcs.bbk.ac.uk">pg@dcs.bbk.ac.uk</a>
Admissions Tutor:	Carsten Fuhs, <a href="mailto:carsten@dcs.bbk.ac.uk">carsten@dcs.bbk.ac.uk</a>
Projects Tutor:	Oded Lachish, <a href="mailto:oded@dcs.bbk.ac.uk">oded@dcs.bbk.ac.uk</a>

## 1.2 Web presence

Detailed and updated information about the programme is available from the

- programme internet page:  
[www.dcs.bbk.ac.uk/study/postgraduate/msc-computer-science/](http://www.dcs.bbk.ac.uk/study/postgraduate/msc-computer-science/)
- Departmental Moodle page (for enrolled students);  
<https://moodle.bbk.ac.uk/course/view.php?id=3884>

It is your responsibility to familiarise yourself with the contents of both of this booklet as well as the internet pages of the programme. You should also read your college email on a regular basis.

## 2 Student Support

Every student is allocated a personal tutor in the first weeks of the programme. The personal tutor is someone students can contact to discuss any problems of a non-academic nature. These may relate to special needs or personal problems that may affect the student's academic performance. The Department also has a disability officer whom students can contact.

Academic problems should first be addressed to the lecturer concerned. If the problem is not resolved or it does not relate to a specific module, then the Programme Director should be contacted.

For more general information about Birkbeck, student services and regulations have a look at

<https://www.bbk.ac.uk/student-services>.

It is expected that students familiarise themselves with these pages so that they are aware of the services and regulations.

The School of Business, Economics and Informatics has Learning Co-ordinators. Their role is to support students in their studies. They can offer help and support on a variety of topics ranging from writing skills to basic maths. See

<http://www.bbk.ac.uk/business/current-students/learning-co-ordinators>

for details.

### 3 Important Dates

Lectures will commence in the week starting on Monday 30 September 2019. The teaching (i.e., not including exams and project) covers two terms of eleven weeks each (autumn and spring term). The summer term is given over to revision (including revision lectures), exams, and the project.

- Autumn term: 30 September 2019 – 13 December 2019.
- Spring term: 13 January 2020 – 27 March 2020.
- Summer term: 27 April 2020 – 10 July 2020.

Please refer to

<http://www.bbk.ac.uk/about-us/term-dates>

for the College holiday closing times.

Students should attend lectures during term time as shown in the timetables in Section 4.3. If students are unable to attend lectures, they should arrange with lecturers or fellow-students to obtain copies of any material distributed in class.

Any student who decides to withdraw from the programme should inform the Programme Administrator. Students who simply stop turning up for lectures without formally withdrawing from the programme will still be held liable for fees. It is especially important for international students that they inform the department about any absence.

## 4 Syllabus

### 4.1 Introductory Talks

The programme will kick off with introductory talks to new students in the week preceding the start of the first term. The dates, times and venues of these will be made available through My Birkbeck. They are also mentioned at <http://www.bbk.ac.uk/events/?tag=7>.

The talks will include a hands-on introduction to the departmental computer systems and short presentations by representatives of the library and the disability office.

### 4.2 List of Modules

We give a general overview of the content of the programme here; detailed descriptions of the individual modules is in the next section.

#### 4.2.1 Compulsory Modules

- Principles of Programming I — PoP I (15 credits)
- Principles of Programming II — PoP II (15 credits)
- Fundamentals of Computing — FoC (15 credits)
- Information Systems — IS (15 credits)
- Computer Systems — CS (15 credits)
- Data and Knowledge Management — DKM (15 credits)
- Software Design and Programming — SDP (15 credits)
- MSc Computer Science Project (60 credits)

#### 4.2.2 Optional Modules

Students also have to choose one optional module from the following list.

- Data Warehousing and Data Mining<sup>1</sup> — DWDM (15 credits)
- Information and Network Security — INS (15 credits)

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<sup>1</sup>Note that DWDM may not be offered in 2020/21.

- Internet and Web Technologies — IWT (15 credits)
- Natural Language Processing and Information Retrieval — NLP (15 credits)

Optional module availability is subject to timetabling constraints and student demand. In the event that an optional module is over-subscribed, available places will be allocated on a first-come, first-served basis determined by the date you return your module choice form to the Programme Administrator.

### 4.3 Timetables

Personal timetables (including the teaching venues) are provided through My Birkbeck. A general timetable for the week ahead is available online:

<http://www.dcs.bbk.ac.uk/study/>

Below is the timetable for the modules. Note that occasionally there might be changes (e.g. swapping of lectures between modules, or additional tutoring sessions). Please check the web pages of the modules regularly for up-to-date information.

#### 4.3.1 Part-time Students Year 1

In the first year PT students take only compulsory modules as follows.

First year		
Term 1 (Autumn)	18:00–19:20	19:40–21:00
Mon	PoP I	PoP I
Wed	FoC	IS

First year		
Term 2 (Spring)	18:00–19:20	19:40–21:00
Mon	PoP II	PoP II
Wed	IS	FoC
Thu	CS	CS



### 4.3.2 Part-time Students Year 2

In the second year PT students follow the compulsory modules below, and also one optional module — see Section 4.3.5 below.

Second year		
Term 1 (Autumn)	18:00–19:20	19:40–21:00
Thu	DKM	DKM
Fri, 3rd week only	MSc Project	MSc Project

Second year		
Term 2 (Spring)	18:00–19:20	19:40–21:00
Thu	SDP	SDP

### 4.3.3 Full-time Students

FT students follow the compulsory modules below, and also one optional module — see Section 4.3.5 below.

Term 1 (Autumn)	13:30–15:00	15:30–17:00
Mon	PoP	PoP
Tue	DKM	DKM
Wed	PoP	PoP
Thu	IS	FoC
Fri, 3rd week only	MSc Project	MSc Project

Term 2 (Spring)	13:30–15:00	15:30–17:00
Tue	SDP	SDP
Wed	CS	CS
Thu	IS	FoC

### 4.3.4 Day-release Part-time Students

Day-release part-time students attend lectures with the full-time students for one day of the week and attend the other lectures with the part-time students during

the evening.

First year	
Mon 18:00–21:00	PoP
Thu 13:30–17:00 (term 1)	IS, FoC
Thu 13:30–21:00 (term 2)	IS, FoC, CS

Second year	
Tue 13:30–17:00 (term 1)	DKM
Tue 13:30–17:00 (term 2)	SDP
Fri 18:00–21:00 (term 1), 3rd week only	MSc Project

Alternatively, students can attend the lectures in any combination of the tables above as long as all modules are attended in the correct year (PoP I and II, FoC, IS, and CS in year 1 and the remaining modules in year 2).

#### 4.3.5 Optional Modules

Here are the times for the optional modules. You have to choose only one of them.

Mon 18:00–21:00 (term 1)	INS
Tue 18:00–21:00 (term 2)	NLP, IWT
Wed 18:00–21:00 (term 2)	DWDM

Note that DWDM may not be offered in 2020/21.

## 5 Compulsory Module Descriptions

### 5.1 Principles of Programming I (PoP I)

#### Teaching Staff

Vladislav Ryzhikov, Hubie Chen

#### Online material

On Moodle.

#### Aims, Outline and Learning Outcomes

To provide the student with a comprehensive grounding in programming. This module introduces programming concepts and techniques, as well as elementary software development principles. Both for absolute beginners and for those with prior programming experience, the module introduces the fundamentals of programming, including: variables and assignment, primitive and complex types, methods, control structures, collections, iteration, recursion, as well as classes and objects in object-oriented programming. The module also introduces basic software development issues such as design, testing, debugging.

On successful completion of this module a student will be expected to be able to:

- Demonstrate knowledge of fundamental imperative programming concepts such as variables and assignment, conditional statements, loops and methods.
- Code an application in a suitable programming language, from a detailed software specification.
- Evidence knowledge of basic concepts and principles of object-orientation such as objects and classes, encapsulation, object state, coupling, cohesion and modularity.
- Show awareness of basic principles of software design and development including appropriate naming of variables and classes, code layout, testing, debugging, and code version control.

#### Syllabus

- Core imperative programming ideas: sequence, iteration, assignment, and variables

- Data types
- Collection Data Structures: Arrays, List, Sets, Dictionaries
- Functions
- Version Control
- Automated testing and test-driven development (TDD)
- Object-oriented programming: Encapsulation, Inheritance, Polymorphism
- Functional programming features of Python
- Dynamic data structures: Linked lists, Queues, and Stacks
- Recursion
- Exception handling

### **Prerequisites**

A pass in the relevant admissions test.

### **Assessment**

By examination (80%) and programming coursework (20%). The examination is split into two parts; 1) 40% via an online programming exam, and 2) 40% via a written exam.

### **Reading**

A set of course notes will be provided but the following text covers similar topics:

- Python for Everyone, Interactive Edition, 2nd Edition, by Cay S. Horstmann, Rance D. Necaise. Wiley. 2016. ISBN: 978-1-119-18665-6

## 5.2 Principles of Programming II (PoP II)

### Teaching Staff

Hubie Chen

### Online material

On Moodle.

### Aims and Learning Outcomes

This module covers object-oriented programming using the Java programming language, including the use of subclasses, modules, and library classes to create well-organised programs. A further aim is to enhance students understanding of making appropriate choices on the selection of algorithms, their implementation together with the required data structures (e.g. arrays, lists, trees, graphs, depth- and breadth-first search algorithms).

This module further develops the techniques described in the Principles of Programming I module. This module discusses issues specifically related to developing programs for large programming projects and for modern computer hardware architectures.

On successful completion of this module a student will be expected to be able to:

- Explain and exploit subclasses, inheritance and interfaces to produce modular, well-organised code.
- To utilise the relevant features of a programming language.
- Implement simple algorithms and data structures, both in sequential and parallel environments.
- Show knowledge of basic concepts and principles of object-orientation such as objects and classes, encapsulation, object state, coupling, cohesion and modularity.

### Syllabus

- Data types in Java
- Control flow in Java
- Transition to Object-Oriented Programming, including types, classes, inheritance, etc.

- Static typing and reference types
- Local I/O
- Exception handling
- Generics
- Multithreaded programming
- Style
- Further test driven development
- Programming in teams

### **Prerequisites**

Principles of Programming I module.

### **Assessment**

This module is assessed by

- Two-hour unseen examination online or paper (80%)
- Programming assignments and group work (20%)

### **Reading**

Materials will be provided by the instructor; the following text is recommended as a reference:

- Java: A Beginner's Guide (Sixth Edition), by Herbert Schildt. 2014, McGraw-Hill Education. ISBN: 978-0-07-180926-9.

## 5.3 Fundamentals of Computing (FoC)

### Teaching Staff

Michael Zakharyashev (module coordinator), Trevor Fenner

### Aims

Discrete mathematics, mathematical logic, and the related fundamental areas of data structures and algorithms lie at the heart of any modern study of Computer Science. Any understanding of how computers operate and how to use them effectively and efficiently, in terms of either their hardware or software, inevitably involves numerous mathematical concepts.

### Syllabus

- Digital logic. Arithmetic for computers.
- Elements of set theory.
- Finite state machines (automata). Nondeterministic automata.
- Regular languages.
- Context-free languages and pushdown automata.
- Turing machines. Universal Turing machines. Undecidable problems.
- Data structures: representations and operations.
- Lists, stacks, queues and dequeues.
- Trees, forests, binary trees.
- Tree traversal and other operations; binary search trees.
- Organisation of disk storage; methods of file organisation; B-trees.
- Design and analysis of algorithms. Sorting and searching.

### Prerequisites

Students taking this module must be also be currently taking (or have previously taken) a suitable programming module (Principles of Programming, or Introduction to Software Development). With the permission of the Programme Director, other students may take this module if they have equivalent appropriate programming experience.

### Assessment

By 3-hour written examination and coursework exercises, weighting 80% and 20% respectively.

## Reading

- D. Patterson and J. Hennessy, Computer Organization and Design: The Hardware/Software Interface. Morgan Kaufmann; 3 edition, 2007.
- E. Kinber and C. Smith, Theory of Computing. A gentle introduction. Prentice Hall, 2001.

## Online material

<http://www.dcs.bbk.ac.uk/~michael/foc/foc.html>

<http://www.dcs.bbk.ac.uk/~trevor/FoC/focTF2018.html>



## 5.4 Information Systems (IS)

### Teaching Staff

Brian Gannon

### Aims

The primary aim of the module is to describe enterprise information systems (EIS) and to set out the considerations and approaches used to implement (deploy) these systems in the business enterprise. This covers predominantly the Systems Development Life Cycle (SDLC) and the various methodologies used to formalise it, including waterfall and agile approaches, with particular emphasis on the Scrum method. In the course of this module students are introduced to a range of topics relevant to EIS deployment and the SDLC, including object-orientation, the Unified Process and Universal Modelling Language (UML), enterprise architecture and technical architecture.

Alongside describing the SDLC, students will be introduced to practical aspects associated with a career as an IS professional, and social and organisational aspects of enterprise computing. This will include topics such as Intellectual Property, Digital Surveillance, Data Privacy and Ethical issues in computing.

### Outline

The module describes approaches, processes, methodologies and techniques commonly used for large-scale information systems development. It covers the systems development life cycle (SDLC), including project initiation, analysis, design and implementation, addressing key aspects and techniques at each stage. Project methodologies are described, with an emphasis on the Scrum methodology. The module also incorporates insights into professional and legal issues associated with EIS development.

### Syllabus

- Introduction to Enterprise Information Systems (EIS)
- SDLC, IS project methodologies and the Unified Process
- Unified Process Planning & Analysis
- Scrum I Process, Roles, Activities & Ceremonies
- Scrum II Artefacts & Concepts

- Enterprise Architecture & Technical Architecture;
- EIS Implementation and Operation;
- GDPR, Freedom of Information & Intellectual Property Rights, Contracts & Business Planning, and
- Computer Misuse, Digital Surveillance, Ethical Issues in Computing.

### **Assessment**

By a 2-hour unseen written examination and in-class tests, weighting 80% and 20% respectively.

### **Recommended Reading**

Multiple sources including various academic papers. Also, various textbooks including:

- Essential SCRUM, Rubin, Addison Wesley, NJ 2013.
- A guide to the SCRUM body of knowledge, 3rd edition, VM Education, AZ 2016.
- Systems Analysis and Design with UML, Tegarden, Dennis, & Wixom, 5th edition, Wiley.
- Professional Issues in Information Technology, Bott, 2nd edition, BCS, 2014.

### **Online Material**

<https://moodle.bbk.ac.uk/>

## 5.5 Computer Systems (CS)

### Teaching Staff

Szabolcs Mikulás

### Aims

To learn the basics of computer architecture and organisation, and the role and mechanism of operating systems.

### Syllabus

- Introduction: Computer architecture (CA) and Operating system (OS) overview
- Processors
- Processes and threads
- Concurrency
- Memory management
- I/O and file systems
- Protection and security
- Distributed and parallel processing

### Prerequisites

MSc IT students who wish to enrol to this module are expected to pass the test for the short course.

### Assessment

By 2-hour written examination and coursework, weighting 90% and 10%, respectively.

### Reading

Textbook:

- W. Stallings, Operating Systems, Internals and Design Principles, Prentice Hall, 5th (or later) edition, 2005.

Recommended reading:

- W. Stallings, Computer Organization and Architecture: Designing for Performance, Prentice Hall, 7th (or later) edition, 2006.
- A.S. Tanenbaum, Modern Operating Systems, Prentice Hall. 2nd (or later) edition, 2001.

**Online material**

<http://www.dcs.bbk.ac.uk/~szabolcs/compsys.html>

## 5.6 Data and Knowledge Management (DKM)

### Teaching Staff

Nigel Martin

### Online material

<http://www.dcs.bbk.ac.uk/~nigel/teaching/dkm/>

### Aims and Outline

To study the principles and application of data and knowledge management technology.

This module covers the principles and application of data and knowledge management technologies and languages including SQL. Students study the use of these in leading commercial database management systems as well as emerging approaches to data management.

### Syllabus

- Database management software: origins and objectives.
- The relational model: algebraic and logical foundations.
- Relational algebra and calculus.
- SQL: data manipulation, host language support for SQL.
- Transaction management: recovery, concurrency.
- Relational database theory: dependencies, normal forms.
- SQL data definition, other features.
- DBMS architectures and implementations.
- DBMS storage and indexing.
- Query optimisation.
- Enhanced database capabilities: procedural extensions to SQL, database triggers, deductive databases.
- Non-relational DBMS, object databases, NoSQL databases.
- Distributed databases, architectures, query processing.
- Databases and the Web, JDBC, alternative persistence frameworks, databases and XML.
- Database research topics.

**Assessment**

By 2-hour written examination and practical coursework, weighting 90% and 10% respectively.

**Pre-requisites and co-requisites to the module**

No formal pre-requisite, but a strong aptitude for programming is essential.

**Reading**

- Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, Third Edition, McGraw Hill, 2003, ISBN 0072465638.
- Students will also be directed to Web resources on the subject.

## 5.7 Software Design and Programming (SDP)

### Teaching Staff

Keith Mannock

### Online material

<http://moodle.bbk.ac.uk/>

### Aims

The main aim of the module is to provide students with the necessary skills for developing software utilising the object-oriented and functional programming paradigms utilising the Java programming language.

### Syllabus

A selection from the following topics:

- The object model and how it is realised in various object-oriented languages (e.g., Java, Scala, Ruby, C++, ...)
- Further development the ideas of inheritance and polymorphism and abstraction
- Language features: inner classes, closures, higher-order functions, meta-objects, etc.
- The functional paradigm. Abstract data types, polymorphic types, static typing and type inference. Recursion and induction. List processing. Higher-order functions. Eager and lazy evaluation. Imperative features. Signatures, structures, functors, typeclasses, monads
- An introduction to Test Driven Design (TDD) and Behavioural Driven Design (BDD)
- The use of an Integrated Development Environment (IDE) for software development: e.g., editing, debugging, compilation, etc.
- Modularity, versioning, packaging, and managing the build process
- Design Patterns and Anti-Patterns and their application to software design

- The SOLID (Single responsibility, Open-closed, Liskov substitution, Interface segregation and Dependency inversion) approach to object oriented programming and design
- Code refactoring and analysis
- Concurrency and agents/actors

Please note that the materials for this module are presented using a combination of blended learning techniques together with the inverse curriculum approach to teaching.

### **Prerequisites**

Introduction to Software Development with a distinction level grade, or Principles of Programming I and II, or an appropriate level of experience with a modern programming language otherwise (requires approval by the module leader).

### **Assessment**

By 3-hour unseen written and practical examination and coursework exercises; weighting 80% and 20% respectively.

### **Reading**

- Scala for the Impatient by Cay Horstmann, 2nd Edition, Addison-Wesley Professional, 2016. ISBN-10: 0-13-454063-8
- Scala Design Patterns, Patterns for Practical Reuse and Design by John Hunt, Springer International Publishing, 2013. ISBN-13: 978-3-319-02191-1
- Scala Design Patterns by Ivan Nikolov, Packt Publishing; 2016. ISBN-10: 1785882503

Through extensive course notes and example code. See the module webpage for details.



## 6 Optional Module Descriptions

### 6.1 Data Warehousing and Data Mining (DWDM)

#### Teaching Staff

Nigel Martin

#### Module URL

<http://www.dcs.bbk.ac.uk/~nigel/teaching/dwdm/>

#### Aims and Outline

To study advanced aspects of data warehousing and data mining, encompassing the principles, research results and commercial application of the technologies.

This module covers the organisation, analysis and mining of large data sets to support business intelligence applications. Students study the principles and commercial application of the technologies, as well as research results and emerging architectures underpinning the analysis and mining of “big data”.

#### Syllabus

- Data warehousing requirements.
- Data warehouse conceptual design.
- Data warehouse architectures.
- Data warehouse logical design: star schemas, snowflake schemas, fact tables, dimensions, measures.
- OLAP architectures, OLAP operations. SQL extensions for OLAP.
- Data warehouse physical design: partitioning, parallelism, compression, indexes, materialized views, column stores.
- Data warehouse construction: data extraction, transformation, loading and refreshing. Warehouse metadata. Continuous ETL.
- Data warehouse architecture trends. MapReduce and warehouse architectures: Pig, Hive, Spark.
- Data mining concepts, tasks and algorithms.
- Data mining technologies and implementations. Techniques for mining large data sets, stream mining, architecture trends, standards, products.
- Research trends in data warehousing and data mining.

## **Prerequisites**

A first module in Database Systems (e.g. as taught in a typical UK undergraduate degree in computer science) or the Birkbeck module Data and Knowledge Management.

## **Assessment**

By 2-hour written examination and practical coursework, weighting 90% and 10% respectively.

## **Reading**

- R. Ramakrishnan, J. Gehrke, Database Management Systems (3rd ed.), McGraw Hill, 2003, ISBN 0-07-246563-8.
- M. Golfarelli, S. Rizzi, Data Warehouse Design: Modern Principles and Methodologies, McGraw Hill, 2009, ISBN 978-0-07-161039-1.
- J. Celko, Joe Celko's Analytics and OLAP in SQL, Morgan Kaufmann, 2006, ISBN 978-0-12-369512-3.
- J. Han, M. Kamber, J Pei, Data Mining Concepts and Techniques (3rd ed.), Morgan Kaufmann, 2011, ISBN 978-0-12-381479-1.
- Research papers will be distributed to students; students will also be directed to Web resources on the subject.

## 6.2 Information and Network Security (INS)

### Teaching Staff

Igor Razgon

### Aims

Information security is about protecting information (and information systems) against unauthorised access and tampering. Avoiding security breaches has a high priority for organisations storing and handling confidential data.

The main aim of this module is to provide broad coverage of the field of information security. This course covers the technical as well as the management side of security in information systems. Despite being an essential part of security, technical methods such as cryptography are not enough to guarantee a high level of security. They have to be embedded into a wider context in order to make them more effective. Users of technology have to understand the underlying principles and follow certain policies to avoid security breaches. This module introduces the fundamental approaches to security engineering and includes a detailed look at some important applications.

### Syllabus

- Overview of Information Security
- Access Control Matrix Model
- Security Policies
- Social Engineering
- Basic Cryptography
- Identity Management
- Access Control Mechanisms
- Confinement
- Assurance and Trust
- Network Intruders and Intrusion Detection
- Firewalls and Malicious Software
- Cryptographic Protocol Concepts
- Authentication
- Key Exchange
- Economics of Information Security

## **Assessment**

Two-hour written examination (80%) and practical coursework (20%).

## **Reading**

- Keith M. Martin, *Everyday Cryptography: Fundamental Principles and Applications*, 2012, ISBN 978-0-19-969559-1
- William Stallings, *Cryptography and Network Security* 5th edition, Pearson, 2010, ISBN 0136097049
- Matt Bishop, *Computer Security: Art and Science*, Addison-Wesley, 2002, ISBN 0201440997
- Ross Anderson, *Security Engineering* 2nd edition, John Wiley & Sons, 2008, ISBN 0470068523
- Bruce Schneier, *Applied Cryptography*, John Wiley & Sons, 1996, ISBN 0-471-11709-9

## **Online material**

<https://moodle.bbk.ac.uk/>

## 6.3 Internet and Web Technologies (IWT)

### Teaching Staff

Peter Wood

### Aims

To provide students with an understanding of how network protocols work, particularly those used on the Internet, and the ability to present and manipulate information on the World Wide Web, with an emphasis on XML and JSON.

### Syllabus

- Introduction to the Internet and its applications
- Web languages (e.g. HTML, XHTML, XML, JSON)
- Languages for defining Web document types (e.g. DTDs)
- Web query and transformation languages (e.g. XPath, XSLT)
- Client-side processing (e.g. using Javascript, jQuery)
- Server-side processing (e.g. using PHP)
- The transport layer (e.g. TCP, UDP)
- The network layer (e.g. IP, DHCP, ICMP)
- The link layer (e.g. Ethernet, ARP)

### Prerequisites

A first module in programming.

### Assessment

By 2-hour written examination and coursework exercises, weighted 80% and 20% respectively.

### Reading

- Sas Jacobs, *Beginning XML with DOM and AJAX*. Apress, 2006, ISBN 1-59059-676-5.
- Anders Moller and Michael Schwartzbach, *An Introduction to XML and Web Technologies*. Addison Wesley, 2006, ISBN 0-321-26966-7.
- James F. Kurose and Keith W. Ross, *Computer Networking: A Top-Down Approach* (7th edition), Pearson, 2016, ISBN 1-292-15359-8
- Kevin R. Fall and W. Richard Stevens, *TCP/IP Illustrated, Volume 1, Second Edition*, Addison-Wesley, 2012, ISBN 0-321-33631-3

## Online material

<https://www.dcs.bbk.ac.uk/~ptw/teaching/IWT/index.html>

<https://moodle.bbk.ac.uk>

## 6.4 Natural Language Processing and Information Retrieval (NLP)

### Teaching Staff

Dell Zhang

### Online material

<http://www.dcs.bbk.ac.uk/~dell/teaching/ir/>

### Aims and Outline

The aim of this module is to introduce modern NLP & IR concepts and techniques, from basic text indexing to advanced text analysis. Both theoretical and practical aspects of NLP & IR systems will be presented and the most recent issues in the field of NLP & IR will be discussed. This will give students an insight into how modern search engines work and are developed.

Due to the explosive growth of digital information in recent years, modern Natural Language Processing (NLP) and Information Retrieval (IR) systems such as search engines have become more and more important in almost everyone's work and life (e.g. see the phenomenal rise of Google). NLP & IR research and development are one of the hottest research areas in academia as well as industry. This module will convey the basic principles of modern NLP & IR systems to students.

### Syllabus

- Boolean Retrieval
- The Term Vocabulary and Postings Lists
- Regular Expressions and Text Normalization
- Dictionaries and Tolerant Retrieval
- Edit Distance
- Index Compression
- Scoring, Term Weighting and the Vector Space Model
- Evaluation in Information Retrieval
- Probabilistic Information Retrieval
- Language Models for Information Retrieval
- Language Modeling with N-Grams
- Spelling Correction and the Noisy Channel

- Text Classification, Naive Bayes, and Sentiment Analysis
- Vector Space Classification
- Logistic Regression
- Matrix Decompositions and Latent Semantic Indexing
- Vector Semantics
- Neural Nets and Neural Language Models
- Sequence Processing with Recurrent Networks

### **Assessment**

By 2-hour written examination and practical coursework, weighting 80% and 20%, respectively.

### **Reading**

- Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, *Introduction to Information Retrieval*, Cambridge University Press, 2008, ISBN 0521865719.  
<https://nlp.stanford.edu/IR-book/>
- Dan Jurafsky and James H. Martin, *Speech and Language Processing*, 3rd ed draft.  
<https://web.stanford.edu/~jurafsky/slp3/>



## 7 MSc Project

### Online material

Please refer to the page

[http://www.dcs.bbk.ac.uk/dcswiki/index.php/MSc\\_CS\\_project](http://www.dcs.bbk.ac.uk/dcswiki/index.php/MSc_CS_project)

for a detailed description and guidelines.

### Aims

In the MSc project students will be able to demonstrate their skills in organising and completing a task that goes beyond a typical coursework assignment. This includes planning and executing a major piece of programming work appropriate to the MSc programme and presenting existing approaches in the problem area (placing the student's own approach in the wider technical and conceptual context).

The MSc project will offer students the opportunity to:

- develop a systematic understanding and critical awareness of an agreed problem relevant to Computer Science, as described in a project proposal form;
- plan and execute a major piece of programming work appropriate to the MSc programme;
- critically present existing approaches in the problem area, place their own approach in the wider area and evaluate their contribution, and
- gain experience in communicating complex ideas and concepts to others by writing a comprehensive, self-contained report.

Students are encouraged to come up with their own ideas for projects. Students will be asked to select areas of interest for their projects. Allocation of supervisors to students will be done automatically, based on these selected interests. The details of the project will then be discussed between the student and allocated supervisor.

### Syllabus

The main part of the module will be done by the students on their own (supported by the supervisor). There is a small taught part of the module (in week 3) in which the students are acquainted with

- how to formulate the objectives/aims of an MSc project
- how to write a project proposal
- how to organise and plan the project
- how to research literature
- how to write a project report.

### **Assessment**

Written project proposal (of about 2000-3000 words) and written project report (of about 10,000 words), weighting 20% and 80%, respectively.

### **Reading**

- As recommended by the supervisor.

### **Ethical Implications**

All activities carried out by Birkbeck staff and students that involve one or more of:

- intervention or interaction with human participants;
- the collection and/or study of data derived from human participants;
- a potential impact on animals or the environment;

requires ethical consideration and approval.

For details see

[http://www.bbk.ac.uk/committees/research-integrity/  
GuidelinesonResearchwithEthicalImplications.pdf](http://www.bbk.ac.uk/committees/research-integrity/GuidelinesonResearchwithEthicalImplications.pdf)

## 8 Administration and Assessment

For detailed College rules and regulations see

<http://www.bbk.ac.uk/registry/policies>

and, in particular,

<http://www.bbk.ac.uk/registry/policies/documents/CAS-regs-19-20.pdf>

Below we summarise the most relevant rules for the MSc Computer Science.

### 8.1 Requirements for the Award of the MSc

Each taught module (all modules except the project) is assessed by a written exam and, in most cases, by additional coursework. The project module is assessed by the project proposal document (20%) and the project report (80%).

For each module, a Pass requires at least 50% of the available marks (computed according to the corresponding weights of the parts of the assessment). Up to 30 credits of the taught modules (excluding the project) with a mark between 40% and 49% can be compensated (assuming that the total weighted average mark of the taught modules is at least 50%) on the MSc and on the PGDip (note that College regulations do not allow compensation on PGCert). Additionally, there is a 60-credit project module.

To gain an award, the following is required:

- Postgraduate Certificate (PGCert): pass PoP I and II and two additional compulsory 15-credit modules.
- Postgraduate Diploma (PGDip): pass all compulsory taught modules and one optional taught module.
- Master of Science (MSc): requirements for PGDip and pass the project.

The final grade is computed by taking the weighted average (according to the credits) of the module assessment marks. The following has to be satisfied:

- Pass requires at least a 50% weighted average pass mark.
- Merit requires at least a 60% weighted average pass mark.
- Distinction requires at least a 70% weighted average pass mark.

## 8.2 Announcement of Results

The Examination Board meets in July to consider the results of the written exams and coursework, and in November to consider the results of the projects and to award degrees.

After the meeting of the exam board, your results and grades will be officially confirmed by the College through My Birkbeck.

Students who have not paid their fees will not get any information about their examination results.

## 8.3 Choosing the Optional Module

You will receive a form from the Programme Administrator on which you need to indicate your choice of the optional module. You should make this selection by the specified deadline so that your chosen module can be listed among the modules for which you wanted to be assessed that year.

Optional module availability is subject to timetabling constraints and student demand. In the event that an optional module is over-subscribed, available places will be allocated on a first-come, first-served basis determined by the date on which you return your module choice form to the Programme Administrator.

## 8.4 Examinations

Please consult the *Computer Science and Information Systems* Moodle page (for enrolled students).

## 8.5 Coursework

A number of modules require students to submit coursework as part of the assessment. Please consult the web page of the relevant module or contact the teaching staff of the module for particular details.

Submitted coursework must always be the students' own work, except where explicitly noted. Students are required to confirm in writing that each item of coursework submitted is indeed their own work.

The Department and College have strict guidelines and penalties associated with plagiarism, and routinely submit students' work to plagiarism detection services. More details are given in the section "Assessment Offences and Plagiarism" of this booklet.

College policy dictates how Departments will treat work that is due for assessment but is submitted after the published deadline. Any work that is submitted

for formal assessment after the published deadline but before the cut-off date (normally ten working days after the deadline) is given two marks: a capped mark of 50% for postgraduate students, assuming it is of a pass standard, and the “real” mark that would have been awarded if the work had not been late. If the work is not of a pass standard a single mark is given.

If you submit work that is to be considered for assessment late, then you should submit a mitigating circumstances form, see below, and provide written documentation, medical or otherwise, to explain why the work was submitted late. The case will then be considered by the appropriate sub-board or delegated panel of the Board of Examiners. If no case is made then the capped mark will stand. If the case is made and accepted then the examination board may allow the “real” mark to stand.

College policy about the provision of feedback on assessment is as follows.

<http://www.bbk.ac.uk/mybirkbeck/services/rules/Feedback-on-Assessment.pdf>

Unlike many other disciplines, feedback on computer science coursework/tests is often given in the form of model answers/solutions (e.g., program code), rather than textual comments.

## 8.6 Projects

Please consult the *Project - MSc Computer Science* and *Computer Science and Information Systems* Moodle pages (for enrolled students).

## 8.7 Mitigating Circumstances and Deferral

A Mitigating Circumstances claim should be submitted if valid detrimental circumstances result in:

- the late or non-submission of assessment;
- non-attendance of examination;
- poor performance in assessment.

If a student feels their circumstances warrant consideration by the Board of Examiners, they should submit a *Mitigating Circumstances Claim Form* to the Programme Administrator (within 2 weeks of the assessment deadline or examination). The form can be downloaded from:

<http://www.bbk.ac.uk/registry/policies/documents/mitigating-circumstances-form.docx>

In the form, students should state whether the circumstances relate to non-attendance at an examination or late submission of an assignment and should include supporting evidence (e.g. a medical certificate giving the nature and duration of any illness). Students should be aware that discussing their claim with a member of staff does not constitute a submission of a claim of mitigating circumstances.

For a claim to be accepted a student must produce independent documentary evidence to show that the circumstances:

- have detrimentally affected their performance/submission/attendance in assessment or will do so;
- were unforeseen;
- were out of their control and could not have been prevented;
- relate directly to the timing of the assessment affected.

In **exceptional cases**, students may be permitted to defer the written exams to the next examination period and/or the project to the following year. They must apply by filling in a *Mitigating Circumstances Claim Form*. Students have to do this before **May 1st** for exams and by **September 1st** for the project.

A student who defers an element of assessment normally has to enter for that element at the next available opportunity; usually no further deferrals are permitted. Simply not turning up for an exam or failing to submit a coursework or project, without permission to defer, will be considered to be the same as failing it, in the sense that it will count as one of the two attempts that you are permitted to make at passing that element.

## 8.8 Retake and Reassessment

One reassessment, and **only one**, is allowed for each element. You may be **re-assessed** in a failed coursework, written exam or the project if your marks for that module are below 50%.

Students who fail an assessment and are awarded a reassessment opportunity have their reassessment mark subject to a *cap* of 50% for the reassessed element. The cap does not apply to a retake of a whole module and to students with accepted mitigating circumstances.

Reassessment for exams takes place in August/September, while coursework reassessment is usually done the following year, in line with the normal coursework submission deadlines for modules. For students who do not take the summer reassessment exam (perhaps because of accepted mitigating circumstances) and

where the syllabus for the next year has changed, we set a paper that is suitable for resit candidates, providing alternative questions where necessary. Note, however, that we do this only for candidates from the previous year, not from further in the past.

Also note that part-time students need to accumulate at least 45 credits (out of the available 75) in their first year in order to progress into the second year.

## 8.9 Re-enrolment

*Repeat students*, i.e., students who have to retake some modules (and are not taking any new modules) will be charged pro-rata based on the number of credits they retake.

*Assessment only students*, i.e. those students who

- are being reassessed for coursework and/or examinations only
- have deferred their examinations and are not taking any new modules
- have deferred the project and do not require supervision (resubmitting only)

do not have to pay fees. While deferred students are classed as assessment only, they are allowed to attend lectures for revision purposes. They should formally seek the permission of module tutors to ensure classes are not oversubscribed.

*Dissertation only students*, i.e. students who retake the project with supervision, pay one third of full fees. Note that

- a student who has to resubmit the dissertation with supervision and be reassessed for examination or coursework will be progressed as dissertation only
- a student who has to resubmit the dissertation and also repeat modules will be progressed as repeat and fees are based pro-rata on the number of credits.

## 8.10 Assessment Offences and Plagiarism

See

<http://www.bbk.ac.uk/student-services/exams/assessment-offences>

for the College Policy on Assessment Offences.

One particular assessment offence is *plagiarism* that is defined as

“[...] copying a whole or substantial parts of a paper from a source text (e.g., a web site, journal article, book or encyclopedia), without proper acknowledgement; paraphrasing of another’s piece of work closely, with minor changes but with the essential meaning, form and/or progression of ideas maintained; piecing together sections of the work of others into a new whole; procuring a paper from a company or essay bank (including Internet sites); submitting another student’s work, with or without that student’s knowledge; submitting a paper written by someone else (e.g., a peer or relative), and passing it off as one’s own; representing a piece of joint or group work as one’s own.”

Also,

“[a] student who knowingly assists another student to plagiarise (for example by willingly giving them their own work to copy from) is committing an examination offence.”

The College considers plagiarism a serious offence, and as such it warrants disciplinary action. This is particularly important in assessed pieces of work where plagiarism goes so far as to dishonestly claim credit for ideas that have been taken by someone else.

The College also provides learning support for exams and assessments, please see

<http://www.bbk.ac.uk/student-services/learning-development>

and guidelines on plagiarism

<http://www.bbk.ac.uk/student-services/exams/plagiarism-guidelines>



## 9 Student Services

The College provides various services to students, see:

<http://www.bbk.ac.uk/student-services>

In particular, there are the Counselling Service, the Disability and Dyslexia Service, and the Mental Health Service. They provide specialist support to students.

### 9.1 Counselling Service

The Counselling Service

<http://www.bbk.ac.uk/student-services/counselling-service>

provides assistance to students who are experiencing emotional difficulties which may be impacting upon their studies or overall experience at Birkbeck.

### 9.2 Mental Health Service

Many students experience mental health difficulties at some point in their time at university. Whether you have a formally diagnosed psychiatric condition or other form of mental health difficulty such as anxiety or depression, we encourage you to seek support in your studies. Birkbecks Mental Health Service

<http://www.bbk.ac.uk/student-services/mental-health-advisory-service>

is a first point of contact for students experiencing mental health issues at any stage during their studies.

### 9.3 Disability and Dyslexia Service

At Birkbeck we welcome students with disabilities. We aim to provide all of our students with a study environment that enables them to participate fully in our courses.

The Disability and Dyslexia Service:

<http://www.bbk.ac.uk/student-services/disability-service>

can provide advice and support to students with conditions that impact their ability to study, such as:

- specific learning difficulties (dyslexia, dyspraxia, dyscalculia, AD(H)D)

- sensory impairments (blind/partially sighted, deaf/hearing impaired)
- mobility conditions (including RSI, arthritis, neck back and knee conditions etc.)
- medical conditions (e.g. HIV, CFS, diabetes, cancer, chest and respiratory conditions etc.)
- autism-spectrum conditions (autism or Aspergers syndrome)

They can provide support during your studies including

- Your Study Support Plan
- The Disabled Students' Allowance
- Access to Learning Fund
- Charities and trusts
- Dyslexia screening test
- Government benefits
- Personal emergency evacuation plans
- Pager alert system
- Rest Room
- Toilet facilities
- Car parking
- Disability and Dyslexia Support in the Library and IT Services

## 10 Career Development

Most students are interested in developing their careers, either within their current field of work or in a completely new direction. The Careers Group, University of London

<http://www.thecareersgroup.co.uk/>

offers great expertise and experience in working with students and graduates of all ages and at all stages of career development.

The Careers and Employability Service

<http://www.bbk.ac.uk/careers/careers-service>

is our in-house service for enhancing career development and employability throughout your time at Birkbeck, from enrolment through to graduation.

There is also Birkbeck Talent, a professional recruitment service aimed exclusively at assisting Birkbeck students to find work whilst studying and after graduation. They work with top employers in and outside London to offer innovative internships, prestigious job vacancies and exciting graduate opportunities. To find out more please visit

<http://www.bbk.ac.uk/student-services/birkbeck-talent-service>

# 11 The Business Engagement Team

The School of Business, Economics and Informatics has a dedicated Business Engagement team to provide you with extra support. The team delivers the following initiatives to support you in your career aspirations:

## 11.1 Mentoring Pathways

Mentoring Pathways pairs successful applicants with industry professionals for individual advice and guidance. There are a number of places available for final year undergraduates and postgraduate students. We have partnerships with a number of key organisations and work alongside Birkbeck alumni who provide mentors. Applications open in the autumn. Please email [mentoring@bbk.ac.uk](mailto:mentoring@bbk.ac.uk) or visit

<http://www.bbk.ac.uk/business/business-services/mentoring-external>

for more information.

## 11.2 Enterprise Pathways

Whether you are setting out in your journey as an entrepreneur or have already established a thriving business, we offer various pathways to support you. These include a non-credit bearing module with workshops once a month throughout the academic year, access to digital resources, enterprise boot camps and inspirational talks to help you to develop your ideas and network with other students. Please email [enterprise@bbk.ac.uk](mailto:enterprise@bbk.ac.uk) or visit [www.bbk.ac.uk/enterprise](http://www.bbk.ac.uk/enterprise).

## 11.3 Keeping in Touch

You can also follow BEI on social media for information and conversations:

- Twitter: @BirkbeckBEI
- Facebook, Google+ and LinkedIn: Search 'BirkbeckBEI'

Please visit our website

[www.bbk.ac.uk/business/business-services](http://www.bbk.ac.uk/business/business-services)

for more resources and information.