Department of Computer Science
and Information Systems

MSc Computing
for the Financial Services

2020–2021

Version of October 6, 2020
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1 General Information

1.1 Contacts

Programme Director: George Roussos, g.roussos@bbk.ac.uk
Programme Administrator: Stacey Hine, pg@dcs.bbk.ac.uk
Projects Tutor: Oded Lachish, oded@dcs.bbk.ac.uk
Disability Officer: Oded Lachish, oded@dcs.bbk.ac.uk

1.2 Web presence

Detailed and updated information about the programme is available from the Moodle Virtual Learning Environment (moodle.bbk.ac.uk) including announcements about each module on which you are enrolled.

It is your responsibility to familiarise yourself with the contents of both of this booklet as well as the online resources. You should make a habit of consulting Moodle and 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.

Students on each programme elect Class Representatives from amongst themselves early in the academic year. Class Reps provide a point of contact with the Department for student feedback on modules and other aspects of the programme. They can make the Department aware of students’ views both in respect of any problems students are experiencing as well as positive points they want to make. While Class Reps can raise matters with the Programme Director at any time, they also attend Staff-Student Exchange meetings in each of the autumn and spring terms at which students’ views on any aspect of the Programme can be raised with the Programme Director. These meetings are minuted and the minutes made available on the Department intranet. Students should make sure that their Class Reps are aware of any matters which they wish to be raised at these meetings.

The Birkbeck Students’ Union provides help and advice to students; information about their services can be found on the Students’ Union web page: www.birkbeckunion.org

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

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 who can provide general support to students in their studies. They can offer help and support on a variety of topics ranging from writing skills to basic maths. See

www.bbk.ac.uk/business/current-students/learning-co-ordinators

for details.
3 Important Dates

Lectures will commence in the week starting on **Monday 5 October 2020**. 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: Monday 5 October 2020 to Friday 18 December 2020.
- Spring term: Monday 11 January 2021 to Friday 26 March 2021.
- Summer term: Monday 26 April 2021 to Friday 9 July 2021.

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(s). 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 Talk

The programme will kick off with online introductory talks to students:

- 18:00, Tuesday, 29th September 2020.

The session will include a short hands-on introduction to the departmental computer systems, as well as short presentations by representatives of the library, learning support, careers and employability and Birkbeck talent. If you are not able to attend the introductory talk, recordings will be available in moodle after the date.

4.2 List of Modules

This section provides a general overview of the content of the programme with detailed descriptions of individual modules in Section 5.

The MSc Computing for the Financial Services provides an intensive course specifically tailored for Computer Science graduates or graduates of related subjects with containing a substantial amount of programming interested in pursuing a career in financial services. As well as gaining a broad knowledge of the subject, students acquire practical skills and have the opportunity to investigate certain areas of current research more deeply.

For students who are new to the subject, this MSc provides the foundation for a career in IT within the financial services industry, and for those already working in IT, it provides an opportunity to broaden their knowledge and update their skills specifically for finance while obtaining a formal qualification.

In addition to the project (cf. Section 6), all students must take and pass the following core module:

- Financial Markets (FM) offered by the Department of Economics

and select six optional modules from the following list:

- Advances in Data Management (ADM)
- Machine Learning (ML)
- Applied Machine Learning (AML)
- Software Design and Programming (SDP)
- Concepts of Computation (COC)
- Applied Machine Learning (AML)
- Natural Language Processing and Information Retrieval (NLP)
• Asset Management (AM) by the Department of Economics
• Corporate Finance (CF) offered by the Department of Economics
• Econometrics for FM (EFM) offered by the Department of Economics
• Principles of Financial Reporting (PFR) offered by the Department of Management
• Accounting and Financial Management (AFM) offered by the Department of Management

It is also possible to take other optional modules from the range of electives offered under the MSc Advanced Computing Technologies after approval by the Programme Director. Please contact the Programme Director to discuss this option. A list of possible modules is available via http://www.dcs.bbk.ac.uk/study/postgraduate-specialist/msc-advanced-computing-technologies/.

Not all modules will necessarily be offered each year. In addition, the availability of modules is subject to timetabling constraints and student demand. In the event that a 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.

The Moodle Virtual Learning Environment (moodle.bbk.ac.uk) is used to provide detailed information and post announcements about each module.

The information in this booklet is specific to the MSc Computing for the Financial Services. More information about the programme is available from the departmental web pages and the intranet. For more general information about Birkbeck and the Department of Computer Science and Information Systems, please consult the Departments Student Handbook.

It is your responsibility to familiarise yourself with the contents of both of these booklets as well as the web site, and to consult the web site on a regular basis since additional information will be posted there during the year.

Please note that any re-assessment which is attempted will be subject to a cap at the pass mark for postgraduate awards this is 50%. Specifically, for any module that you do not pass at your first attempt you may be re-assessed or you may be required to re-take. Re-assessment is where a student will re-attempt a failed element of a failed module; it does not require attendance at lectures and seminars. A re-take requires attendance at the modules lectures and seminars as well as another attempt at the assessment. A decision on whether you will be permitted to be re-assessed in one or more elements of a module that has not been passed is at the discretion of the Sub-Board of Examiners.
4.3 Timetables

Due to CV-19 changes are likely to be introduced throughout the year in response to developments. Please consult the moodle pages of the modules you are enrolled in regularly for up-to-date information.

Module abbreviations used in the following timetables follow Section 4.2 above.

Provisional Timetable for 2020/21

<table>
<thead>
<tr>
<th>Day</th>
<th>Autumn Module</th>
<th>Autumn Time</th>
<th>Spring Module</th>
<th>Spring Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td></td>
<td></td>
<td>ADM</td>
<td>18:00–21:00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CF</td>
<td>13:00–16:00</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>18:00–21:00</td>
</tr>
<tr>
<td>Tuesday</td>
<td>BDA</td>
<td>18:00–21:00</td>
<td>NLP</td>
<td>18:00–21:00</td>
</tr>
<tr>
<td>Wednesday</td>
<td>EFM</td>
<td>18:00–21:00</td>
<td>FM</td>
<td>18:00–21:00</td>
</tr>
<tr>
<td>Thursday</td>
<td>PFR</td>
<td>18:00–21:00</td>
<td>SDP</td>
<td>18:00–21:00</td>
</tr>
<tr>
<td></td>
<td>COC</td>
<td>18:00–21:00</td>
<td>FM</td>
<td>18:00–21:00</td>
</tr>
<tr>
<td></td>
<td>EFM</td>
<td>18:00–21:00</td>
<td>ML</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AML</td>
<td>18:00–21:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td>Project</td>
<td>13:00–17:00</td>
<td>FM (class)</td>
<td>18:00–19:30</td>
</tr>
<tr>
<td></td>
<td>Project</td>
<td>18:00–21:00</td>
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<table>
<thead>
<tr>
<th>Day</th>
<th>Summer Module</th>
<th>Summer Time</th>
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<tbody>
<tr>
<td>Monday</td>
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<tr>
<td>Tuesday</td>
<td></td>
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</tr>
<tr>
<td>Wednesday</td>
<td>AFM</td>
<td>18:00–21:00</td>
</tr>
<tr>
<td></td>
<td>AM</td>
<td>18:00–21:00</td>
</tr>
<tr>
<td>Thursday</td>
<td>AM</td>
<td>18:00–21:00</td>
</tr>
<tr>
<td>Friday</td>
<td></td>
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</tbody>
</table>

NOTES:

1. The departments of Management and Economics teach over three terms i.e. some modules are offered in the summer term. Notably AFM and AM are currently taught during the summer term.

2. Lectures giving guidance on projects are held in Week 3 of the autumn term. Lectures are repeated to allow attendance on either Friday afternoon or Friday evening.
3. Note that some modules at CSIS, notably ADM, are offered in the evening on alternate years only.

4. Part-time students should select 4 modules each year in such a way as to ensure that they can complete their chosen 8 modules in 2 years.
5 Module Descriptions

Lectures aim to introduce the key ideas of each module. The specific objectives of each module and the principal readings are circulated at the start of the term. The reading lists for individual modules given below are only indicative. Lecturers will specify, usually at the first lecture, whether or not books need to be purchased for particular modules. Independent study is a key learning objective of the programme.

Most modules have dedicated web pages that provide links to relevant online literature. Depending on the nature of the material, some lecturers use ‘lecture outlines’ to support their teaching and may even distribute these outlines via their web pages. However, there is no expectation that written notes will be provided for the modules.

Students can also contact lecturers outside the classroom to discuss the material. They can meet the lecturers during scheduled ‘office hours’ or can contact them via email either to discuss a problem or to make an appointment. Lecturers’ contact details are given on the Department web site.

Students are expected to attend all lectures. Any student who decides to withdraw from the programme should inform the Programme Administrator, in writing or by email. Students who simply stop turning up for lectures without formally withdrawing from the programme will still be held liable for fees.

A number of modules require students to submit coursework as part of the assessment. More details are given in individual module descriptions below.

Pre-course Reading

5.1 Financial Markets (FM)

Teaching Staff
Ken Hori

Pre-requisite
The EMS pre-sessional Mathematics course or equivalent.

Aims
The course aims primarily to familiarise you with the principles of finance. It will introduce you with the characteristics of equity, fixed income and derivatives markets, and provides grounding in financial models that would enable them to evaluate different financial assets. You will be introduced to option pricing theory, as well as to issues related to credit risk.

You will be equipped with the necessary knowledge of the financial markets, ready to work as practitioners in the financial industry.

Learning Outcomes

- By the end of the course, students should be able to demonstrate that they can:
- Understand and make use of financial statements.
- Explain the time value of money and calculate present values of future cash flows and net present values of real investment projects.
- Understand the characteristics of equity, fixed income and derivative markets.
- Derive and apply pricing models for shares including the discounted-dividend model.
- Price bonds and extract interest rates from bond data.
- Understand different derivative securities such as forwards, futures, swaps and options.
- Explain the no-arbitrage principle and apply this to the pricing of derivative securities using both Black-Scholes option pricing model and the Binomial model.
- Understand the issues related to credit risk.

Required Reading

5.2 Asset Management (AM)

Teaching Staff
David Schroeder

Overview
The module aims at giving thorough understanding of the foundations of modern asset management in both theory and practice.

In the short introduction, we discuss the meaning of asset management and review the basic concepts of portfolios optimization. In the first part of the module, we turn to utility-based long-term (strategic) asset allocation strategies, including important extensions, such as labour income and life-cycle investment strategies. In the second part of the module, we look at specific asset management concepts, including portfolio insurance, hedge funds, pension funds and private wealth management. In the last section, we look at the performance measurement of investment funds.

The module includes also a variety of guest lectures with distinguished speakers from the asset management industry.

Syllabus
- Strategic asset allocation
- Hedge funds
- Performance measurement

Assessment
By 2-hour written examination and practical coursework.

Reading
- Campbell, Viceira: Strategic Asset Allocation. Oxford University Press
- Claus Munc: Dynamic Asset Allocation, unpublished manuscript

More texts will be indicated in the course outline to be distributed at the beginning of the module.
5.3 Corporate Finance (CF)

Teaching Staff
Arina Nikandrova

Pre-requisite
Financial Markets

Aims
The course considers 2 broad sets of questions. The first part of the course focuses on assessing investment opportunities and (real and financial) asset valuation. The second part of the course considers how to raise funds necessary to finance investments. Here, special attention is devoted to implications of informational asymmetries, the possibility of bankruptcy and differential tax treatments of debt and equity incomes.

The analysis will then broaden to allow for the possibility that debt/equity choices may the corporate decision making process.

Assessment
By 2-hour written examination.

Textbooks
The lectures will be based on textbooks and journal articles. The journal articles will be circulated during the lectures.

- Berk, Jonathan and DeMarzo, Peter, Corporate Finance. Pearson.
5.4 Accounting and Financial Management (AFM)

Aims
The aim of this module is to provide a solid understanding of the concepts of financial management for non-accountants. At the end of this module, students are expected to:

- Appreciate the use of accounting numbers in managing a company’s performance (financial statement analysis)
- Understand corporate financial decision making through standard techniques such as Project appraisal, Risk and return and cost of capital
- Be aware of issues such as corporate long term survivability through the management of its capital structure

Learning Objectives
On successful completion of this module students will be expected to be able to:

- Read and understand financial reports and company accounts;
- Comprehend the fundamental ideas and concepts of finance;
- Appreciate the usefulness and limitations of accounting in aiding financial management decisions; and
- Critically appraise key issues in accounting and finance raised in the media.
- Develop a logical approach in dealing with complex issues; and
- Compute and solve numerical problems.
- Extend their knowledge on IT skills such as excel, word processing and simple statistical software;
- Research company-related information via the library resources and on the internet.
- Enhance personal ability to work independently; and
- Continue to improve social skills through interaction during the seminars.

Content
- Introduction to financial reports and statements (simple explanation of profit and loss accounts and balance sheets)
- Cash flow statements and financial ratio analysis
- Financial project appraisals (discounted cash-flow techniques, internal rate of return and payback period) and valuation of business
- Risk and return (including the Portfolio Theory)
- Cost of capitals and Capital Assets Pricing Model
- Capital structure theory
- Dividend policy
Reading

- Gitman, L J (2009), Principles of Managerial Finance (12th Edition), Pearson Addison Wesley
5.5 Econometrics of Financial Markets (EFM)

Pre-requisite
Financial Markets

Aims
This course provides an introduction to applied financial econometrics, statistical methods and an understanding of the data with the ability to use the appropriate software and interpret the output.

Learning Objectives
By the end of this module, students should be able to:

- Understand the foundations of statistics, including probability distributions and descriptive statistics.
- Derive the Ordinary Least Square (OLS) estimator and understand its properties.
- Explain the basis for standard tests and use them in practice.
- Develop and analyse basic univariate and multivariate time-series models for integrated and co-integrated data and know how to choose between alternative models.
- Use standard econometrics packages and interpret their output.
- Read, understand and explain empirical articles in academic literature.
- Conduct and report on an independent piece of empirical research that uses econometric techniques.

Assessment
Exam (80%) and coursework (20%).

Reading
5.6 Principles of Financial Reporting (PFR)

Teaching Staff
Libon Fung

Overview
This module explores the fundamental concepts which underpin the development of the current practices of financial reporting. It will enable you to understand and interpret the importance of accounting information in decision making for complex entities. You will also learn how to prepare and interpret financial statements for individual and group of companies.

There is an emphasis throughout on international financial reporting and the accounting information in capital markets.

Learning Objectives
At the end of this module, students will be able to:

- Prepare and interpret financial statements for single and group of companies.
- Critically assess accounting conventions and their information content including fair value accounting.
- Integrate subject matter studied on related modules and to demonstrate the multidisciplinary aspect of practical financial reporting problems.
- Use academic theory and research to question established financial reporting standards and theories.
- Proficiently research materials on the internet and the Birkbeck Library database.
- Interpret corporate financial reports.
- Appreciate public speaking and presentation, through group discussion and case study.

Assessment
Group coursework of 4000 words (40%) and an examination (60%).

Reading

Additional articles and further readings will be recommended throughout the module.
5.7 Advances in Data Management (ADM)

Teaching Staff

Richard Brownlow

Online material

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

Aims

To study advanced aspects of database management and recent advances in data management technologies in three major directions: performance, distribution of data, and heterogeneity of data.

The module examines the technologies underlying modern database management systems. It studies advanced aspects of query processing, transaction management, distributed data management, and recent developments in web data, big data and alternative database architectures.

Syllabus

- Review of the fundamental principles of modern database management systems, relational databases and SQL.
- Query processing and query optimisation.
- Transaction management: ACID properties, concurrency control, recovery.
- Beyond records and objects: stored procedures and functions, triggers, semantic technologies.
- Distributed databases: data fragmentation and replication, distributed query processing, distributed transaction management.
- Heterogeneous data integration.
- XML data management.
- Linked Data.
- Parallel databases.
- NoSQL/NewSQL stores.
- Graph databases.
- Data Warehouse architecture trends.
- Data Lakes.

Prerequisites

A first module in Database Systems (e.g. Data and Knowledge Management, Programming with Data or a similar module as taught in a typical undergraduate degree in Computer Science).

Knowledge of computer programming.
Assessment

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

Reading

• Research papers will be distributed to students; students will also be directed to Web resources on the subject.
5.8 Concepts of Computation (COC)

Teaching Staff
Oded Lachish

Aims
To provide students with the basic mathematical and algorithmic tools of Computer Science.

Outline
Discrete mathematics, mathematical logic and algorithms form the underlying language of computer hardware and software. Digital computers are machines literally built out of memory and logic (logical gates). The same elements appear in all programming languages; hence the importance of this knowledge for understanding information technology. In this module we introduce these areas. The focus will be not just on the technical aspects but also on how these abstract concepts manifest themselves in reality.

Syllabus
- Numbers from the digital computer point of view (Binary, Hexadecimal, 2s Complement, Floating Point, Integers)
- Binary Logic and Boolean Circuits
- Sets and the universal and existential quantifiers
- Onotation and the important complexity classes
- Pattern matching and sorting
- Binary search
- Graph algorithms such as Breadth First Search, Depth First Search, Dijkstra’s algorithm
- State machines and regular expressions
- Basic probability
- Histograms

Prerequisites
Introduction to Software Development (ISD) or suitable experience with a modern programming language.
Information Systems (IS).
Assessment
By a 2-hour unseen written examination and Moodle quizzes, weighting 90% and 10% respectively.

Coursework
Five Moodle quizzes. Each quiz will cover the material of up to three sessions. The quizzes will be on Moodle and hence automatically checked. This will ensure feedback immediately after the deadline.

Recommended Reading

Online Material
https://moodle.bbk.ac.uk/
5.9 Component-Based Software Development (CBSD)

Teaching Staff
Keith Mannock

Online material
http://moodle.bbk.ac.uk/

Aims
This module introduces the theory and practice associated with implementing large-scale distributed information systems in heterogeneous environments. The student will develop the technical knowledge necessary to analyse the scalability and interoperability problems associated with large-scale heterogeneous systems and will experience the design and implementation of enterprise-level computer applications. Industry standard frameworks such as Java Enterprise Edition (JEE), Spring, Enterprise Service Bus (ESB), etc. will be explored utilising practical workshops. The development of web services will also be discussed through the use of standards such as XML, SOAP, WSDL and UDDI. How web services can be used to implement a Service Oriented Architecture (SOA) will be described. Note: this course requires a great deal of time outside class. Students should take this into account when considering taking other modules or if they encounter a lot of travel for work.

Syllabus
- Introduction to Component Based Software
- Java approaches to n-tier architectures (JEE, Spring, etc.)
- Enterprise Computing in the real world (Case Study)
- Message-Oriented Middleware (RabbitMQ, etc.)
- Virtualization and Cloud Computing
- Design Patterns and Enterprise Architectures
- The .NET model for distributed computing
- Persistence layers
- User Interfaces
- Web Services
- RESTful services

Prerequisites
Introduction to Software Development with a distinction level grade, or Principles of Programming I and II, or a similar course or relevant experience (as approved by the module leader).
Assessment

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

Reading

- M. Hailperin, Operating Systems and Middleware, Course Technology Inc.. 2007.
5.10 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

5.11 Applied Machine Learning (AML)

Teaching Staff
Paul Yoo

Online material
http://moodle.bbk.ac.uk/

Aims
This module covers the fundamental concepts and techniques of applied machine learning using Python and how to use the existing tools to analyse data. Students develop the hands-on and practical skills needed for applied machine learning including the use of existing Python libraries and tools (e.g. Scikit-Learn and TensorFlow) and the use of the techniques needed to analyse data (e.g. pre-processing, feature selection and classification). The module will use Python the most popular machine learning language to solve practical problems based on use cases extracted from real domains such as financial forecasting and computer vision.

Syllabus
- Introduction to Python for machine learning
- Preparing data
- Feature selection for machine learning
- Evaluation and resampling
- Rule-based algorithms: decision tree and random forest
- Regression-based algorithms: logistic regression and neural networks
- Large-scale machine learning using TensorFlow
- Real-life case studies (e.g. financial forecasting and computer vision)

Prerequisites
No specific module is pre- or co-requisite but knowledge of mathematical concepts and basic python will be assumed.

Assessment
By 2-hour written examination and practical coursework, weighting 70% and 30%, respectively.
Reading

- Students will also be directed to papers available online and other Web resources on the subject.
5.12 Machine Learning (ML)

Teaching Staff
George Magoulas

Online material
http://moodle.bbk.ac.uk/

Aims
The module covers computational algorithms for intelligent information management, decision making and complex problem solving. It provides an introduction to machine learning methods such as neural networks, fuzzy logic, fuzzy clustering, natural computing, and covers basic concepts of feature selection and generalisation.

Syllabus
- Learning from data
- Feature selection and generalisation
- Supervised learning, unsupervised learning and clustering
- Fuzzy logic and fuzzy clustering
- Deep networks: architectures and learning algorithms
- Natural computing: genetic algorithms, evolutionary algorithms, swarm intelligence
- Advanced learning and evolution schemes

Prerequisites
No specific module is pre- or co-requisite but knowledge of mathematical concepts (algebraic concepts, vector, matrix, function and graph, gradient, trigonometry concepts, statistical concepts and the notion of probability), and data structures and algorithms, as taught in a typical undergraduate degree in computer science or engineering, is essential.

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

- S. Theodoridis, K. Koutroumbas, Pattern Recognition, Academic Press.
- Students will be directed to papers available online and other Web resources on the subject.
5.13 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.
- 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 Design Patterns by Ivan Nikolov, Packt Publishing; 2016. ISBN-10: 1785882503

Through extensive course notes and example code. See the module webpage for details.
5.14 Concepts of Computation (COC)

Teaching Staff
Oded Lachish

Aims
To provide students with the basic mathematical and algorithmic tools of Computer Science.

Outline
Discrete mathematics, mathematical logic and algorithms form the underlying language of computer hardware and software. Digital computers are machines literally built out of memory and logic (logical gates). The same elements appear in all programming languages; hence the importance of this knowledge for understanding information technology. In this module we introduce these areas. The focus will be not just on the technical aspects but also on how these abstract concepts manifest themselves in reality.

Syllabus
- Numbers from the digital computer point of view (Binary, Hexadecimal, 2s Complement, Floating Point, Integers)
- Binary Logic and Boolean Circuits
- Sets and the universal and existential quantifiers
- Onotation and the important complexity classes
- Pattern matching and sorting
- Binary search
- Graph algorithms such as Breadth First Search, Depth First Search, Dijkstras algorithm
- State machines and regular expressions
- Basic probability
- Histograms

Prerequisites
Introduction to Software Development (ISD) or suitable experience with a modern programming language.
Information Systems (IS).
Assessment

By a 2-hour unseen written examination and Moodle quizzes, weighting 90% and 10% respectively.

Coursework

Five Moodle quizzes. Each quiz will cover the material of up to three sessions. The quizzes will be on Moodle and hence automatically checked. This will ensure feedback immediately after the deadline.

Recommended Reading


Online Material

https://moodle.bbk.ac.uk/
6 MSc Project

Please refer to the page

http://www.dcs.bbk.ac.uk/dcswiki/index.php/MSc_ACT_project

for a detailed description and guidelines.

Aims

Each student is required to undertake an individual project, under the supervision of a staff member, which should represent one-third of the student’s effort for the degree (60 credits).

The main aims of the project are to offer students the opportunity to:

• develop a systematic understanding and critical awareness of an agreed problem relevant to the MSc programme 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

• gain experience in communicating complex ideas/concepts and approaches/techniques to others by writing a comprehensive, self-contained report.

Choosing a Project

Students are encouraged to come up with their own ideas for projects. In order to arrange supervision for the project, a student should discuss possible projects with the Projects Tutor, Programme Director or with the lecturer who seems the most appropriate for the topic.

The project must relate to one or more modules on the MSc programme. For the MSc in Computing for the Financial Services, the project should build on advanced topics in computing technologies in order to develop a system and/or algorithms specifically targeting the financial services domain.

Syllabus

The main part of the project will be done by students on their own (supported by the supervisor). There is a small taught part of the module 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.
7 Administration and Assessment

For detailed College rules and regulations see

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

and, in particular,


Below we summarise the most relevant rules for the MSc Computing for the Financial Services.

7.1 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 modules of at least 60 credits total.
• Postgraduate Diploma (PGDip): pass modules of at least 120 credits total.
• 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.

7.2 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 degree.

Shortly after the meeting of the exam board you will receive a letter from the Department about your results. Your results and grades will be officially confirmed by the College.

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


7.3 Choosing the Optional Module
You will receive a form from the Programme Administrator at the beginning of the relevant term to indicate your choice of optional modules. You have to return this form by the specified deadline so that your chosen modules can be listed among the modules that 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 you return your module choice form to the Programme Administrator.

7.4 Examinations
Please consult the Computer Science and Information Systems moodle page (for enrolled students).

7.5 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 or via e-mail 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 penalty 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. Both marks are given to the student on a cover sheet. If the work is not of a pass standard a single mark is given.

If you submit late work that is to be considered for assessment, 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 penalty mark will stand. If the case is made and accepted then the examination board may allow the “real” mark to stand.

Note that a mitigating circumstances claim relating to an assessment or examination must be submitted within 14 days of the assessment deadline or examination date, respectively. It is essential to make such claims within the specified period, even if the evidence supporting the claim (e.g., a medical diagnosis or test results for a suspected
illness) is not available at the time of the claim submission. In this case, it is required to mention in the Mitigating Circumstances claim form that the evidence is pending, and the evidence may be submitted to the postgraduate administrator separately also after the 14 days period. Claims made after the 14 days period will not be accepted, unless the student can prove that, due to extraordinary circumstances, access to the means to submit the claim (e.g., email) was unavailable earlier. In that case, evidence of such extraordinary circumstances must be provided.

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.

7.6 **Projects**

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

7.7 **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 notify the Programme Director, in writing, in advance, at the earliest opportunity (within 7 days of the assessment deadline or examination) using a *Mitigating Circumstances Claim Form*, which can be downloaded from:

http://www.bbk.ac.uk/registry/policies/documents/MitCircs.pdf

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.

7.8 Retake and Reassessment

One reassessment, and only one, is allowed for each element. You may be reassessed 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 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 takes place over the summer, with exams taking place in August/September. 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.

7.9 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)
pay a reduced fee that will allow them access to College facilities (Library and workstation rooms). 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 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.

### 7.10 Assessment Offences and Plagiarism


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](http://www.bbk.ac.uk/student-services/learning-development) and guidelines on plagiarism

[http://www.bbk.ac.uk/student-services/exams/plagiarism-guidelines](http://www.bbk.ac.uk/student-services/exams/plagiarism-guidelines)
8 Student Services

The College provides various services to students, see:

http://www.bb克.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.

8.1 Counselling Service

The Counselling Service

http://www.bb克.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.

8.2 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.bb克.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.

8.3 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.bb克.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
9 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
10 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:

10.1 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 or visit http://www.bbk.ac.uk/business/business-services/mentoring-external for more information.

10.2 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 or visit www.bbk.ac.uk/enterprise.

10.3 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 for more resources and information.