00131

THE OPEN UNIVERSITY OF SRI LANKA

Faculty of Engineering Technology
Department of Electrical & Computer Engineering
Diploma in Technology – Level 04

FINAL EXAMINATION – (2010/2011)

ECX4236 – Microprocessors and Interfacing

CLOSED BOOK EXAM

Time Allowed: **3 hours**

Date: 24th March 2011 **Time: 1400 – 1700 hours**

INSTRUCTIONS TO CANDIDATES

1. This question paper contains one question in **SECTION A** and three questions in **SECTION B** on 4 pages.
2. Answer **ALL** parts in **SECTION A**.
3. Answer any **TWO** questions from **SECTION B**.

NOTE:

1. When you have to write any Assembly Language Program (ALP) for your answer, you need to provide appropriate comments where necessary. **Full marks will only be given to correct programs with comments**.

2. Refer **data sheet of the 8051 microcontroller (given separately)**, when you answer the questions in this paper.

3. State your assumptions (if any) clearly.

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SECTION A:
Answer ALL questions

Question 01

Smart Bike Docking Station (SBDS) (Source: http://www.smartbike.com/how)

The following description is about the *Smart Bike Docking Station (SBDS)* and you are to analyze and design the requirements for the ***SBDS*** according to the 8051 microcontroller specifications.

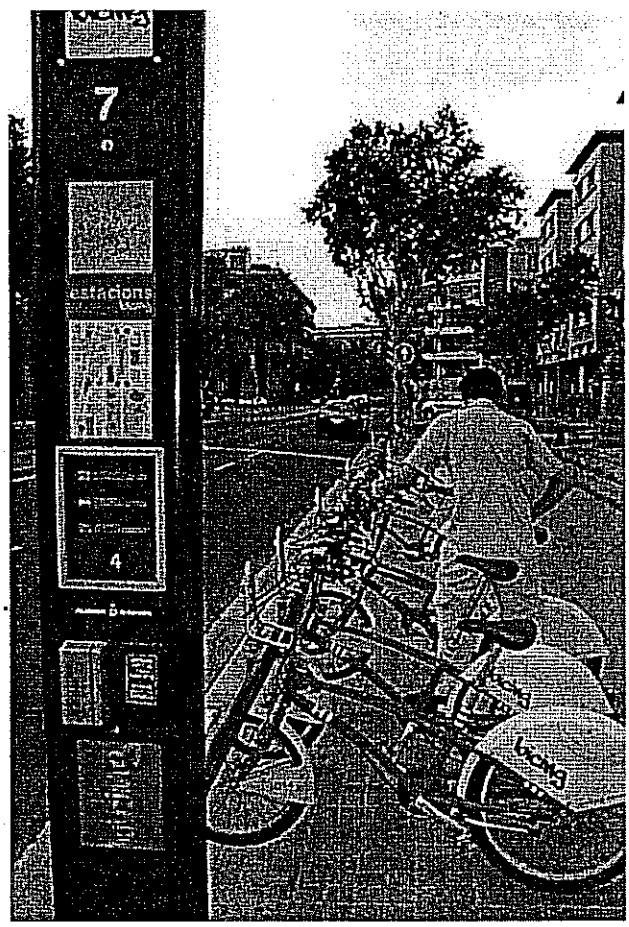

Figure 1.1: Typical view of SBDS

A typical view of the ***SBDS*** is given in Figure 1.1. The popularity of public bike sharing is easily explained as cities around the world are fighting traffic congestion, struggling to reduce pollution and working hard to extend their networks of public transportation.
SBDS are especially designed for frequent use by different users and under varied conditions. The bikes are typically used between 10 to 15 times a day. With an average ride of 20 minutes, that makes over 4 hours of continuous use per day!

It is clear that a public bike has different requirements than a private one. It needs to be strong and must tolerate rough handling and at the same time be easy controllable and light for the user. But most importantly it must be safe and comfortable. ***SBDS*** has been specifically designed for self-service use.

SBDS can be found at all central and convenient locations throughout the city. Only 3 simple steps are necessary to ensure the user care-free and individual transport:

REGISTER – User-code will be made available upon registration.

RIDE - Type in your code at a ***SBDS*** and it will release a bike for you to ride.

RETURN - When you have reached your destination, return your bike to any ***SBDS***. The bike is automatically locked and ready for the next user!

The ***SBDS*** consists of the 'docking modules' which lock the bicycles in place, ready for use, as well as the vertical interactive and informative column that identifies the user.

Design Guidelines

1. A keypad and two seven segment displays are used in ***SBDS***.
2. Assume user-code is a two-digit number and ten users can be registered.
3. User can select either RIDE mode or RETURN mode.
4. In the RIDE mode, user needs to enter his/her user-code. When the correct user-code is detected the lock will be released and the bike released time will be recorded.
5. Assume user will be returned the bike and only one ***SBDS*** is opened for users.
6. In RETURN mode, user needs to place the bike into free slot and enter his/her user-code again. When the correct user-code is detected the appropriate lock will be closed and the bike return time will be recorded. Thereafter it displays the fare for the journey.
7. You can use external memory of the microcontroller to store the start and end time of a journey.
8. Fare of a journey would be calculated as one rupee per minute basis.
9. Operation of the ***SBDS*** should be simple with minimum number of keys.
10. Crystal frequency of the 8051 microcontroller is 12MHz.

State all other assumptions (if any) clearly, when answering the questions.

(i) Draw the external view of the system (i.e. a diagram that shows the inputs and the outputs of the system). [10 Marks]

(ii) Identify the sub units/sub modules of the system and draw the interconnected block diagram of the system using the central controller. [10 Marks]

(iii) Draw a flowchart to represent the algorithm for *RIDE, RETURN and Fare display* operations of the system. [25 Marks]

(iv) Write an Assembly Language Program for the system. [25 Marks]
(Clearly show *RIDE, RETURN and Fare display* assembly routines with comments)

SECTION B:

Answer any TWO questions

State your assumptions (if any) clearly.

Question 02

(i) In a serial communication experiment of 8051 microcontroller, a student set the crystal frequency as 11.0592MHz and the variable baud rate is 4800. Find out the timer values of the 8051 microcontroller for the experiment.

[05 Marks]

(ii) Write an Assembly Language Program to send a block of external RAM (XRAM) data located at 0025H – 0050H to a PC through serial communication of the 8051 microcontroller. Use 4800bps, 8 data bits, 1 start bit, 1 stop bit and no parity bits for the communication. Use *serial interrupt* facility available in the 8051 microcontroller. (Assume that the PC will receive data without any error)

[10 Marks]

Question 03

(i) Draw a block diagram to represent the I/O of 4 inputs multiplexer. [05 Marks]

(ii) Write an Assembly Language Program (ALP) to represent the behavior of 4 inputs multiplexer. [10 Marks]

Question 04

(i) Briefly explain the switch bounce using waveform. [04 Marks]

(ii) Explain a hardware technique and a software technique that can be used for overcome the bounce caused by push button switch. [06 Marks]

(iii) Write an Assembly Language Program (ALP) for software technique that you have explained in Question 4 part ii. [05 Marks]

— The End —