

# COMP 516

## Research Methods in Computer Science

Othon Michail

Department of Computer Science  
University of Liverpool

with material from Ullrich Hustadt, Rahul Savani, and Dominik Wojtczak

# Introduction and Overview

**Staff: Dr Othon Michail****Weeks: S1 01 (24 Sep 2018-30 Sep 2018)**

	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:30	17:00	17:30
Mon									<b>COMP516 - Res Methods in Computer Sci [LECTURE]</b> COMP516/LEC/A/01 S1 01-S1 12	<a href="#">COMP516</a> <a href="#">ELEC-202[E2]</a>								
Tue					<b>COMP516 - Res Methods in Computer Sci [LECTURE]</b> COMP516/LEC/B/01 S1 01-S1 12	<a href="#">COMP516</a> <a href="#">BROD-106</a>												
Wed			<b>COMP516 - Res Methods in Computer Sci [LAB]</b> COMP516/LAB/02 S1 01-S1 12	<a href="#">COMP516</a> <a href="#">GHOLT-H116/117 (Lab2)</a>														
Thu			<b>COMP516 - Res Methods in Computer Sci [LECTURE]</b> COMP516/LEC/C/01 S1 01-S1 12	<a href="#">COMP516</a> <a href="#">LIFS-LT2</a>														
Fri			<b>COMP516 - Res Methods in Computer Sci [LAB]</b> COMP516/LAB/01 S1 01-S1 12	<a href="#">COMP516</a> <a href="#">GHOLT-H116/117 (Lab2)</a>														

# Delivery of the Module (1)

- **Module Coordinator**

- Othon Michail (Othon.Michail@liverpool.ac.uk)

- **Lectures**

Mondays 13:00-14:00 ELEC-202

Tuesdays 11:00-12:00 BROD-106

Thursdays 10:00-11:00 LIFS-LT2

- **Practicals**

Not starting week 1

Wednesdays 10:00-11:00 GHOLT-H116117 (Lab2)

Fridays 10:00-11:00 GHOLT-H116117 (Lab2)

Demonstrators: To be assigned

- **Departmental research seminars**

Tuesdays 1-2pm Ashton Lecture Theater (First Floor)

<http://www.csc.liv.ac.uk/research/seminars/>

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# Delivery of the Module (2)

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Room GHOLT 2.14, send me an e-mail first

- Website

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- Module homepage

check 201819-COMP516 - RESEARCH METHODS IN COMPUTER SCIENCE module on VITAL

- detailed information about assessments, all assessment submissions, discussion board, recorded lectures, practical handouts, lecture notes, useful resources (including example past submissions) can be found on VITAL

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# Recommended Texts

- Christian W. Dawson: Projects in Computing and Information Systems (A Student's Guide). Addison Wesley, 2005.  
Harold Cohen Library, Class No 518.561.D27  
  
Earlier edition:  
Christian W. Dawson: The essence of computing projects (A student's guide). Prentice Hall, 2000.  
Harold Cohen Library, Class No 518.561.D27
- Justin Zobel: Writing for Computer Science. Springer, 2004.  
Harold Cohen Library, Class No 378.962.Z81
- F. Bott: Professional Issues in Information Technology.  
British Computer Society (latest edition).
- J. M. Kizza: Ethical and Social Issues in the Information Age.  
Springer (latest edition).

- 1 To provide a deep and systematic **understanding** of the nature and **conduct of Computer Science research**
- 2 To enable students to **undertake independent research**
- 3 To **enhance** existing transferable key skills
- 4 To **develop** high-order transferable key skills
- 5 To remind students of the **Legal, Social, Ethical and Professional (LSEP) issues** applicable to the computer industry

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# Learning Outcomes (1)

- ① Have an **understanding** of how established **techniques of research** and enquiry are used to extend, create and interpret knowledge in Computer Science
- ② Have a conceptual **understanding sufficient to**:
  - (i) **evaluate** critically **current research** and advanced scholarship in Computer Science, and
  - (ii) **propose** possible **alternative directions** for further work

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# Learning Outcomes (2)

## 3 Be able to:

- (i) deal with complex issues at the forefront of the academic discipline of Computer Science in a manner, based on sound judgments, that is both systematic and creative,
- (ii) demonstrate self-direction and originality in tackling and solving problems within the domain of Computer Science,
- (iii) act autonomously in planning and implementing solutions in a professional manner, and
- (iv) define, plan, and/or carry out a project related to research and to communicate conclusions clearly to both specialists and non-specialists

# Learning Outcomes (3)

- ④ Make use of the qualities and **transferable skills** necessary for employment requiring:
  - (i) the exercise of **initiative** and **personal responsibility**,
  - (ii) **decision making in complex and unpredictable situations**,
  - (iii) **scientific risk identification, assessment and control**, and
  - (iv) the **independent learning ability** required for continuing professional development
- ⑤ Understand and participate within the **professional, legal, social and ethical framework** within which they would be expected to operate as professionals within the IT industry
- ⑥ Have the **skills set** to be able to continue to **advance their knowledge and understanding**, and to **develop new skills to a high level**, with respect to continuing professional development as a “**self-directed life-long learner**” across the discipline of Computer Science

# Learning Outcomes (4)

In short, you should learn to

- 1 understand research and research methods in Computer Science
- 2 be able to plan, and conduct your own research, taking into account ethical, legal, and professional limitations
- 3 be able to communicate its results

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This module is preparation for COMP702.



- BCS (British Computer Society), The Chartered Institute for IT
- Recognised as a professional engineering institute for the registration of information systems and software engineers
- Chartered Scientist is a professional qualification in the UK
- the required standard for Chartered Scientist registration is MSc qualification (or equivalent) with four years of postgraduate work experience

- Module updated this year
- Response to SSLC input
- Group projects
- Group presentations: fewer, more time per presentation, attempt to attend half of them
- A variety of project topics



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# Assessments Overview and Module Structure (1)

## Group Project Related to Research

- Groups (of 3-4 students depending on final numbers), will work on a research-related project throughout the semester
- Self-form and let me know of your **group** and chosen **project type** by **October 1st (by email)**
  - Groups of **3 students** for the time being
- Any half-filled groups and unassigned students shall be filled/assigned randomly
- Assignment is confirmed and groups start working on their project, from week 3 to 9

# Assessments Overview and Module Structure (2)

- End of week 5 (roughly), groups submit their slides and other material related to their presentation
- Presentations shall take place in class weeks 6 to 9 (roughly)
- Groups shall continue working on their projects to be submitted end of week 9 (roughly)
- Final deliverable for all types of projects will be one or two documents



# Expected Schedule

- weeks 1-4: lectures
- week 2: propose groups/topic, confirmed, start working on projects
- weeks 4-5: short break, class test, class test discussion
- week 5: submit presentation material (e.g., PDF/Powerpoint slides)
- weeks 6-9: group oral presentations in class
- week 9-10: submit project deliverables/outputs (e.g., 1-2 documents)
- Enjoy Christmas

# Assessments (1)

## CA1: Group Oral Presentation related to Project (20%)

- presentation material to be submitted, e.g., slides in PDF/Powerpoint, a video, ...
- presentation 25 minutes, questions 5 minutes, per group
- some types of group projects may be assigned 45 minutes, questions 5 minutes, per group
- submit week 5, present within weeks 6-9

## CA2: Class test on the material covered in the lectures (20%)

- Most likely within weeks 4-5
- More specific instructions shall be provided in due course

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## CA3: Research Project (60%)

- Research-related project
- Should be strongly related to Computer Science research
- Weeks 2 to 9, Submit 1-2 documents, end of week 9

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Each group will pick **ONE** of the following types:

- 1 Carrying out research, or
- 2 Literature review, or
- 3 MSc project specification, or
- 4 Teaching and communications methods of research, or ...

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- ② Literature review, or
- ③ MSc project specification, or
- ④ Teaching and communications methods of research, or ...

**Important:** Pass mark is **50%** (standard for MSc modules)

# 1. Carrying out Research

First experience on:

- working within a group on a concrete **research problem**
  - basic or applied research
- present their results in the form of a **paper draft**

Suitable for research-oriented students (e.g., research MSc, thinking about a PhD)

- Could be any problem/topic related to CS that qualifies as an **open research question**

# How to Pick Problem

Approaches that typically work:

- Go through the "Past MSc project topics" on VITAL
- Pick latest papers from CS conferences (e.g., within last 2 years) in your areas of interest
  - problems/questions/directions that they leave open
  - [https://en.wikipedia.org/wiki/List\\_of\\_computer\\_science\\_conferences](https://en.wikipedia.org/wiki/List_of_computer_science_conferences)
  - avoid too prestigious (e.g., STOC) and too technical

Expected from you: **Preliminary ideas and solutions** and not a publishable piece of research



Deliverables:

- 1 A **paper draft** (8 A4 pages max including everything,  $\geq$  11pt font,  $\geq$  1 inch margins)
- 2 An **accompanying report** (5 A4 pages max)

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## Examples of papers:

- <http://www.cs.yale.edu/publications/techreports/tr1281.pdf>
- <https://cgi.csc.liv.ac.uk/~michailo/Documents/Papers/Conferences/icalp13.pdf>
- <https://core.ac.uk/download/pdf/131155846.pdf>
- <https://arxiv.org/pdf/1707.04282.pdf>

- Expected from you: Preliminary ideas and solutions and not a publishable piece of research
- Not assessed on the basis of actually solving the chosen problem
- Mostly on the basis of
  - Following a concrete plan of potential strategies to solve it
  - Attempting some of those strategies
  - Making observations on why they do or do not work
  - Modifying them accordingly or trying to follow alternative approaches, etc.

## 2. Literature Review

Gain experience on:

- Working within a group on exploring/studying/understanding a **research area**
  - landmark traditional topic
  - modern, state of the art area
  - also a list of examples provided on VITAL
- Transferring/communicating the acquired knowledge to others

Good opportunity for students who want to explore a research area

- Could build a strong background for their COMP702 project
- Could be any CS research area

# What to Do

## An Approach:

- Pick a **topic** that you like
  - e.g., deep learning/deep neural networks
- Pick a **“top” paper** on that topic
  - e.g., Silver, David, et al. "Mastering the game of Go without human knowledge." *Nature* 550.7676 (2017): 354.
- Use that paper as a **starting point to explore** the area around it
  - Its references
  - Papers that cite it
  - Find out other related papers

# Deliverables

## Deliverables:

- 1 A **review article** (8 A4 pages max including everything,  $\geq$  11pt font,  $\geq$  1 inch margins) introducing the reader to the area
- 2 An **accompanying report** (5 A4 pages max)

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## Examples of review articles:

- [http:  
//www.cs.yale.edu/homes/aspnes/papers/minema-survey.pdf](http://www.cs.yale.edu/homes/aspnes/papers/minema-survey.pdf)
- [https://cacm.acm.org/magazines/2018/2/  
224637-elements-of-the-theory-of-dynamic-networks/  
fulltext](https://cacm.acm.org/magazines/2018/2/224637-elements-of-the-theory-of-dynamic-networks/fulltext)
- [https:  
//theory.stanford.edu/~tim/papers/ec14\\_exchanges.pdf](https://theory.stanford.edu/~tim/papers/ec14_exchanges.pdf)
- [http:  
//erikdemaine.org/papers/AlgGameTheory\\_GONC3/paper.pdf](http://erikdemaine.org/papers/AlgGameTheory_GONC3/paper.pdf)

### 3. MSc Project Specification

- Any current **research topic or current technological** development in Computer Science
- Provide an **overview of the current state**, possibly together with some historical information of the subject area
- your MSc topic for COMP516 is **not related** to final MSc project (COMP702)
- MSc project is almost always picked from a list (available at the end of semester 2)
- at <https://cgi.csc.liv.ac.uk/~comp702/> you can see all of these topics with a short description
- use your CS login/password or MWS (?) to access that website



# Clarification about the topic (1)

- it is sometimes possible to propose a new MSc project, but that requires finding a suitable supervisor
- We may be able to help you find a suitable supervisor if you like to continue with your project
- if you pick a topic (or closely related one) suggested by someone who is still in the department, it should be no problem
- continuing with the same project would give you some extra time in COMP702
- the topic that you select in COMP516 can be anything that interests you in CS
- COMP516 section on VITAL lists all MSc topic proposed in the last five years (nearly 500 of them)

## Clarification about the topic (2)

- comment on ethical and professional issues of your proposal
- going one step further than specification and actually start designing, e.g., producing a software, is encouraged in COMP516

## 4. Teaching and Communicating Research

Develop skills on:

- Working within a group on a topic **related to research**
- developing material and strategies in order to effectively **teach the subject in class**

Only for these projects, if time permits: will preferably be presented closer to week 9 and might be allocated a whole session in order to deliver a full 1-hour lecture

Submit:

- a **report** (5 A4 pages max) and
- at least one **visual aid** that would be used in a lecture of their chosen subject
  - **slides, video, any software, ...**

# The Presentation (1)

- at most 25 min + 5 min questions (possible exception: teaching projects)
- all of them will take place during 12-15 sessions most likely between weeks 6-9 during the usual COMP516 lecture slots
- 2 groups per session
- aim:
  - communicate the topic of your project
  - demonstrate that you have chosen an interesting research topic
  - that you have a good plan or are on track to carry out the work required

# The Presentation (2)

- try to minimise text
- avoid full sentences
- just key points or very short phrases
- try to include pictures, animations, ...
- prepare well for your presentation
- when submitting, your presentation has to be named **GroupID.???**, where ??? is pdf (or ppt or pptx only if necessary)
- the only assessment with no reassessment opportunity

# The Presentation (3)

A good presentation will:

- Provide a high-level view of your project
- Clearly identify a well-defined research question/application/teaching subject
- Demonstrate that you have
  - well-defined goals
  - clear plan towards achieving them
  - discuss progress and next steps

- All students in the group should have an **as an equal contribution as possible** in the preparation and delivery of the group presentation
  - **The same holds for the research project as a whole**
- Still, their roles could differ, e.g., for the presentation: one of the students might be primarily presenting, another mainly writing on the board, another having main responsibility of preparing the slides, figures, tables, or other visual material

**Group Marking:** Unless an issue of unequal contribution is reported to us, **by default all members of the group shall be equally marked** (i.e., one mark/feedback per group).

- Expected to start week 2/3
- **Practical handouts** can be found on **VITAL**
- Lab will serve **two main purposes**:
  - 1 Allow you to familiarise in a guided way with **practical issues**, e.g., Gantt charts, referencing, retrieving literature, interview skills, ...
  - 2 Give you some standard slot to **work on your research project** for COMP516



# Academic English Classes

- for all international students and staff members
- no need to register for these classes (but take your student card)
- many more classes: **Academic Writing, Academic Reading, Academic Speaking & Pronunciation, Academic Listening, Britain Today, Grammar & Vocabulary**
- 1:1 ACADEMIC WRITING CONSULTATIONS, up to 40 minutes long

<http://www.liverpool.ac.uk/english-language-centre/in-sessional-support/>  
or “Learning Resources” on COMP516’s VITAL page

# Academic English classes for International Students

- discipline-specific language classes
- for MSc Computer Science students only
- all overseas students are expected to enroll on this module

<http://www.liverpool.ac.uk/english-language-centre/in-sessional-support/>  
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