

OLLSCOIL NA hÉIREANN
THE NATIONAL UNIVERSITY OF IRELAND

COLÁISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

SUMMER EXAMINATIONS 2008

BSc Honours

Computer Science

CS4403 Introduction to Embedded Systems

Professor Susan Crow
Professor James Bowen
Dr. Richard Studdert

Answer all questions
(Total 80 Marks)

Time 1 1/2 Hours

Please write your answers on this examination paper and attach to the script provided.

You may use the script for extra and/or rough work.

Write your examination number in the space provided.

Do NOT write your name or student id number on this examination paper.

Write your name, examination number and student id number on the script provided.

EXAMINATION NUMBER

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Q1.

- (a) Explain how the circuit in Figure 1 can be used to buffer a data line between a microprocessor data pin and an external system. 5 Marks

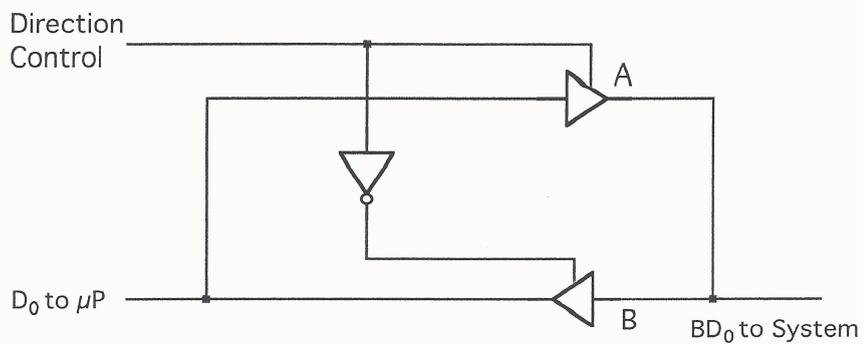


Figure 1

- (b) Figure 2 depicts an output system where no actual data transfer takes place. Explain its operation. 5 Marks

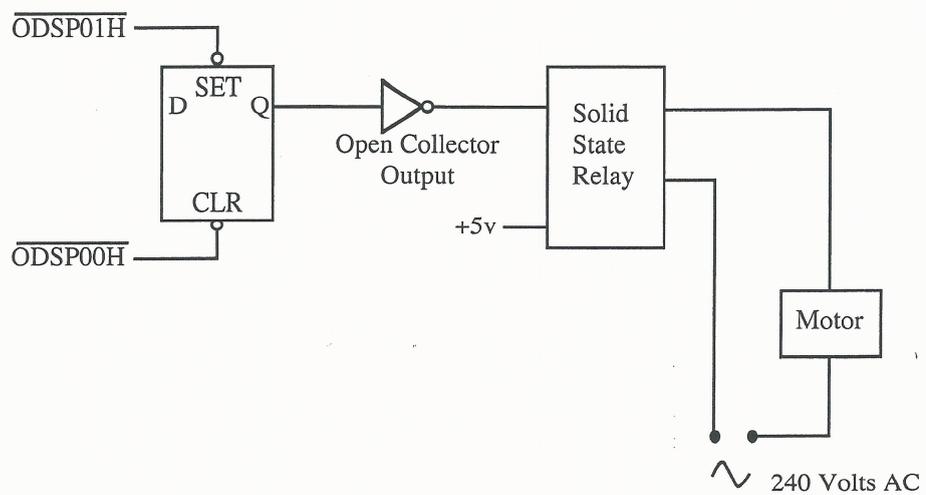


Figure 2

- (c) Briefly explain how the system shown in Figure 3 operates as an output port. Also, describe how a number of output ports could be selected simultaneously and state why that might be desirable. 6 Marks

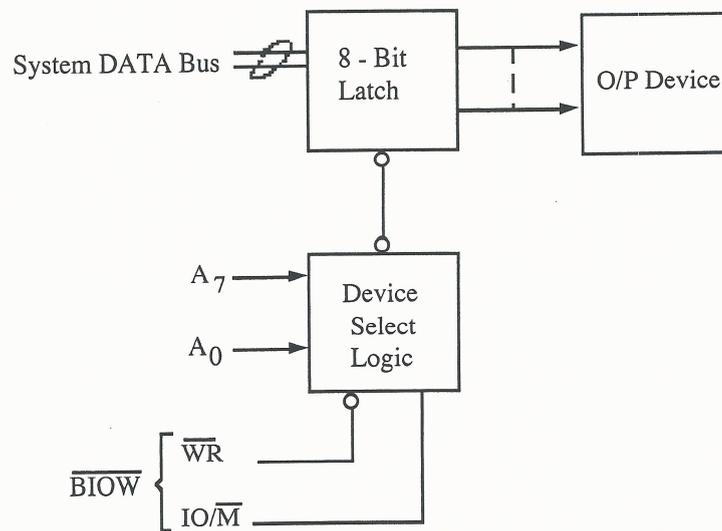


Figure 3

Q2. Figure 4 shows how eight input devices might be connected to a data bus using addresses 00h through 07h. Note that a ninth input address 08h is used. Explain the operation of this input system. 16 Marks

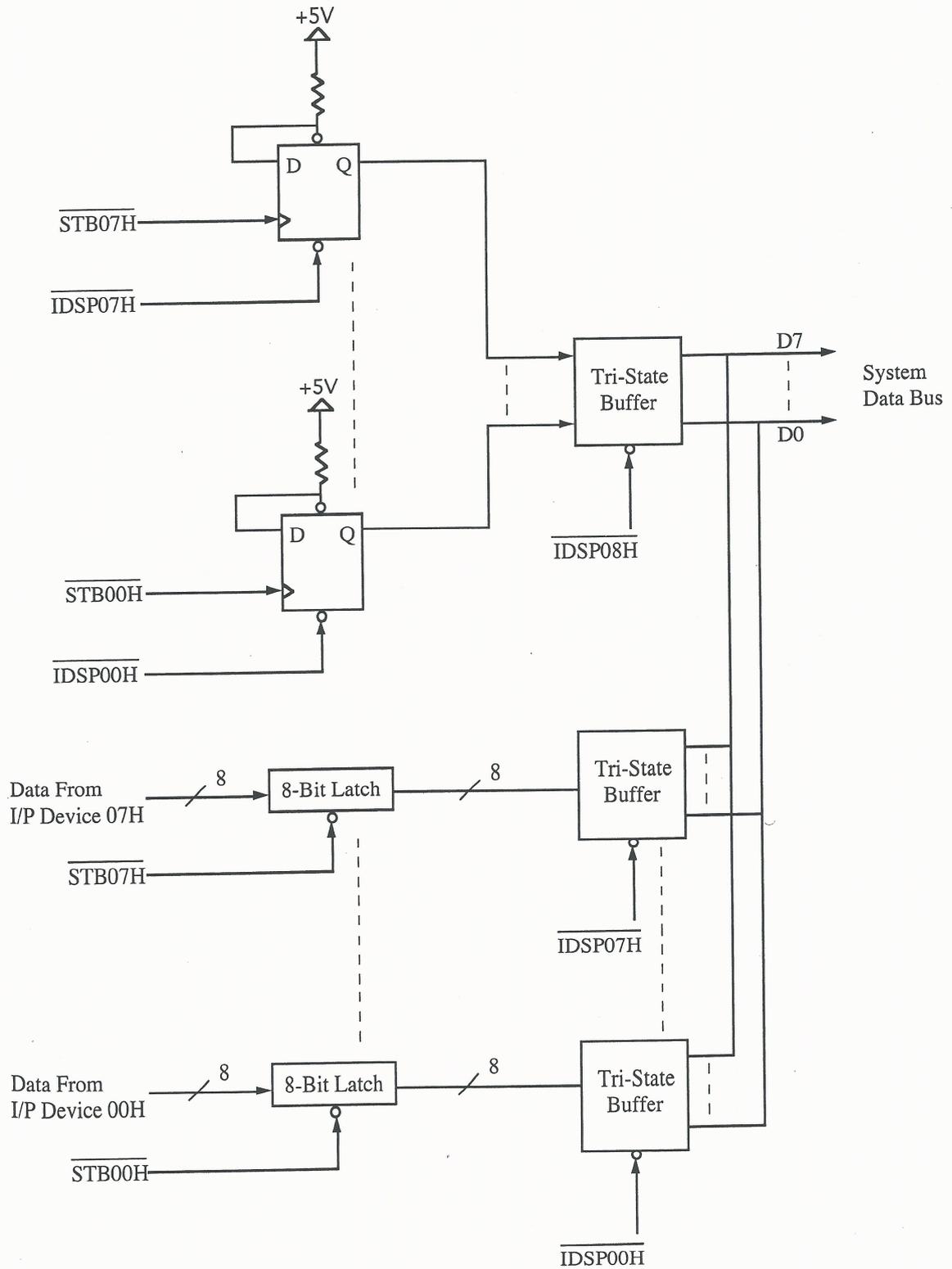


Figure 4

Q3. Figure 5 shows how up to eight devices can be connected to the vectored interrupt input on the 8085 microprocessor using the Restart instruction. Explain how it works. 16 Marks

The RESTART instruction $RST\ n$ $0 \leq n \leq 7$ consists of the following micro-operations:

- | | | |
|--------------|-----------------------|---|
| $((SP) - 1)$ | $\leftarrow (PCH)$ | Load contents of PC onto the stack |
| $((SP) - 2)$ | $\leftarrow (PCL)$ | |
| (SP) | $\leftarrow (SP) - 2$ | Decrement stack pointer |
| (PC) | $\leftarrow 8*n$ | Place the restart address, i.e. $8*n$, in the PC |

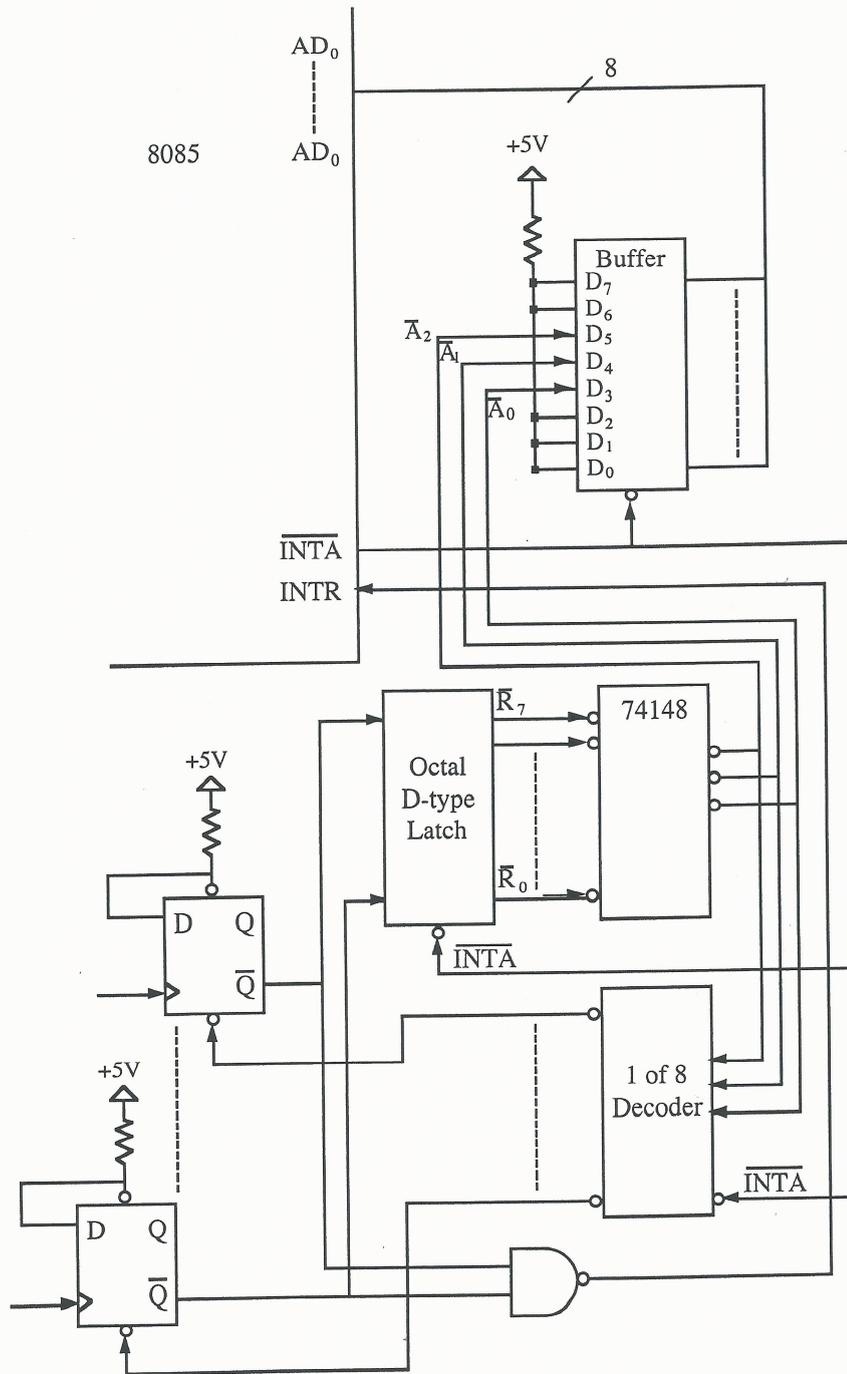


Figure 5

Q4 Programmable Peripheral I/O

16 Marks

Describe, with reference to Figure 6, how Programmable Peripheral ICs (PPIs) are used in the I/O subsystem of a microprocessor based system. In particular, show how the PPIs are addressed and programmed. It is not necessary to use real code in your description, pseudocode will suffice.

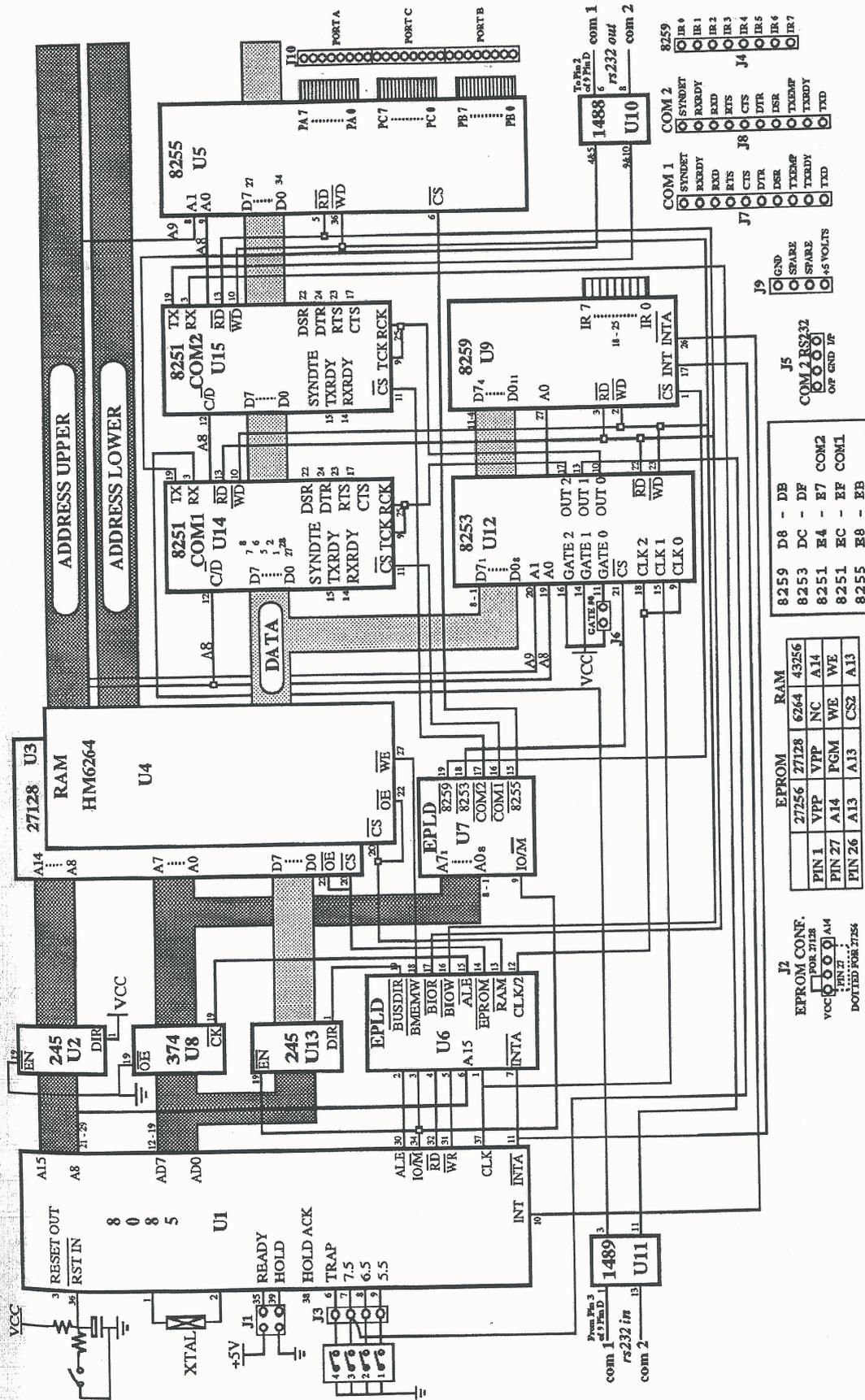


Figure 6

Q5. Serial Transmission

(a) In the context of asynchronous serial transmission:

4 Marks

(i) In what way is it asynchronous and at what level is it synchronous?

1 Mark

(ii) What functions do the start and stop bits perform and what should be their polarities?

1 Mark

(iii) Why should the receiver clock rate be a multiple of the bit rate?

1 Mark

(iv) What is meant by "echo checking" and how and why is it used?

1 Mark

(b) In the context of synchronous serial transmission: *12 Marks*

(i) In what circumstances are character oriented and bit oriented protocols used? *2 Marks*

(ii) What levels of synchronisation are used in character oriented transmission? *1 Mark*

(iii) What levels of synchronisation are used in bit oriented transmission? *1 Mark*

(iv) How (and why?) is data transparency effected in character oriented transmission? *4 Marks*

(v) How (and why?) is data transparency effected in bit oriented transmission? *4 Marks*