WESTERN SYDNEY
UNIVERSITY

## School of Computer, Data and Mathematical Sciences

# Subject Outline

COMP2008 Computer Organisation
Spring 2024

Western Sydney University acknowledges the peoples of the Darug, Dharawal, Eora and Wiradjuri nations. We also acknowledge that the teaching and learning currently delivered across our campuses is a continuance of the teaching and learning that has occurred on these lands for tens of thousands of years.

## Subject Details

| | |
|---|---|
| **Subject Code:** | COMP2008 |
| **Subject Name:** | Computer Organisation |
| **Credit Points:** | 10 |
| **Subject Level:** | 2 |
| **Assumed Knowledge:** | Not Applicable |

Note: Students with any problems, concerns or doubts should discuss those with the Subject Coordinator as early as they can.

## Subject Coordinator

**Name:** Jamie Yang
**Phone:** (02) 96859233
**Location:** ER.G.12 Parramatta Campus
**Email:** J.Yang@westernsydney.edu.au
**Consultation Arrangement:**
Consultation hours: Tuesday 09:00-11:00 ER.G.12, Parramatta South; or via Zoom if necessary. Please also check vUWS site for the most up to date information on consultation arrangement in case of changes.

For subject inquiries, you can also email a staff member directly. Please note that a staff member is typically teaching multiple subjects, so make sure you start the subject line with "COMP2008 CO" and then include a relevant subject.

For any subject related inquiries, you need to use your Western Sydney University student email account; we really should not correspondent with students via external email addresses as per the university policy since they are not verifiable.

In addition, the coordinator may use emails to address the subject related issues (clarifying administrative policies, providing hints to practical activities, presenting extra/supplementary materials for the subject studies). So please check your Western Sydney University emails regularly and carefully. It is pivotal for any student wishing to perform well to read all these emails carefully.

*Edition: Spring 2024*

# Contents

# 1 About Computer Organisation

## 1.1 An Introduction to this Subject

This subject is designed for computer science students, particularly those interested in systems programming and hardware development. The students will learn about the interface between the hardware and software of a computer system. This will involve study of some aspects of computer architecture and low level interfacing to gain an insight into central processing subject (CPU) organisation at the assembly language level. After completing this subject students will be able to write procedures in an assembly language, use their understanding of the relationship between the instruction set architecture and the implementation of high level languages to write efficient programs.

## 1.2 What is Expected of You

**Study Load**

A student is expected to study an hour per credit point a week. For example a 10 credit point Subject would require 10 hours of study per week. This time includes the time spent within classes during lectures, tutorials or practicals.

*Note for Summer Terms: As Summer subjects deliver the same content and classes over a shorter period of time, the subjects are run in a more intensive mode. Regardless of the delivery mode, the study hours for each subject in Summer will be around 30 hours.*

**Attendance**

It is strongly recommended that students attend all scheduled learning activities to support their learning. Students with a poor attendance record may find themselves at risk of not passing assessment.

## Approach to Learning

This subject has been iteratively designed and implemented by following the key steps applying blended learning:

- Planning for integration of blended learning principles
- Designing the learning activities and assessment and developing them as required
- Implementing the blended learning design
- Evaluating the effectiveness of blended learning designs
- Making improvements for the next time of the subject delivery

With the blended delivery model, the subject's teaching activities consist of face-to-face lectures or online-lecturing (e.g. via Zoom or online videos) and on-campus practicals or online practice (e.g. via Zoom or Blackboard Collaborate Ultra). In addition to lecture notes and laboratory worksheets, we may also provide some recorded lectures and online discussion to support the subject content so that you can practice further the presented concepts in your own time. Following this approach to learning, you will gain programming expertise in becoming a confident and competent system programmer and hardware developer. We'll continue to revise the Blended Learning approach (e.g. implementing adaptable techniques and settings) to satisfy the needs for student-centered learning. This could be a long-run process.

**Lecture**: 2 hours; Face-to-face or Online lectures (via Zoom or Blackboard Collaborate Ultra) on requirement subject to resource allocation and pedagogical implementations

There are weekly lectures (on-campus or online via Zoom / Blackboard Collaborate Ultra) to present related topics of the subject. The lectures and text reading will examine the theoretical aspects related to computer organisation and architecture. It is strongly recommended that you attend lectures to support your learning. Students with a poor attendance record may find themselves at risk of not passing assessment.

**Tutorial**: 2 hours; On-campus class or Online session (via Zoom or Blackboard Collaborate Ultra) on requirement subject to resource allocation and pedagogical implementations

The practical activities are designed to reinforce students' understanding of theoretical concepts. You are required to practice the topics by during tutorials for each module of the subject. Tutorial attendance is mandatory, where tutorial tasks are to be demonstrated for grading purpose. This is to ensure students on-going achievements step by step.

**Online Learning Requirements**

Subject materials will be made available on the Subject 's vUWS (E-Learning) site (https://vuws.westernsydney.edu.au/). You are expected to consult vUWS at least twice a week, as all Subject announcements will be made via vUWS. Teaching and learning materials will be regularly updated and posted online by the teaching team.

**Special Requirements**

*Essential Equipment:*
Not Applicable
*Legislative Pre-Requisites:*
Not Applicable

## 1.3 Changes to Subject as a Result of Past Student Feedback

The University values student feedback in order to improve the quality of its educational programs. The feedback provided helps us improve teaching methods and Subject s of study. The survey results inform Subject content and design, Subject Outlines, teaching methods, assessment processes and teaching materials.

You are welcome to provide feedback that is related to the teaching of this Subject . At the end of the semester you will be given the opportunity to complete a Student Feedback on Subject questionnaire to assess the Subject . If requested by your Subject coordinator, you may also have the opportunity to complete a Student Feedback on Teaching (SFT) questionnaire to provide feedback for individual teaching staff.

As a result of student feedback, the following changes and improvements to this Subject have recently been made:

- Subject vUWS pages have been modified to make the content exploration and information retrieval more user friendly.
- The text has been updated to the most recent edition (6th Ed).
- All lecture notes and laboratory materials have been updated to match the latest textbook edition.
- Lecture notes have been expanded to cover more computer architecture content.
- Review questions have been added to lecture notes.
- Laboratory exercises have been revised for clarity.
- Sample exam papers and extra exam information have been provided to help students for the final exam.
- Online teaching classes are provided for students' convenience if needed.

## 2 Learning and Teaching Activities

| **Teaching Weeks** | **Topic** | **Lecture** | **Tutorial** | **Independent** | **Assessment Due** |
|---|---|---|---|---|---|
| Week 1<br>22-07-2024 | Introduction: Detailed outline of the subject, approach to teaching, assessment structure. Basic components of computer, MIPS, PCSpim | Lect. 01 | No tutorial Make sure you enrolled to a tutorial class. | Read Lecture note 1<br><br>*Please check whether PH6 (also PH5 and PH4) eBook available on library site*<br><br>***PH6: companion materials*** *(e.g. online sections for further readings) at* here<br>***PH5: companion materials*** *at* here | |

| Teaching Weeks | Topic | Lecture | Tutorial | Independent | Assessment Due |
|---|---|---|---|---|---|
| | | | | **PH6**: P54: Road Map for Major Components. [keep the road map in your mind for further references; no need to read through Ch 3-6 for now]<br>- Memory: Ch 5<br>- Datapath: Ch 3, 4, 6, Appendix C<br>- Control: Ch 4, 6, Appendix C<br>- I/O: Ch 5, 6<br>**PH5**: P53: Road Map for Major Components.<br>- Memory: Ch 5<br>- Datapath: Ch 3, 4, 6, Appendix C<br>- Control: Ch 4, 6, Appendix C<br>- I/O: Ch 5, 6<br>**PH4**: P55: Road Map for Major Components.<br>- Memory: Ch 5<br>- Datapath: Ch 3, 4, 7, Appendix A<br>- Control: Ch 4, 7, Appendix A<br>- I/O: Ch 6<br>**AppA.pdf** ->A-24: MIPS registers<br>**AppA.pdf** ->A-46: MIPS CPU | |

| Teaching Weeks | Topic | Lecture | Tutorial | Independent | Assessment Due |
|---|---|---|---|---|---|
| Week 2<br>29-07-2024 | ISA-MIPS: MIPS assembly language, R, I, J instructions, decision making | Lect. 02 | Prac 1 starts | Read Lecture note 2<br><br>**PH6**: 2.2-2.3, P69: Operations and Operands<br>**PH5**: 2.2-2.3, P63: Operations and Operands<br>**PH4**: 2.2-2.3, P78: Operations and Operands<br>**PH6**: 2.2-2.3, 2.5: 1st-3rd Principle of hardware design<br>**PH5**: 2.2-2.3, 2.5: 1st-3rd Principle of hardware design P65: Design Principle 1 P67: Design Principle 2 P83: Design Principle 3<br>**PH4**: 2.2-2.3, 2.5, P79-P97: 1st-4th Principle of hardware design P79: Design Principle 1 P81: Design Principle 2 P86: Design Principle 3 P97: Design Principle 4<br>**PH6**: 2.5, P86: pay attention to Stored-Program Concept<br>**PH5**: 2.5, P86: Stored-program concept<br>**PH4**: 2.5, P101: Stored-program concept<br>**PH6**: 2.7, P96: Understand basic control structures<br>**PH5**: 2.7, P90-P96: Basic control structures<br>**PH4**: 2.7, P105-P111: Basic control structures<br>**AppA.pdf** ->A-21: Memory layout<br>**AppA.pdf** ->A-44: System services | |

| Teaching Weeks | Topic | Lecture | Tutorial | Independent | Assessment Due |
|---|---|---|---|---|---|
| Week 3<br>05-08-2024 | Addressing: Constants, addressing, loops, arrays and pointers, processing text | Lect. 03 | Prac 2 starts Prac 1 due | Read Lecture note 3<br><br>**PH6**: 2.3, P72: immediate operands; making the common case fast<br>**PH5**: 2.3, P72: immediate operands; making the common case fast<br>**PH4**: 2.3, P86: immediate operands; 3rd Principle of hardware design<br>**PH6**: 2.10, P118: Addressing mode in MIPS<br>**PH5**: 2.10, P111: Addressing mode in MIPS<br>**PH4**: 2.10, P128: Addressing mode in MIPS<br>**PH6**: 2.10, P125-P127: Instruction decoding and Instruction Formats<br>**PH5**: 2.10, P118-P120: Instruction decoding and Instruction Formats<br>**PH4**: 2.10, P134-P136: Instruction decoding and Instruction Formats<br>**PH6**: 2.14, P147: Traversing arrays - index vs pointer<br>**PH5**: 2.14, P141: Traversing arrays - index vs pointer<br>**PH4**: 2.14, P157: Traversing arrays - index vs pointer<br>**AppA.pdf** ->A-43 (PH6, PH5) or B-43 (PH4) pack characters<br>**AppA.pdf** ->A-48 (PH6, PH5) or B-48 (PH4) explains directive .asciiz<br>Also refer to "ascii_chart.pdf" on vUWS | - Laboratory exercises |

| Teaching Weeks | Topic | Lecture | Tutorial | Independent | Assessment Due |
|---|---|---|---|---|---|
| Week 4<br>12-08-2024 | Memory: Memory layout, memory alignment, procedures | Lect. 04 | Prac 3 starts Prac 2 due | Read Lecture note 4<br><br>**PH6**: 2.8, P102-P112: Procedure calling<br>**PH5**: 2.8, P96-P106: Procedure calling<br>**PH4**: 2.8, P112-P122: Procedure calling<br>**AppA.pdf** ->A-22: Procedure calling<br>**AppA.pdf** ->A-24: MIPS registers<br>**AppA.pdf** ->A-25: Stack frame | - Laboratory exercises |
| Week 5<br>19-08-2024 | Numbers: Numbers, masking | Lect. 05 | Prac 4 starts Prac 3 due | Read Lecture note 5<br><br>**PH6**: 3.1, 3.2, 3.3, 3.5: MIPS Arithmetic; MIPS FP Architecture<br>**PH5**: 3.1, 3.2, 3.3, 3.5 [p211-p217 of 3.5]: MIPS Arithmetic; MIPS FP Architecture<br>**PH4**: 3.1, 3.2, 3.3, 3.5 [p259-p265 of 3.5]: MIPS Arithmetic; MIPS FP Architecture<br>**AppA.pdf** ->A-51: Arithmetic and Logical Instructions | - Laboratory exercises |
| Week 6<br>26-08-2024 | Virtual-Performance: Virtual memory, performance, benchmarks | Lect. 06 | Prac 5 starts Prac 4 due | Read Lecture note 6<br><br>**PH6**: 5.1-5.5: Memory hierarchy<br>**PH5**: 5.1-5.5: Memory hierarchy<br>**PH4**: 5.1-5.3: Memory hierarchy | - Laboratory exercises<br>- 2 × In-class quizzes |

| Teaching Weeks | Topic | Lecture | Tutorial | Independent | Assessment Due |
|---|---|---|---|---|---|
| Week 7<br>02-09-2024 | I/O systems: I/O, polling/interrupts, exceptions, kernel/user mode | Lect. 07 | Prac 6 starts Prac 5 due | Read Lecture note 7<br><br>*PH6 & PH5: instead of putting I/O together into a single chapter, it has the I/O related contents spread throughout the book*<br><br>**PH6**: 4.10: Exceptions (not as detailed as in PH4, so also refer to AppA.pdf -.7)<br>**PH5**: 4.9, P325- P327: Exceptions (not as detailed as in previous editions, so refer to AppA.pdf ->A.7)<br>**PH4**: 6.6, P586: Interfacing I/O<br>**AppA.pdf** ->A.7 (A-33 to A-38): Exceptions & Interrupts<br>**AppA.pdf** ->A.8 (A-38 to A-40): I/O | - Laboratory exercises |
| Week 8<br>09-09-2024 | N/A | N/A | N/A | N/A | |
| Week 9<br>16-09-2024 | Bus-Disk: Disks, RAID | Lect. 08 | Prac 7 starts Prac 6 due | Read Lecture note 8<br><br>**PH4**: 6.3, P575: Disk storage<br>**PH6**: 5.11, P488 [5.11-1 to 5.11-8]: RAID<br>**PH5**: 5.11, P470 [5.11-1 to 5.11-8]: RAID<br>**PH4**: 6.9, P599: RAID | - Laboratory exercises |

| Teaching Weeks | Topic | Lecture | Tutorial | Independent | Assessment Due |
|---|---|---|---|---|---|
| Week 10<br>23-09-2024 | Logic-Datapath: Datapath, combinational and sequential logic, gates, clocking | Lect. 09 | Prac 8 starts Prac 7 due | Read Lecture note 9<br><br>**PH6**: Appendix B: The Basics of Logic Design<br>**PH5**: Appendix B: The Basics of Logic Design<br>**PH4**: Appendix C: The Basics of Logic Design | - Laboratory exercises |
| Week 11<br>30-09-2024 | ALU: Arithmetic Logic Unit (ALU), Karnaugh maps | Lect. 10 | Prac 9 starts Prac 8 due | Read Lecture note 10<br><br>**PH6**: Appendix B: The Basics of Logic Design<br>**PH5**: Appendix B: The Basics of Logic Design<br>**PH4**: Appendix C: The Basics of Logic Design | - Laboratory exercises |
| Week 12<br>07-10-2024 | Single cycle processor: Requirements of the instruction set, Assembling a datapath, Designing and assembling control | Lect. 11 | Prac 10 starts Prac 9 due | Read Lecture note 11<br><br>**PH6**: 4.1-4.4, P256-P284: The processor<br>**PH5**: 4.1-4.4, P244-P272: The processor<br>**PH4**: 4.1-4.4, P300-P329: The processor | - Laboratory exercises<br>- 2 x In-class quizzes |
| Week 13<br>14-10-2024 | Pipelining: Pipelined datapath, Hazards in pipeline | Lect. 12 | Prac 11 starts Prac 10 due | Read Lecture note 12<br><br>**PH6**: 4.6-4.9, P285-P337: Pipelining, Pipelined datapath, Hazards in pipeline<br>**PH5**: 4.5-4.8, P272-P325: Pipelining, Pipelined datapath, Hazards in pipeline<br>**PH4**: 4.5-4.8, P330-P385: Pipelining, Pipelined datapath, Hazards in pipeline | - Laboratory exercises |

| Teaching Weeks | Topic | Lecture | Tutorial | Independent | Assessment Due |
|---|---|---|---|---|---|
| Week 14<br>21-10-2024 | ISA Remarks and Subject Revision: RISC and CISC architectures, interpretation of 0-1 strings, Preparation for final exam. | Lect. 13 | Prac 11 due [No labs accepted after this week!] | Read Lecture note 13<br><br>**PH6**: 2.19, P157-P166: x86 instructions<br>**PH5**: 2.17, P149-P158: x86 instructions<br>**PH4**: 2.17, P165-P174: x86 instructions<br><br>Exam Information<br>Sample exam paper | - Laboratory exercises |
| Week 15<br>28-10-2024 | Stuvac | | | | |
| Week 16<br>04-11-2024 | Exams | | | | |
| Week 17<br>11-11-2024 | Exams | | | | |
| Week 18<br>18-11-2024 | | | | | |

The above timetable should be used as a guide only, as it is subject to change. Students will be advised of any changes as they become known on the Subject's vUWS site.

# 3 Assessment Information

## 3.1 Subject Learning Outcomes

| | Outcome |
|---|---|
| 1 | Consider the Instruction Set Architecture (ISA) in order to carry out assembly programming tasks. |
| 2 | Examine the stored program concept and internal representation of different types of data. |
| 3 | Examine the memory hierarchy and how this relates to computer system performance. |
| 4 | Identify the hardware mechanisms that support interrupt handling and how the latter is used to implement I/O control. |
| 5 | Explain the structure of datapath and control as well as the basic instruction level parallelism using pipelining. |
| 6 | Critique fundamental issues in evaluating computer system performance. |

## 3.2 Assessment Summary

The assessment items in this Subject are designed to enable you to demonstrate that you have achieved the Subject learning outcomes. Completion and submission of all assessment items which have been designated as mandatory or compulsory is essential to receive a passing grade.

**To pass this Subject you must:**

- Achievement of at least 50% overall is required to pass this subject. - At least 6 lab submissions must be attempted; at least one quiz must be attempted. No mandatory pass assessment components.

| Item | Weight | Due Date | SLOs Assessed | Mandatory | Threshold |
|---|---|---|---|---|---|
| Laboratory exercises | 40% | Weekly tutorial time for the corresponding laboratory tasks | 1, 2, 3, 4, 5, 6 | Yes | No |
| 2 x In-class quizzes | 10% | Quiz 1 and Quiz 2 are scheduled in week 6 and week 12 respectively. | 1, 2, 3, 4 | Yes | No |
| Final exam | 50% | To be scheduled during the university exam period. | 1, 2, 3, 4, 5, 6 | Yes | No |

**Feedback on Assessment**

Feedback is an important part of the learning process that can improve your progress towards achieving the learning outcomes. Feedback is any written or spoken response made in relation to academic work such as an assessment task, a performance or product. It can be given to you by a teacher, an external assessor or student peer, and may be given individually or to a group of students. As a Western Sydney University student, it is your responsibility to seek out and act on feedback that is provided to you as a resource to further your learning.

For this subject, the lab tasks are usually marked in the laboratory classes that physical lab attendance required. In this way, students submit their lab work during lab class time and are given comments or feedback to their work interactively. Where online delivery (partially or fully) is applied, the policy for lab work documentation, lab work

submission, and lab work grading procedure will vary. For electronic submission in vUWS, written comments to lab work will be provided via Grade Center.

For quizzes, you can expect result and feedback within 2 weeks of the due date for submission. Further informal feedback will also be provided in lectures as exemplar annotations.

**Academic Integrity and Student Misconduct Rule**

Western cares about your success as a student and in your future career. Studying with academic integrity safeguards your professional reputation and your degree. All Western students must:

- be familiar with the policies listed below;
- apply principles of academic integrity;
- act honestly and ethically in producing all academic work and assessment tasks; and
- submit work that is their own and acknowledge any sources used in their work.

Each time you submit an assessment, you will declare that you have completed it individually, unless it is a group assignment. In the case of a group assignment, each group member should be ready to document their individual contribution if needed.

The Student Misconduct Rule applies to all students of Western Sydney University including Western Sydney University programs taught by other education providers. You must not engage in academic, research or general misconduct as defined in the Rule or you may be subject to sanctions. The University considers submitting falsified documentation in support of requests to redo, resit or extend submissions, including sitting of deferred examinations, as instances of general misconduct.

More information is available in the Academic Integrity Guidelines. It is your responsibility to apply these principles to all work you submit to the University.

**Disruption to Studies and Requests for Extensions**

Western recognises that there may be times when things outside of your control impact your ability to complete your studies.

You can complete the "Request an extension or apply for a Disruption to Studies Provision" to request that you are:

- granted an extension,
- excused from a compulsory teaching activity,
- provided an alternate assessment such as a supplementary, or
- awarded another Disruption to Studies Provision.

Before you fill in the form, you should:

- Compile any documentary evidence that you have which demonstrates that you have been impacted by an event outside of your control.
- The Supporting Documentation website outlines the type of documents that you can submit to substantiate any impact.

Please note that if you don't have documents, you should still submit the form but you may be asked for documentation at a later stage.

**Need help?**

If you are having difficulties with understanding or completing an assessment task, contact your Subject Coordinator as soon as possible. Western also has a range of academic support services, including:

- **Library Study Smart**: book a one-to-one Zoom consultation with a literacy expert. You can discuss how to develop your assignment writing and study skills or seek assistance to understand referencing and citation requirements. Check the Library Study Smart website for how-to study guides and tools.
- **Studiosity**: Upload your assignment draft to Studiosity within vUWS to receive writing feedback within 24 hours.
- Online workshops, programs and resources: From maths and stats help to academic literacy and peer support programs, the University has a range of resources to assist.

Please also remember that there is a range of wellbeing support available - from counselling and disability services to welfare.

### 3.2.1 Laboratory exercises

| | |
|---|---|
| **Weight:** | 40% |
| **Type of Collaboration:** | Individual |
| **Due:** | Weekly tutorial time for the corresponding laboratory tasks |
| **Submission:** | Written answers to the exercises as well as the program associated. In-class marking for physical attendance with an on-site demonstration. Where online submission is allowed, after-class marking is applied. |
| **Format:** | Written answers to the exercises are presented in Word document, hand-written on paper, schematic drawings or scanned images etc.<br><br>Programs are demonstrated on computer or in hard copy for walk-through checking.<br><br>NOTE: For this subject, the lab tasks are usually submitted and marked in the laboratory classes (physical lab attendance required). In this way, students submit their lab work during lab class time and are given comments or feedback to their work interactively. If online submission is accepted, the policy for lab work documentation, lab work submission, and lab work grading procedure will vary. For electronic submission in vUWS, written comments to lab work will be provided via Grade Center. Refer to more detailed instructions below. |
| **Length:** | 11 x 2 hours |
| **Use of Artificial Intelligence:** | Ethical use of generative artificial intelligence (AI) tools is permitted in this assessment task. Any use of content from generative AI tools must be acknowledged. See advice on acknowledging the use of generative AI on the Library web page. Be aware that the output from generative AI tools may be incorrect, incomplete or biased. |

**Instructions:**

Note: For this subject, Laboratory, Tutorial, Practical, Workshop all refer to the same thing. A Laboratory class can be either an in-person class or an online session; in both cases, you must be present.

There are 11 sets of laboratory tasks, which are provided in vUWS. Each laboratory task consists of a home preparation part and a practical exercise part. Students should complete the home preparation part of each lab before starting the appropriate lab, not when the lab is due. The practical exercise part can be done during the corresponding tutorial time (or before the tutorial class if you wish).

Resources: Refer to the weekly lab sheets and recommended readings listed in the lab sheets. Students are expected to solve the lab questions with reference to the recommended readings and relevant lecture notes. Every lab sheet provides recommended readings for students' convenience. For instance, in lab 2, the following readings are recommended:

Study the lecture notes. Also use HP_AppA.pdf (in Extra Materials folder on vUWS) as a reference. Study at least the following sections from the Patterson and Hennessy "Computer Organization and Design" textbook:

- If you have Edition 2: Chapters 3.1, 3.2, first part of 3.3
- If you have Edition 3: Chapters 2.1, 2.2, first part of 2.3
- If you have Edition 4: Chapters 2.1 to 2.5
- If you have Edition 5: Chapters 2.1 to 2.5
- If you have Edition 6: Chapters 2.1 to 2.5

Each set of laboratory tasks is worth different amount of marks as indicated in the lab worksheets. For grading purpose, the answers to the exercises must be well documented, which can be presented in Word document, hand-written on paper, schematic drawings or scanned images etc. The code for the programming tasks can be demonstrated to the tutor electronically or submitted to the tutor in hard copy for marking.

For on-campus tutorials, the lab tasks are usually marked in the laboratory classes. As a consequence, attendance at the laboratory classes is required. No laboratory work will be accepted if it is submitted outside the scheduled tutorial time (unless it is required). Marks for the laboratory work can only be obtained by demonstrating it to the tutor during the scheduled lab session.

Where online delivery (partially or fully) is applied, the policy for lab work documentation, lab work submission, and lab work grading procedure will vary. With online tutorial mode, if in-class demo and grading are inconvenient, you are allowed to submit your lab work through the drop-boxes set in VUWS. In this event, the grading will be mainly based on the electronic submissions on vUWS. As the marking will be completed after the online tutorial session scheduled, the written answer to the lab questions should be well documented for after-class marking. For this purpose, you need to provide all the necessary written responses, recorded lab demonstration in screen shots, step-by-step description, or other appropriate format, as well as the relevant .s programs.

Unless an extension to a further date is granted to the student by the subject coordinator, no late submission is accepted. An extension of time may be granted only under exceptional circumstances by the subject coordinator. Resubmission of the laboratory work is not permitted in this subject.

Students are required to keep copies of all written work submitted. If a student believes that there was an error in his/her marking result, he/she must be able to present original laboratory work including the cover page signed and graded by the tutor.

**Marking Criteria:**

Students should demonstrate a mastery of knowledge of the relevant content; understand the theoretical/practical concepts, and implement the programming points to gain an insight into computer organisation.

The laboratory work must be submitted and demonstrated for grading within the scheduled tutorial session. The laboratory work will not be accepted without demonstration during the scheduled tutorial session unless there is a conflict of time, coordinating difficulties with partially or fully online teaching modes, etc.

Students' performance regarding the preparation and task implementation will be individually checked. A true and proper attempt must be in evidence. Students are encouraged to present programs which are fully tested. Any program language errors, run time errors, and logical errors will detract from the full marks. At least 6 lab submissions must be attempted.

### 3.2.2 2 x In-class quizzes

| | |
|---|---|
| **Weight:** | 10% |
| **Type of Collaboration:** | Individual |
| **Due:** | Quiz 1 and Quiz 2 are scheduled in week 6 and week 12 respectively. |
| **Submission:** | In session |
| **Format:** | On-paper or Online (subject to the teaching mode, resource allocation and pedagogical implementation). |
| **Length:** | 2 x 20 minutes (per Quiz) |
| **Use of Artificial Intelligence:** | In this assessment task, you will not be able to meet the learning outcomes related to the assessment by using generative artificial intelligence (AI) tools. Working with another person or technology in order to gain an unfair advantage in assessment or improperly obtaining answers from a third party including generative AI to questions in an examination or other form of assessment may lead to sanctions under the Student Misconduct Rule. Use of generative AI tools may be detected. More information is available on the Library web page. |

**Instructions:**

Students are expected to do the quizzes during scheduled lecture time. However, you may be prescribed alternative ways of doing the quizzes (e.g. online sessions in after-class hours). If alternative options are offered due to a variety of reasons (e.g. scheduling difficulty), in any case students will be notified in advance via announcements or emails.

The format of the quizzes can be on-paper or online subject to the teaching mode, resource allocation and pedagogical implementation.

Each quiz takes 20 minutes and is worth 5%. The quizzes will test what learnt thus far. Questions can be in form of True/False, multiple choice, and short answer.

Resources: Each quiz will cover what have learnt by the quiz week including concepts, principles, code analysis, and code writing. Please refer to corresponding lecture notes, tutorial questions, and textbook chapters. In addition, sample quiz questions are available in vUWS before the quiz. At the end of each set of lecture notes, there are a few revision questions that can be helpful for the quiz.

Absence of these quizzes will not be tolerant; supplementary/late quizzes will not be held. At least one quiz must be attempted in order to pass this subject.

**Marking Criteria:**

Based on understanding of the theoretical/practical concepts and programming skills of computer organisation.

### 3.2.3 Final exam

| | |
|---|---|
| **Weight:** | 50% |
| **Type of Collaboration:** | Individual |
| **Due:** | To be scheduled during the university exam period. |
| **Submission:** | Examination paper (hard copy or electronic version) completed in the session |
| **Format:** | On-paper or Online (subject to the examination policy and pedagogical implementation) |
| **Length:** | 2 hours |
| **Use of Artificial Intelligence:** | In this assessment task, you will not be able to meet the learning outcomes related to the assessment by using generative artificial intelligence (AI) tools. Working with another person or technology in order to gain an unfair advantage in assessment or improperly obtaining answers from a third party including generative AI to questions in an examination or other form of assessment may lead to sanctions under the Student Misconduct Rule. Use of generative AI tools may be detected. More information is available on the Library web page. |

**Instructions:**

The final examination is a mandatory component of this subject, which is a formal two-hour **open-book** exam to be completed in the scheduled exam period.

The final exam will cover all the contents we have discussed during lectures and practiced in tutorials including concepts, principles, coding skills. It comprises of questions in multiple choices, short answers, task analysis and design, code writing and code comprehension in computer organisation mechanics. The exam questions may range over all topics treated in the subject, including those studied in lectures, tutorial/laboratory classes, and self-study modules and exercises.

Resources: Common resources for exam revision are lecture notes, tutorial questions, quiz questions, and textbook chapters. In addition, sample final exam paper(s) are provided in vUWS, which are very useful resources for preparing the final exam.

Special consideration of the Final Exam: If you are sick on the day of the exam, or you have urgent matters/misadventures that will really affect you in the exam, do not attend the exam. If you are sick, go to see doctors and get a medical certificate and then apply for a deferred exam through Student Central. All deferred exams are run centrally. Special consideration will not be given for students who sit the exam and then go to the doctor afterwards (unless there is an emergency during the final exam). This rule applies to other urgent matters/misadventures.

**Marking Criteria:**

Multiple choice and insert blank questions - correct/incorrect.

Other questions will vary depending on questions' requirement, for instance, you should provide scholarly answers (i.e. supply evidence) and argue a case where appropriate. For code writing tasks, the program should be well structured and fulfil the task; any program language errors, run time errors, and logical errors will detract from the full marks.

1. Marking of the final exam will be done concisely that even the most minute (e.g. 0.2) marks are given a careful consideration before being awarded or deducted.

2. Marks are not given at will, but are based on the quality of students' answers. The consistency will be fairly maintained for the marking.

# 4 Readings and Resources

## 4.1 Essential Readings

### Prescribed Textbook

Patterson, D., & Hennessy, J. (2020). *Computer Organization and Design MIPS Edition* (6th ed.). Morgan Kaufmann.

## 4.2 Recommended Readings

### Additional Reading

Gothmann, W. H. (1982). Digital electronics: An introduction to theory and practice (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Govindarajalu, B. (2004). Computer architecture and organization: Design principles and applications. New Delhi, India: Tata McGraw-Hill.

Hamacher, V. C., Vranesic, Z. G., Zaky, S. G., & Manjikian, N. (2012). Computer organization and embedded systems (6th ed.). New York, NY: McGraw-Hill..

Hayes, J. P. (1998). Computer architecture and organization (3rd ed.). Boston, MA: WCB.

Hsu, J. Y. (2001). Computer architecture: Software aspects, coding, and hardware. Boca Raton, FL: CRC.

Mano, M. M. (1993). Computer system architecture (3rd ed.). Englewood Cliffs, NJ: Prentice Hall.

Patterson, D. A., & Hennessy, J. L. (2016). Computer organization and design: The hardware/software interface (1st ARM® ed.). Amsterdam: Morgan Kaufmann.

Patterson, D. A., & Hennessy, J. L. (2017). Computer organization and design: The hardware/software interface (1st RISC-V ed.). Amsterdam: Morgan Kaufmann.

Shiva, S. G. (1996). Pipelined and parallel computer architectures. New York, NY: HarperCollins.

Stallings, W. (2016). Computer organization and architecture: Designing for performance (10th ed.). Hoboken, NJ: Pearson.

Stone, H. S. (1993). High-performance computer architecture (3rd ed.). Reading, MA: Addison-Wesley.

Sweetman, D. (2010). See MIPS run (2nd ed.). Burlington, MA: Morgan Kaufmann.

Zargham, M. R. (1995). Computer architecture: Single and parallel systems. Englewood Cliffs, NJ: Prentice Hall.

## 4.3 Other Teaching and Learning Resources

# 5 Key Teaching and Learning Policies

The University has several policies that relate to teaching and learning. Links to important policies affecting students are below. It is your responsibility to ensure you familiarise yourself with these policies so that you are aware of your rights and responsibilities.

- Assessment Policy
- Assessment Policy - Review of Grade Procedures
- Bullying Prevention Policy
- Disruption to Studies Policy
- Enrolment Policy
- Examinations Policy
- Learning and Teaching Policy
- Progression Policy
- Student Code of Conduct
- Student Misconduct Rule