**BIRKBECK (UNIVERSITY OF LONDON)**

**MODULE PROPOSAL FORM**

**School use only:**

<table>
<thead>
<tr>
<th>Date Proposed</th>
<th>Date approved School TQEC</th>
<th>Date reported to College Programmes Committee</th>
<th>Module Code</th>
</tr>
</thead>
<tbody>
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**Module Title**

Cloud Computing

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**Level**

(See Guidance Note 2)

- 7

**Credit Value**

(See Guidance Note 3)

- 15

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**Department/School responsible for the Module**

Indicate if School held module e.g. Law

- DCSIS

**Subject Area**

(See Guidance Note 4)

- Computer Science

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**Date Module will commence**

Spring 2013

**Minimum / Maximum number of students**

5/50

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**Mode of Delivery**

(Tick box(es))

- Face to Face: X
- Distance Learning
- BLE (Moodle) Access required: X

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**Programme/ Modular Enrolment (tick as appropriate)**

- Programme: X
- Modular

**For modular Enrolment only: Open/Restricted Enrolment/Subject to Placement Test**

(See Guidance Note 7)

- Open Enrolment
- Restricted Enrolment
- Subject to Placement Test (language modules only)

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**Teaching and Learning**

(See Guidance Note 8)

**Method of Teaching**

Contact hours and attendance requirement

- Lectures: 36 (3 per lecture * 10 weekly lectures plus 2 revisions)
- Seminars
- Tutorials
- Project Work
- Practical Classes (labs, computers, languages): 3 (a practical lab class)
- Field Work
- Other (please specify)

**TOTAL CONTACT HOURS**

39

**Directed Learning / Private Study / Assessment (please detail as appropriate)**

**TOTAL NON-CONTACT HOURS**

111 (pre-lecture reading, post-lecture reviewing, coursework, etc.)

**TOTAL LEARNING HOURS (CONTACT & NON CONTACT)**

150

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**Status**

(See Guidance Note 9)

- Core
- Compulsory
- Option: X

**Designated as a CORE / COMPULSORY * Module for the following Programme(s)**

(* Delete as appropriate)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title of Programme</th>
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</thead>
<tbody>
<tr>
<td></td>
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</table>

**Available as an OPTION Module on the following Programme(s)**

(This should be an indicative list as the module may be offered, in future, as an option on other programmes with the approval of the relevant Programme Director(s).)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title of Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMSCOSCI_C</td>
<td>MSc Computer Science</td>
</tr>
<tr>
<td>TMSINFCS_C</td>
<td>MSc Information Technology</td>
</tr>
<tr>
<td>TMSACTEC_C</td>
<td>MSc Advanced Computing Technologies</td>
</tr>
</tbody>
</table>
There is an emerging computing paradigm called cloud computing wherein IT-related functions (e.g., storage or database, applications) are provided “as a service” to end-users under a usage based payment scheme, due to economies of scale and advancements in virtualisation technology. In such a cloud computing model, end-users can hire virtualised services on the fly based on fluctuating requirements (workload pattern, quality of service expectations etc.), and, in doing so, they avoid worry about infrastructure details such as where these resources are hosted or how they are managed. Furthermore, developers with innovative ideas for new Internet services no longer require large capital outlays in hardware to deploy their service or human expense to operate it; instead of buying and maintaining machines, they can just rent computing cycles that are needed. This offers great benefit to IT companies by freeing them from the low level task of setting up basic hardware and software infrastructures, and thus enabling more focus on innovation and creating business value for their services. It is widely believed that cloud computing is the most significant and disruptive transformation the IT industry has ever undergone.

An information system or software application “in the cloud” typically consists of a front-end and a back-end. The front-end is usually in the form of a light-weight Web or mobile-phone program that can be almost as interactive and functional as traditional desktop software. The back-end normally involves heavy-weight batch jobs that harness the power of tens, hundreds, or even thousands of machines to crunch massive amounts of data. Our existing modules cover front-end cloud computing to some degree (e.g., Ajax in IWT and J2ME in MUC), but not back-end cloud computing.

This module aims to introduce back-end cloud computing techniques for processing “big data” (terabytes/petabytes) and developing scalable systems (with up to millions of users). We focus mostly on MapReduce, which is presently the most accessible and practical means of computing for “Web-scale” problems, but will discuss other techniques as well. MapReduce is a programming model that facilitates writing programs to be transparently distributed over a cluster of commodity computer servers. It was originally developed by Google and built on well-known principles in parallel and distributed processing dating back several decades. It has since enjoyed widespread adoption via an open-source implementation in Java --- Hadoop --- which has become the de facto standard and the dominant platform for back-end cloud computing, with prominent users like Yahoo, Facebook, Twitter, eBay, Amazon, etc. Students in this module will learn the principles and methods for distributed large-scale processing, in particular, the MapReduce programming model, MapReduce algorithm design patterns, and typical MapReduce algorithms. To allow them practise MapReduce programming using Hadoop in the cloud, we plan to provide access to Amazon Web Services (AWS) through the “AWS in Education” grant scheme.
Outcomes may be Subject Specific, Intellectual, Practical, or Personal and Social.

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

Subject Specific:
- Knowledge and understanding of facts, concepts, principles & theories about cloud computing
- Use of such knowledge in modelling and design cloud computing systems
- Problem solving strategies in the context of cloud computing
- Analyse if/how a cloud computing system meets current and future requirements
- Deploy theory in design, implementation and evaluation of cloud computing systems
- Recognise legal, social, ethical & professional issues in cloud computing
- Knowledge and understanding of commercial and economic issues in cloud computing
- Deploy cloud computing systems to meet business goals
- Methods, techniques and tools for information modelling, management and security in cloud computing
- Knowledge of cloud computing systems architecture
- Competence in MapReduce programming for distributed processing of big data

Intellectual:
- Specify, design, construct, deploy, verify and maintain systems
- Defining problems, managing design process and evaluating outcomes in terms of quality and trade-offs

Practical:
- Research skills
- IT skills

Personal and Social:
- Development of the ability to work independently
- Development of general transferable skills including planning & organisational skills, and continuous learning skills, etc.

14 Syllabus

Please itemise the main topics of study

- Introduction to Cloud Computing
- Cloud Computing Technologies and Types
- Big Data
- MapReduce and Hadoop
- Practical Lab Class: Running Hadoop in the Cloud
- Developing MapReduce Programs
- Data Management in the Cloud
- Information Retrieval in the Cloud
- Link Analysis in the Cloud
- Beyond MapReduce
- Selected Case Studies
- Advanced Topics in Cloud Computing

15 Scheme of Assessment

(See Guidance Note 15)

<table>
<thead>
<tr>
<th>Elements of Assessment</th>
<th>Weighting (%)</th>
<th>Characteristics (eg, word count, duration of exam)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coursework</td>
<td>20%</td>
<td>A couple of programming assignments</td>
</tr>
<tr>
<td>Examination</td>
<td>80%</td>
<td>A 2-hour written examination (unseen)</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Pass requirements: Just a pass overall must be obtained.

16 Core Teaching Staff

(See Guidance Note 16)

Module Co-ordinator | Name: Dell Zhang | FT / Pt |

Please indicate whether permanent and/or sessional staff will be teaching on this module
<table>
<thead>
<tr>
<th>Permanent</th>
<th>YES / NO</th>
<th>Sessional</th>
<th>YES / NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name(s):</td>
<td>Dell Zhang</td>
<td>Name(s):</td>
<td></td>
</tr>
</tbody>
</table>

### 17 Resources

**Will this module be offered on an annual or biennial basis?**  
Annual

**Are additional resources required for this module?**  
YES / NO  
(Delete as appropriate)

If YES, please give details of additional resources required.

Confirm that consultation has taken place in all cases with relevant colleagues supporting these services (detailed below) to indicate agreement. This consultation should be evidenced by covering emails.

#### Accommodation – additional resources required:

Consultation with Room Bookings: YES / NO

#### Library – additional resources required:

3 copies for each following book:  
1 x 3-week loan, 1 x 1-week loan, 1 x 1-day loan


#### ITS – additional resources required:

Consultation with User Support Manager (ITS): YES / NO

#### Media Services – additional resources required:

Consultation with Media Services Manager: YES / NO

### 18 Agreement

**Name** | **Date**
---|---
Module Co-ordinator  
(or author of this proposal, if different) | Dell Zhang | 31/01/2012
Head of Department (or Executive Dean for School held modules) – to be evidenced by covering email | Mark Levene | 02/02/2012
Chair of STQEC (including date of STQEC meeting at which module approved) | Linda Trenberth |  |

Relevant External Examiners should be consulted and notified of any changes made to existing programmes within their remit, including new modules.

**CLOSING DATE FOR NEW MODULES:** The deadline for the submission of new modules and module/minor programme amendments to QEV is approx 2 weeks after the STQEC in the term preceding the starting date when teaching would begin. Thus, for a new module planned to be introduced in the Summer term 2012, notification should be made to QEV by Friday 17th February 2012. Any submissions received after these dates cannot be guaranteed to be set up in time for when required.

YOU MUST ALSO ENSURE ALL OF THE ABOVE CONSULTATION/APPROVAL HAS TAKEN PLACE AND IS EVIDENCED BY COVERING EMAILS BEFORE YOU SUBMIT THE FORM. Please return the form to the Secretary of the School Teaching and Quality Enhancement Committee (STQEC) in line with the above deadline. If this is not the case the proposal may not be approved for submission to the Committee at this time since this does not allow sufficient time for full consideration to take place and for any possible further work/areas of clarification to be dealt with.

Following approval (where appropriate) by the School TQEC notification of the new module should be made to the College Programmes Committee via Quality Enhancement and Validation (Registry Services). At this time QEV will notify Planning and Business Systems and the required changes will be made to the Birkbeck Student Information System (BSIS).
### Guidance Notes

In developing the module, account should be taken of the College’s Common Awards Scheme (http://www.bbk.ac.uk/mybirkbeck/services/rules/casereg.doc/view), national Framework for Higher Education Qualifications (http://www.qaa.ac.uk/academicinfrastructure/FHEQ/EWN08/default.asp), Higher Education Credit Framework for England (http://www.qaa.ac.uk/england/credit/default.asp), relevant QAA Subject Benchmark Statements (http://www.qaa.ac.uk/academicinfrastructure/benchmark/default.asp) and, where appropriate, the requirements of Professional, Statutory and Regulatory Bodies.

### Section | Note
---|---
1 | Self explanatory
2 | Level: either 4 (C ), 5 (I) or 6 (H) for undergraduate modules; Level 7 (M) for postgraduate modules

Level descriptors are described in the Framework for Higher Education Qualifications: http://www.qaa.ac.uk/academicinfrastructure/FHEQ/EWN/default.asp

3 | Credit Value: 15 (half), 30 (single) or 60 (double)

4a: Self explanatory. 4b: For modular enrolment only the subject area should be provided in addition to the Department with academic responsibility as these are the areas under which the module will appear in the online prospectus and in GURU.

5 | Self explanatory

6 | Give the minimum and maximum number of students required to run this module.

7 | 7a: Tick one or more boxes as appropriate. 7b:Tick one or more boxes as appropriate. For Modular Enrolment only: Open Enrolment/Restricted Enrolment/Subject to Placement Test should be detailed here. Most modules that are available to book individually will be open enrolment, but some are restricted to a specific group or have prerequisite modules. ‘Subject to Placement Test’ refers specifically to language modules which require a separate fee module to be set up to take payment prior to the test.

8 | Normally, 1 credit = 10 notional hours of learning. This includes all study undertaken to achieve the specified learning - contact hours, assessment and private study. Therefore a 30-credit module = approximately 300 hours total learning hours.

**Method of teaching and Contact hours/attendance:** For each teaching component give details of the number of associated study sessions and contact hours the student will be expected to attend/undertake in College or elsewhere, eg, Lectures: 11 weekly sessions, each 1.5 hours, plus revision week.

**Directed Learning/Private Study/Assessment:** Please indicate the approximate number of hours a student might be expected to undertake in other learning and private study, including assessment and preparation for assessment.

9 | Tick one or more boxes as appropriate to indicate status of module.

**Core:** must be taken and passed. **Compulsory:** must be taken, but may be compensated on some programmes (not on subsidiary awards i.e. Cert/Dip HE, GradCert/Dip, PgCert/Dip) if not passed. **Option:** selected from a range of approved modules within the field as specified in the programme regulations. Add details of the designated programme(s) for Core/Compulsory modules. Add details of all programme(s) for which the module may be selected as an approved Option.

**Elective modules:** unless specified otherwise, all modules will be available as electives and open to any student whose programme of study has defined an elective module as part of the approved programme, subject to availability of places, pre(co)-requirement requirements, timetabling constraints and being at the appropriate level/value.

10 | **Pre-requisite:** List any module (Code and Title) which must be successfully completed prior to undertaking this module, or any other condition(s) of eligibility. **Co-requisite:** List any module (Code and Title) which must be selected in parallel with this module

11 | **Restrictions:** List any modules which CANNOT be taken in conjunction with this module

12 | **Rationale for introducing this module in the context of existing provision, including statement of how the proposal meets student need.** If the proposal supersedes an existing module, please give the code and title of the superseded module and the reason for replacement. If the proposal relates to an existing module, please give the code and title of the related module and an explanation of how this relationship will work.

13 | **Learning Outcomes should relate to the overall aims of the programme(s) to which the module forms part and should be achievable and measurable.** The entry should be written in the following format:

“On successful completion of this module, a student will be expected to be able to ….”, followed by a verb, eg, demonstrate, evaluate, operate, apply, analyse, and then an indication of the appropriate skills, complexity, knowledge or understanding.

Learning outcomes may relate to some, all, or, of the following categories:

**Subject Specific:** The main areas of knowledge to be gained by the student, the understanding of the context in which this knowledge exists and the understanding of how this knowledge can be applied.

**Intellectual:** Reference should be made to evaluation, applications of theoretical understanding to work/life situations, critical reasoning, formulation and testing of hypotheses, problem solving, analytical skills, synthesis, the ability to study a problem in depth etc.

**Practical:** Research skills, laboratory skills, IT skills, numeracy skills, use of specialised statistical packages, ability to handle historical documents in a history programme, or other as appropriate.

**Personal and Social:** Skills that the student should be able to use in areas of life independent of the programme eg, communication skills, the ability to work independently, self-awareness, planning and organisational skills, continuous learning skills, presentation skills, teamwork or an increased awareness of ethical practice.

14 | Self explanatory

15 | **Assessment methods should enable the student to demonstrate the learning outcomes for the module.**

ALL elements of assessment must be listed (including those that are zero-weighted for purposes of calculating the overall final mark).

**Elements of Assessment:** e.g. coursework essay, dissertation, project, examination (seen), examination (unseen), group assessment, presentation, portfolio, oral, viva, report (or other that may not be listed here). **Weighting:** percentage weighting the element contributes to the final module result.

**Characteristics:** e.g. word count, submission date, duration of exam or other timed assessment

**Pass requirements:** e.g. all elements have to be passed; some elements must be passed as well as a pass overall; just a pass overall must be obtained.

16 | The module co-ordinator should be a permanent member of teaching staff who should ensure that procedures are being adhered to with regard to teaching and assessment practices.

17 | **Provide details of any ADDITIONAL resources required.** Consultation with Room Bookings, the relevant Subject Librarian, User Support Manager (ITS) and Media Services Manager are required in all cases and this consultation should be evidenced by covering emails. All teaching and learning must be sufficiently flexible to enable all reasonable adjustments to be made in accordance with the Disability Discrimination Act (DDA).

18 | **Approval of the Head of Department (or Executive Dean for School held modules e.g. Law) and the Chair of the School Teaching and Quality Enhancement Committee should be evidenced by covering emails, the latter to include the date of the STQEC meeting at which the module was approved.**