SINGAPORE POLYTECHNIC ET0104

2010/2011 SEMESTER ONE MID-SEMESTER TEST
Diploma in Electrical and Electronic Engineering
3rd Year Full-Time

EMBEDDED COMPUTER SYSTEMS Time Allowed: 1½ Hours

Instructions to Candidates

1. The Singapore Polytechnic examination rules are to be complied with.

2. This paper consists of **THREE** sections :

Section A-10 Multiple Choice (3 mks each)	30 mks
Section B-4 Short Questions (12,13 mks each)	50 mks
and 1 Long Question (20 mks)	20 mks
Total	100 mks

3. **ALL** questions are **COMPULSORY**.

4. All questions are to be answered in the answer booklet. Start each question on a new page.

5 This paper consists of **6** pages.

SECTION A

MULTIPLE CHOICE QUESTIONS [3 marks each]

1. Please write your answers in the answer booklet.

2. No marks will be deducted for incorrect answers.

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1. An embedded system is used to measure the timing for a running event at the Youth Olympics. What is the most important characteristict of an embedded system to consider here?

   (a) Guaranteed response time.
   (b) Low power.
   (c) Reliability.
   (d) Low cost.

2. The preferred choice for interfacing *output* devices on the PC/104 are

   (a) latches, because they use a clock to accurately capture the data.
   (b) latches, because real world devices are not fast enough to respond to the processor.
   (c) buffers, because real world devices are fast enough to respond to the processor.
   (d) buffer, because they do not need a clock signal.

3. Not all the addresses for *memory* on the PC/104 are available. This is due to

   (a) foldover effects.
   (b) addresses clashing with those used for I/O.
   (c) some addresses already used for basic system operation.
   (d) these addresses being more than 20 bits in length.

4. What is true about flash devices as compared to flash *chips*?

   (a) They are more suited for storing data that is to be transferred later.
   (b) They interface using computer busses and so cannot be easily removed.
   (c) Given the same electrical capacity, they will always cost more than flash chips.
   (d) They are always capable of storing more data than flash chips.

5. What is a difference between accessing I/O and memory devices on an PC/104 bus.

   (a) I/O devices will be accessed faster.
   (b) Memory devices require more decoding hardware to work.
   (c) I/O devices would most probably need a extra OR gate for proper access.
   (d) Memory devices have a higher propagation delay.

6. In a keypad that is used for calculations, the three keys: **+ 1 2** were detected as being pressed simultaneously. After processing by a program, which of the following numbers will be *not* be produced as a result?

   (a) 3.
   (b) 12 .
   (c) 21.
   (d) 4.

7. To display a character not available in a Liquid Crystal Display (LCD), what must be done?

   (a) Create the font in DDRAM, then access it.
   (b) Create the bit pattern in CGROM before accessing it.
   (c) Load the bit pattern in CGRAM first.
   (d) Check the user manual for special features.

8. Data is being output to a two line LCD module. You write to the *last* character location on the *first* line. You then write the next character. What happens to this character. Assume correct initialisation.

   (a) It will appear on the first line, first position.
   (b) It will not appear at all.
   (c) It will appear on the second line, first position.
   (d) It will overwrite the last character on the first line.

9. What is *not* an issue when incorporating a microprocessor into a product?

   (a) The operating software has to be thoroughly tested.
   (b) Conversion to and from a digital format may need to be performed.
   (c) Hardware and software testing is difficult because of interaction between them.
   (d) The cost of software and related tools need to be included.

10. Which of the following is not a product constraint?

    (a) Must run from batteries.
    (b) Needs to be waterproof.
    (c) Should cost less than $10 a piece.
    (d) The system analysis must be correct.

Section B

The following questions are related to the use of systems in large sporting events such as the YOG.

B1. Embedded systems are used in sporting events to provide precise timing functions. Explain whether you would use software or hardware timing in these systems. (4 mks)

Would using an interrupt or polling be more suitable to detect when the winner of a sprint (fast running) event crosses the finishing line? (4 mks)

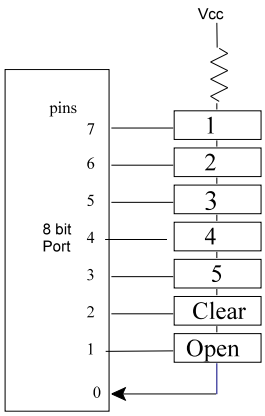
What is the advantage of using a processor using the Intel architecture? (4 mks)

B2. In high speed events, competitors may reach the finishing point in a way that it is difficult to see who arrived first. To help this situation, a camera takes several photographs at high speeds and stored for later analysis. Parameters like number of shots to take, speed of capture are set by a technician beforehand.

For this camera, describe what the memory types below are used for and the reason for its use, in a table format.

a) ROM. (3 mks)
b) RAM. (3 mks)
c) Serial EEPROM. (3 mks)
c) Flash memory. (3 mks)

B3. Athletes staying at the Games Village are given a 5 digit number to access their rooms. There is a Clear button for accidental presses and an Open button when the correct number is keyed in.



Write down the scan codes for the keys, assuming an 8 bit *port* is used as an interface to the electronics. (9 mks)

Briefly describe another way to interface this keypad, *without* using a port. (4 mks)

B4. The access system in the earlier question uses 64K of nonvolatile memory to keep track of the large number of users. It will occupy the memory addresses starting from D0000H. Use 16K devices in your design.

- Draw the memory map (4 mks)
- Show the truth table. (3 mks)
- Draw the schematic (4 mks)
- Select a suitable type of memory device to use (2 mks)

(Long question: 20mks)

B5. An electronic gate is used to control entry to the stadium where the games are held, athletes will have to slot in a card which will control a door. The door is activated by a motor. A green light will indicate that the card is recognized and the person can enter the premises.

Only one person at a time should be allowed entry into the stadium, so the door closes after a while.

I) What are the goals and constraints for the system design? (4 mks)

ii) Identify the sub-systems required by the entry system. (4 mks)

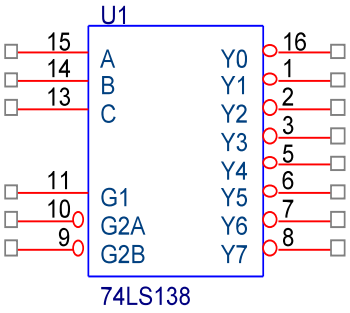
iii) Draw a *use case* diagram for the above system. (4 mks)

iv) Draw the sequential interaction diagram for an athlete entering the stadium (6 mks)

v) In your opinion is a buzzer a suitable device to inform the user when the card is recognized. (2 mks)

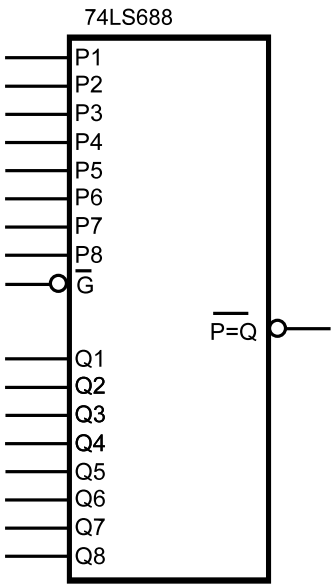
* * * * E n d o f P a p e r * * * *

Truth table



74LS138 schematic

INPUTS						OUTPUTS							
ENABLE			SELECT										
G2B	G2A	G1	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	X	L	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
H	X	X	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	L	L	H	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	L	H	H	H	H	H	L	H	H	H	H
L	L	H	H	L	L	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	H	H	L	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L



74LS688 schematic

Inputs		$\overline{P=Q}$
Data	Enable $\overline{G}$	
P,Q		
P = Q	L	L
P > Q	L	H
P < Q	L	H
X	H	H