Queen Mary
University of London

ECS404U: COMPUTER SYSTEMS & NETWORKS

2020/21 – Semester 1

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Lab Week 7: Practice Sample for Midterm test (from 2018!)

November 02/04, 2020

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Deadline for submitting your proof of work: **Next week's Thursday, at 10:00 AM UK time**

Student Name:

Student ID:

Note: submission of this lab exercise is **optional**. This is a chance for students who do NOT have all of their labs so far as a pass to compensate one of them. So if you have a pass for all weeks 1 – 6 labs, you do NOT need to submit this lab. If you have any "fails" in (or you did not submit) any of your labs 1 – 6, then you can submit this lab, and if you pass, then that will compensate one of them. If you have a full record and you still choose to submit this lab, it will still be assessed and you get a feedback, but it will not add to your passed labs (you will still be having 6 passes out of 10 assessed labs, and you need to do labs of weeks 8, 9, 10 and 11 for a clean sheet).

So the overall formula for computing the 15% contribution of lab assignments is the following:

$$[\min(I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + I_7, 6) + I_8 + I_9 + I_{10} + I_{11}] \times 1.5\%$$

where I_i is a "pass indicator" for week i's lab assignment (1: pass, 0: fail or no sub.).

Queen Mary
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First Name(s) . . . .

Last Name(s) . . . .

Student No:. . . . .

Oct 2018

ECS404U   **Computer Systems and Networks**   Duration: $1\frac{1}{2}$ hours

YOU ARE NOT PERMITTED TO READ THE CONTENTS OF THIS QUESTION PAPER UNTIL INSTRUCTED TO DO SO BY AN INVIGILATOR.

Instructions: This paper contains TWO questions. **Answer BOTH questions**.
Cross out any answers that you do not wish to be marked.

Calculators are permitted in this examination. Please state on your answer book the name and type of machine used.

Cross through any work that is not to be assessed.

Possession of unauthorised material at any time when under examination conditions is an assessment offence and can lead to expulsion from QMUL. Check now to ensure you do not have any notes, mobile phones, smartwatches or unauthorised electronic devices on your person. If you do, raise your hand and give them to an invigilator immediately.

It is also an offence to have any writing of any kind on your person, including on your body. If you are found to have hidden unauthorised material elsewhere, including toilets and cloakrooms it will be treated as being found in your possession. Unauthorised material found on your mobile phone or other electronic device will be considered the same as being in possession of paper notes. A mobile phone that causes a disruption in the exam is also an assessment offence.

Exam papers must not be removed from the exam room.

Question	Points	Score
1	25	
2	25	
Total:	50	

Leave this table blank.

1. This question is about forms of digital representation.

   (a) (10 points) This part of the question is about binary representation of numbers.

      i. What decimal numbers are represented by the 8-bit sequences 11010011 and 00010101 when viewed as **unsigned integers**? (Explain your reasoning.)

11010011	Decimal equivalent:
Explanation	
00010101	Decimal equivalent:
Explanation	

      ii. Show that you understand how to perform long multiplication in binary by using it to multiply 11010011 and 10101. Give your working, including carries.

*

_____

_____
                                  carries
_____
                                  solution

      iii. What does your answer represent when viewed as an unsigned integer? Explain your reasoning.

Number represented	
Explanation	

(10 points)

   (b) (5 points)   i. What numbers are represented by the 8-bit sequences 11010011 and 00010101 when viewed as **signed integers** in 8-bit two's complement? (Explain your reasoning.)

11010011	Decimal equivalent (signed):
Explanation	
00010101	Decimal equivalent (signed):
Explanation	

    ii. Give one key reason why computer designers have opted to use two's complement representation for signed integers rather than, say, sign and magnitude.

(5 points)

(c) (5 points) This part of the question is about hexadecimal, binary and text representation.
A local LAN has the BSSID of `00:1b:63:2d:75:6a`. This represents a bit pattern.

    i. What system of representation is being used? (For example decimal, UTF-8).

    ii. How many characters represent a byte?

    iii. How many bytes are represented?

    iv. How many bits are represented?

    v. What is the bit sequence represented by the subsequence `2d:75:6a`.

Give a brief one or two line explanation for each answer.   (5 points)

i.	Answer:
Explanation	

ii.	Answer:
Explanation	

iii.	Answer:
Explanation	

iv.	Answer:
Explanation	

v.	Answer:
Explanation	

(d) (5 points) This part of the question is about character representation. Recall that the ASCII code for the character '0' (zero) is 48_{10}, for the character 'A' it is 65_{10}, and for the character 'a' it is 97_{10} (these are expressed in decimal). For the purposes of this question we take ASCII to be an eight-bit representation.

    i. Give the bit sequences that represent 'e' and 'F'

    ii. Give the **hex** sequence for the bit pattern representing 's'

    iii. Give the **hex** sequence for the bit pattern representing "abacus"

Give a short explanation or clear working in support of each answer.

Recall that the standard English/American alphabet is:

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
1				5					10					15

p	q	r	s	t	u	v	w	x	y	z
16				20						26

(5 points)

i.	Answer ('e'):
Explanation	

i.	Answer ('F'):
Explanation	

ii.	Answer ('s'):
Explanation	

iii.	Answer ("abacus"):
Explanation	

2. This question is about Computer Architecture

   (a) (5 points) This part is about identifying computational devices. Some of the following devices make critical use of microprocessors, and some don't. For each device say whether it makes such use and justify your answer.

      i. mobile phone
      ii. hairdryer
      iii. internet router
      iv. car

(5 points)

i.	Answer:
Explanation	

ii.	Answer:
Explanation	

iii.	Answer:
Explanation	

iv.	Answer:
Explanation	

   (b) (5 points) This part is about memory hierarchies.

      i. List three levels in a basic memory hierarchy.
      ii. Explain the ordering of the levels in the hierarchy.
   iii. Explain the different functions of the memories in your hierarchy.

(5 points)

i.	Level 1:
	Level 2:
	Level 3:
ii.	
Explanation	
iii.	Level 1
Explanation	
iii.	Level 2
Explanation	
iii.	Level 3
Explanation	

(c) (5 points) This part is about the structure of computer architecture.

   i. Label the parts in the diagram of the classical von Neumann architecture below.

   ii. Identify corresponding parts (where visible) on the diagram of the server computer below (draw on the diagram). Where the server includes multiple components of the same type, you need only label one.

von Neumann component	position in BL680c picture (x,y)

iii. List **one** key way in which the server architecture **differs** from the von Neumann (no marks will be given to students who hedge their bets by listing different possibilities that are not strongly linked).

(5 points)

(d) (10 points) Recall that standard cmos uses two basic types of transistor: *nmos* and *pmos*.

   i. The symbols below are for the two types of transistor. Label them to show which is which. Also label the *Gate* with *G*, *Source* with *S* and Drain with *D*.
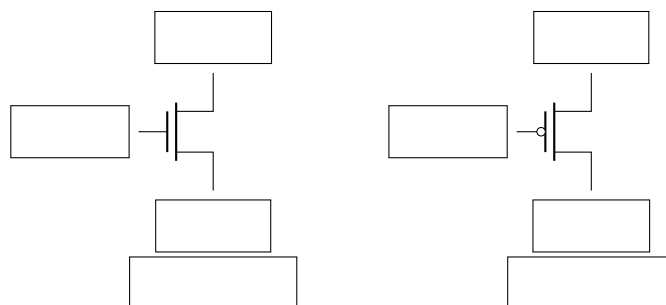
   ii. Describe how these transistors function as switches. What is the role of each part of the transistor? Under what circumstances are the switches open or closed?

   iii. The diagram below depicts a logic gate.
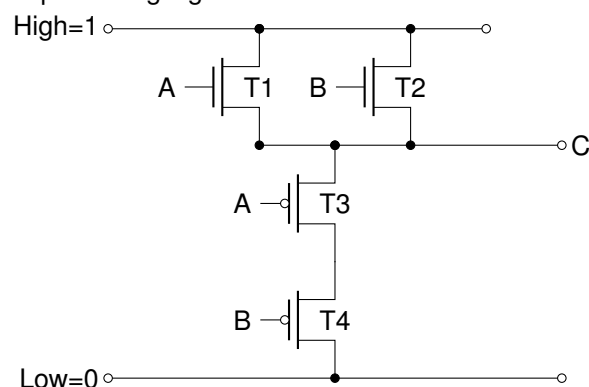
   Complete the table below to explain what output is given by the gate for the various possible inputs. Transistors are viewed as switches and so open or closed. C is either 0 or 1 (or short or undefined if there is an error in the gate design).

A	B	T1	T2	T3	T4	C
1	1					
1	0					
0	1					
0	0					

Explain the sense in which the gate computes a connective.

Identify the connective being computed.

(10 points)

End of questions