UNIVERSITI TUNKU ABDUL RAHMAN

JANUARY 2020 TRIMESTER

MAIN FINAL ASSESMENT

UCCD1133 INTRODUCTION TO COMPUTER ORGANISATION AND ARCHITECTURE

2:00PM, 18 MAY 2020 DURATION: (3 HOURS)

BACHELOR OF INFORMATION TECHNOLOGY (HONS)
COMMUNICATIONS AND NETWORKING
BACHELOR OF COMPUTER SCIENCE (HONS)
BACHELOR OF INFORMATION SYSTEMS (HONS)
INFORMATION SYSTEMS ENGINEERING

Instructions to Students:

General

1. This Final Assessment (FA) is an Individual, Open-Book assessment which consists of FOUR (4) questions. Each question carries 25 marks.

2. You are required to answer **ALL** questions, and submit the **ANSWER SCRIPT** by 5**:00pm, 18 MAY 2020**.

3. During the period of 3 hours of this FA, the examiner(s) can be reached at

   (a). Microsoft Teams with Code/Password: **k6qyzca,** or

   (b). Email: **ooijo@utar.edu.my**

   You may use the above e-platform(s) to check with the examiner(s) if you need any clarification on this FA question paper

4. You may refer to any books, lecture notes, published materials, online resources, etc when answering the questions. However, COPY-AND-PASTE, DISCUSSION, and SHARING OF ANSWERS are STRICTLY PROHIBITED during the FA.

Answer Script File

5. The answer script **MUST** be either a Microsoft Word or PDF file, in A4 size format. **Note: Please keep the file size NOT exceeding 10MB.**

6. Please check you index number generated by the Division of Examinations, Awards, and Scholarships (DEAS). You **MUST** name your answer script using the following file name for submission:

   UCCD1133_FA_[Programme Abbreviation]_[Your Index Number]

   For example, if you are from the degree programme CN, and your Index Number is A01234CBCNF, then your answer script should be named as

   For Word document: **UCCD1133_ FA_CN_A01234CBCNF.doc**
   For PDF document: **UCCD1133_ FA_CN_A01234CBCNF.pdf**

Answer Script Submission

7. Your answer script file has to be submitted to **BOTH** of the following platforms before the due time/date.

   (a). Submit your answer script at Final Assessment link in WBLE.

   (b). Send your answer script to the following Email Account according to your programme:

   i. CN students please send your answer script to:
   UCCD1133FACN@gmail.com

   ii. CS students please send your answer script to:
   UCCD1133FACS@gmail.com

   iii. IA students please send your answer script to:
   UCCD1133FAIA@gmail.com

   Note: For the title of your email, please use the file name of your answer script. That is,

   UCCD1133_FA_[Programme Abbreviation]_[Your Index Number]

8. Please make sure that you submit the same copy of answer scripts to the above platforms. If different answer scripts are received, the examiner will just randomly choose one of them to mark and the other will be totally ignored.

9. The answer script submitted after the due time/date may incur a late penalty as shown below:

   i. 0 hour < lateness ≤ 0.5 hour: 10% mark deduction

   ii. 0.5 hour < lateness ≤ 1 hour: 20% mark deduction

   iii. Lateness > 1 hours : 100% mark deduction

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Contents of Answer Script

10. The first page of your answer script is the cover page. You **MUST** use the template given in **Appendix 1** and fill up the following information
    - You Degree Programme (Abbreviation)
    - Your Index Number
    - Your Name
    - Your Student ID

11. The second page of your answer script is the Declaration Form. You **MUST** use the template given in **Appendix 2**, and sign on this form to indicate your authenticity of submitted work without plagiarism.

12. Each question should be answered starting on a new page. It is recommended that the answer to each question is limited to **2 pages**.

13. In your answer script, all texts **MUST** be typed using Times New Roman characters with font size no less than 12, except for the drawings and equations/calculations.

14. For the drawings and equations/calculations, you **MUST** draw/write them on a blank paper, and then take pictures and include the pictures in the Word document as part of your answers.

15. Please include a page number on each and every page of your answer script.

WARNING OF PLAGIARISM

16. **All answer scripts will be uploaded by the examiners to Turnitin for similarity check. In the case of plagiarism being suspected, the evidences will be submitted to the University Examination Disciplinary Committee for further investigation and trial. If found guilty, serious disciplinary action will be taken against the students.**

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Q1. (a) Answer the following questions. Show all your workings.

(i) Convert the last two decimal digits of your student registration ID into equivalent Binary Coded Decimal code. (4 marks)

(ii) Solve the arithmetic operation $1000\ 1011_{Gray} - 227_{10}$ in binary using 2's complement method. Give your final answer in binary. (8 marks)

(b) Figure 1.1 shows a combinational circuit with three inputs. Answer the following question by referring to this figure.

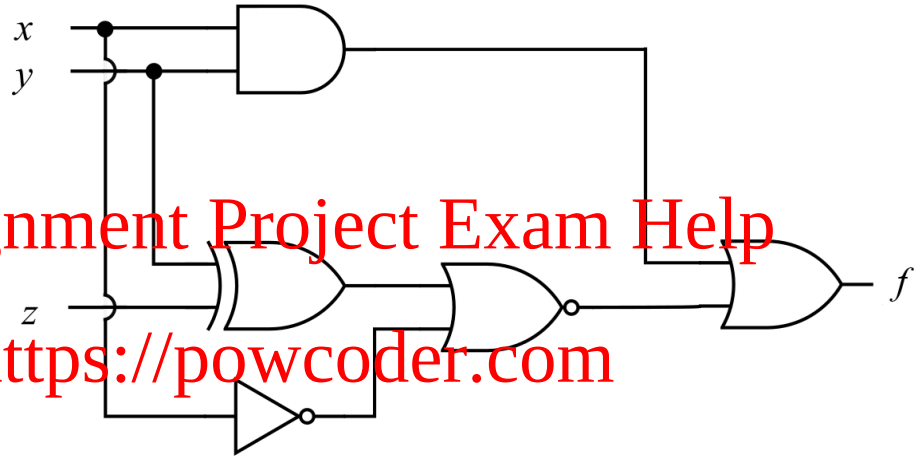

Figure 1.1

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(i) Derive the Boolean expression and determine its minterm list. (6 marks)

(ii) Construct the corresponding truth table for the Boolean expression in Q1(b)(i). (4 marks)

(iii) Given the input waveforms in Figure 1.2, sketch the complete timing diagram with output waveform *f* in your answer script. (3 marks)

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Q1. (Continued)

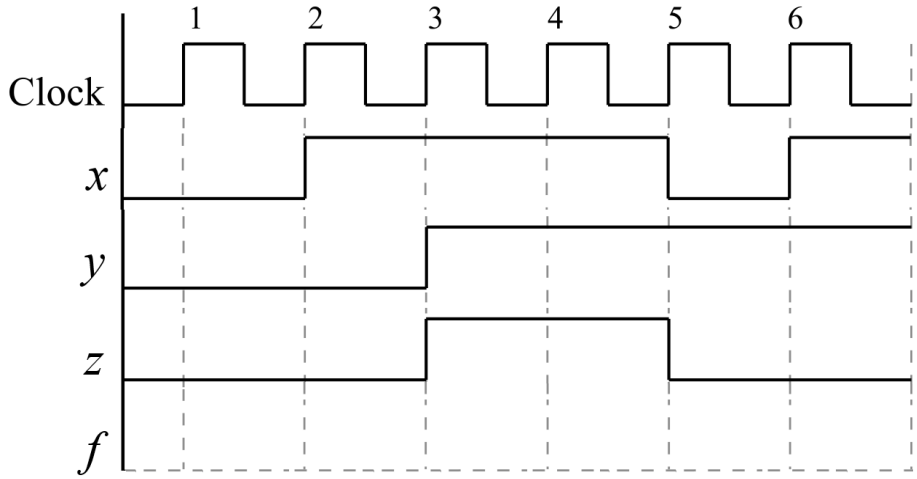

Figure 1.2

[Total: 25 marks]

Q2. (a) The following machine codes are extracted from MIPS based processor's assembly language program. Answer the following questions by referring to this code.

```
0x01048020
0x16000003
```

(i) Translate the machine codes above to MIPS assembly code. Show all your workings. (12 marks)

(ii) The above two instruction can be implemented by a single pseudoinstruction. Identify and briefly elaborate the operation of this pseudoinstruction. (5 marks)

(iii) Define *pseudoinstruction* in MIPS assembly language. (2 marks)

(b) The address field of *jump* instruction in MIPS processor is 26 bits. Answer the below questions based on this fact.

(i) Provide TWO (2) advantages of having a larger address field for this *jump* instruction. (4 marks)

(ii) Give a drawback of having a fix 26-bits address field for J-type instruction. (2 marks)

[Total: 25 marks]

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Q3. (a) In a MIPS based processor's memory hierarchy system, memory allocation is divided into stack, data and text segment. Answer the following.

(i) Describe the TWO (2) types of data segments and indicate the object that is held in each of these segments. (8 marks)

(ii) Explain the objectives of using the stack segment. (3 marks)

(b) In the processor's internal data communication medium, bus width is a critical parameter in determining the whole system performance.

(i) Elaborate the significance of data bus and address bus width. (4 marks)

(ii) Suggest a method on how to improve bus performance. (2 marks)

(c) Describe TWO (2) of the data transfer modes between I/O peripherals and main memory. (8 marks)

[Total: 25 marks]

Q4. (a) Figure 4.1 shows a fragment of a MIPS assembly code. Answer the following questions by referring to this figure.

(i) Compare and contrast the MIPS basic instruction format types applicable for Instruction X, Y and Z as shown in Figure 4.1, by providing THREE (3) similarities and THREE (3) differences. (12 marks)

(ii) Discuss TWO (2) benefits of the similarities and differences as mentioned in Q4(a)(i), such that it can be helpful for program processing improvement in processor datapath. (5 marks)

(b) Compare and provide TWO (2) similarities and TWO (2) differences for addressing modes applied on Instruction X and instruction Y as shown in Figure 4.1. (8 marks)

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Q4. (Continued)

```
Address              Assembly code
   ...                  ...
0x004000A4 getInt: li   $v0, 5
0x004000A8          syscall
0x004000AC          move $t5, $v0
0x004000B0          lw   $t0, maxint     # Instr. X
0x004000B4          lw   $t1, minint
0x004000B8          slt  $t2, $t0, $t5   # Instr. Y
0x004000BC          bne  $t2, $0,  error1
0x004000C0          slt  $t2, $t5, $t1
0x004000C4          bne  $t2, $0,  error1
0x004000C8          jal  ResultOutput    # Instr. Z
0x004000CC error1:
0x004000D0          li   $v0, 4
0x004000D4          la   $a0, errorMessage
0x004000D8          syscall
0x004000DC          j    getInt
   ...                  ...
```


Figure 4.1.

[Total: 25 marks]

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Appendix 1: Final Assessment Cover Page

(Remark: This must be placed as the **FIRST PAGE** of your Answer Script**)**

Answer Script

Main Final Assessment - Jan 2020 Trimester

UCCD1133 Introduction to Computer Organisation and Architecture

Degree Programme	**CN / CS / IA**
Exam Index Number:	
Student Name:	
Student ID:	

Marks Awarded

Q1.	
Q2.	
Q3.	
Q4.	
Total:	

Remark: Late Submission? _____

If Yes, Lateness: _____

Marks after Deduction: _____

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Appendix 2: Final Assessment Declaration Statement

(Remark: This must be placed as the **SECOND PAGE** of your Answer Script**)**

Final Assessment Declaration Statement

Wholly owned by UTAR Education Foundation
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DECLARATION

I, _____(Name), Student ID. _____ hereby solemnly and fully declare and confirm that during my programme of study at Universiti Tunku Abdul Rahman, I shall abide and comply with all the rules, regulations and lawful instructions of Universiti Tunku Abdul Rahman and endeavour at all times to uphold the good name of the University.

I hereby declare that my submission for this Final Assessment is based on my original work, not plagiarised from any source(s) except for citations and quotations which have been duly acknowledged. I am fully aware that students who are suspected of violating this pledge are liable to be referred to the Student Disciplinary Committee of the University.

Programme: _____

(Digital) Signature: _____

Student's I.C. / Passport No:: _____

Exam Index No: _____

Date of Submission: _____