FNU FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRONICS ENGINEERING-STAGE 4

EEE417- DIGITAL ELECTRONICS 1B

FINAL EXAMINATION – PENSTER 4, 2013

TIME ALLOWED: 2 HOURS + 10 MINUTES READING.

INSTRUCTIONS TO STUDENTS

1. You are allowed 10 minutes Extra reading time during which you are NOT to write.

2. Begin each answer on a fresh page and use both sides of the sheet.

3. Write your candidate-number at the top of each attached sheet

4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string

5. For all sheets of paper on which rough/draft work has been done, cross each one through and ATTACH these to your answer scripts.

6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.

7. ATTEMPT ALL QUESTIONS.

8. Show all workings where necessary.

9. Do not use programmable calculators, especially the ones that does the conversions of number systems.

*10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!***

Section A **Multiple Choice** **[10 Marks]**

Choose the best answer and write the correct alphabet beside the question number in your answer booklet.

1) An input of +1.5V to a TTL IC (+5V supply) would be considered a _____ logic level.
   A) high
   B) low
   C) undefined
   D) none of the above

2) The general name for an electronic device that translates from decimal to binary is a (n) _____.
   A) encoder
   B) decoder
   C) comparator
   D) multiplexer

3) The design of circuitry that translates voltages and currents between devices (such as TTL and CMOS) is called _____.
   A) interlacing
   B) sinking
   C) boundary scanning
   D) Interfacing

4) A ROM is:
   A) Volatile memory
   B) Non-volatile memory
   C) Read/write memory
   D) Electrically erasable memory

5) The functional capacity for ULSI devices is _____.
   A) 12 to 99 gates.
   B) Over 100,000 gates.
   C) 100 to 10,000 gates.
   D) more than 10,000 gates.

6) The nematic fluid sandwiched between the glass plates of a LCD is also called _____ _____.
   A) green phosphor
   B) metalized segments
   C) liquid crystal
   D) plasma

7) Two types of RAM semiconductor memories are the DRAM and _____.
   A) SRAM
   B) TRAM
   C) BRAM
   D) None of the above

8) A binary-weighted resistor used in a digital-to-analog converter (DAC) is only practical up to a resolution of _____.
   A) 10 bits
   B) 2 bits
   C) 8 bits
   D) 4 bits

9) Which of the following is not a TTL circuit?
   A) 74AL00
   B) 74HC00
   C) 74F00
   D) 74AS00

10) A(n) _____ converts an analog input to a digital output.
   A) DAC
   B) ADC
   C) bipolar converter
   D) flash converter

SECTION B **TOPIC 1** **[20 Marks]**

1. Which type of transistor do you find in a:
   a. TTL IC and
   b. CMOS IC?

   (2 marks)

2. What are the three performance characteristics to identify any TTL IC. (3 marks)

3. Refer to the table below and make your analysis on the three types of gates in terms of their speed, power consumption, noise margin, fan-in and fan-out. While comparing, state which one is best to use.

   (5 marks)

Type of Gate	Fan-in	Fan-out	Propagation delay (ns)	Noise margin (V)	Power consumption (mW)
TTL	8	10	9	0.4	40
CMOS	8	50	30	1.5	1
ECL	5	50	1.1	0.4	30

4. Using the attached datasheet, determine:
   a) What DM74LS02 mean? (2 marks)
   b) Nominal V_{CC}. (1 mark)
   c) Power dissipation, P_D (3 marks)
   d) High-level noise margin, V_{NH} (2 marks)
   e) Low-level noise margin, V_{NL} (2 marks)

DM74LS02

Absolute Maximum Ratings(Note 1)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V_{CC}	Supply Voltage	4.75	5	5.25	V
V_{IH}	HIGH Level Input Voltage	2			V
V_{IL}	LOW Level Input Voltage			0.8	V
I_{OH}	HIGH Level Output Current			−0.4	mA
I_{OL}	LOW Level Output Current			8	mA
T_A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA			−1.5	V
V_{OH}	HIGH Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max	2.7	3.4		V
V_{OL}	LOW Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IH} = Min		0.35	0.5	V
		I_{OL} = 4 mA, V_{CC} = Min		0.25	0.4	
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 7V			0.1	mA
I_{IH}	HIGH Level Input Current	V_{CC} = Max, V_I = 2.7V			20	μA
I_{IL}	LOW Level Input Current	V_{CC} = Max, V_I = 0.4V			−0.40	mA
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 3)	−20		−100	mA
I_{CCH}	Supply Current with Outputs HIGH	V_{CC} = Max		1.6	3.2	mA
I_{CCL}	Supply Current with Outputs LOW	V_{CC} = Max		2.8	5.4	mA

Note 2: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

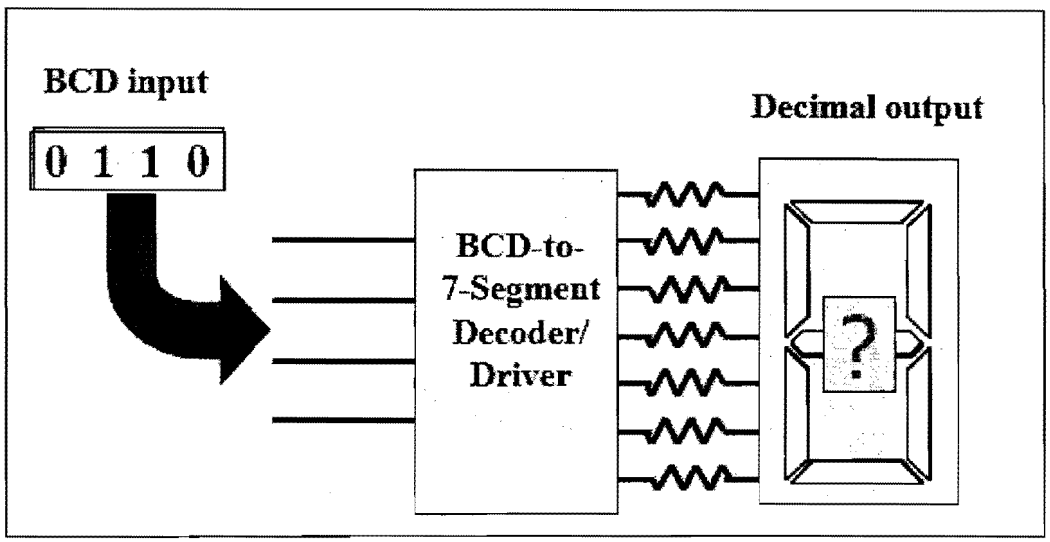
Switching Characteristics

at V_{CC} = 5V and T_A = 25°C

Symbol	Parameter	R_L = 2 kΩ				Units
		C_L = 15 pF		C_L = 50 pF		
		Min	Max	Min	Max	
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output		13		18	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output		10		15	ns

SECTION C **TOPIC 2** **[20 marks]**

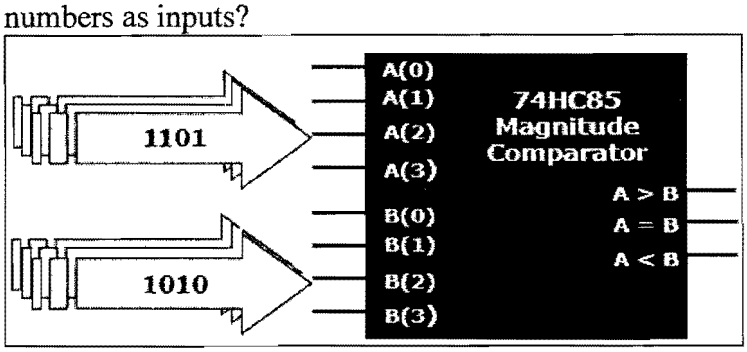
1. Refer to the diagram below and answer the following questions.
   i) What is the decimal output from the decoder that appears on the 7-segment display? (1 mark)
   ii) If the BCD input is 0010, what segments will be illuminated? (1 mark)
   iii) What special name is given to the resistors that are added between the decoder and the display? (1mark)



2. A programmable logic device (PLD) is an IC that can be programmed by the user to execute a complex logic function. There are various types of PLD's available. What do the following acronyms stand for: (3 marks)
   i) PAL
   ii) GAL
   iii) FPL

3. What is the function of a multiplexer (MUX) and also draw the logic symbol for 1-of-4 multiplexer. (4 marks)

4. Which output of the comparator IC will be activated with these two 4-bit binary numbers as inputs? (2 marks)



5. What is the purpose of the following:
   i) Decoder (1 mark)
   ii) Encoder (1 mark)
   iii) Demultiplexer (1 mark)

6. Determine the Boolean equation for the given programmable logic array. (5 marks)