SINGAPORE POLYTECHNIC ET0104

2011/2012 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 B

B1. a) Describe the four ways computers can improve in performance. (5 mks)

b) *Explain* which one of these improvements will make software timing loops difficult to implement. (5 mks)

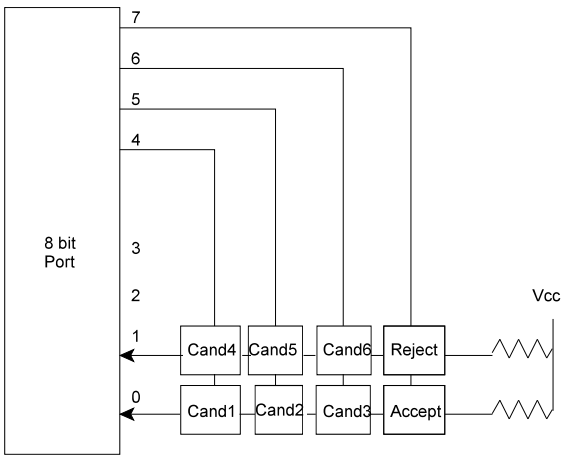
c) Question B1b mentions one disadvantage of software timing loops. What is another disadvantage of these timing methods? (2 mks)

B2. A new method of helping voters in an election is to display pictures of the candidates in various poses. This is similar in principle to the commonly available digital photo frames. Because of the need for various effects like overlaying of the candidate's names and so on, a large amount of high speed memory is needed. Also parameters like display time per image, order of display is needed.

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

a) ROM. (4 mks)
b) RAM. (3 mks)
c) Serial EEPROM. (3 mks)
d) Flash memory. (3 mks)

B3.



A keypad that can be used for an election has the layout as shown the figure. The legend 'Candx' indicates that Candidate x was selected and the other keys are self explanatory.

a) Create a table of scancodes for the above keypad (7 mks)

b) Explain if there is another kind of hardware that can be used instead of the port? (3 mks)

c) If the circuit is to be used for interrupt operation, describe (no need to draw) how this can be done. (2 mks)

B4. An election recording system in the earlier question uses 16K of nonvolatile memory to keep track of the voter's choices. It will occupy the memory addresses starting from E0000H. Use 4K 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. In Singapore's future elections, it is desired to make the voting system completely automatic, to speed up vote counting and to prevent errors in counting. The voter is able to indicate their choice of candidate using buttons placed next to a set of photographs which are displayed on a panel. Upon making a choice, the display will send a confirmatory message indicating that they have 5 seconds to change their mind. If no other action is taken, the vote is recorded into a easily removable type of memory device.

The voter's identity must not be able to be linked to their vote.

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

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

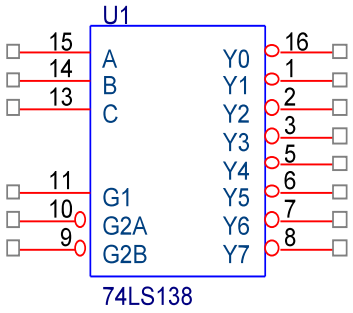
iii) Draw a *use case* diagram for the above system. (4 mks)

iv) Draw the sequential interaction diagram for a voter assuming there is no change in their initial choice. (6 mks)

v) In this current system, how would you store data so as to make it more difficult to trace the identity of the voter? (2 mks)

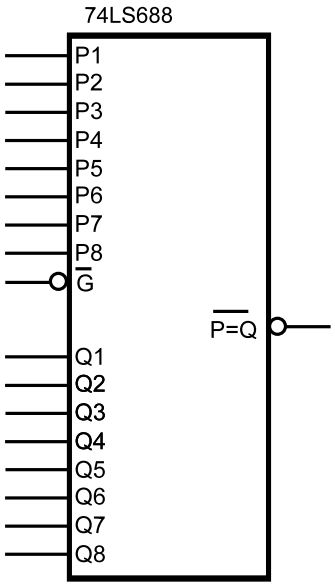
* * * * E n d o f P a p e r * * * *

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