

SULIT



First Semester Examination
Academic Session 2018/2019

December 2018/January 2019

EEE520 – Embedded System

Duration : 3 hours

Please check that this examination paper consists of SIX (6) pages of printed material before you begin the examination.

Instructions: This question paper consists of **FIVE (5)** questions. Answer **ALL** questions. All questions carry the same marks.

1. (a) Propose an embedded system to design a vending machine to sell a magazine under the following condition:
- (i) The price of magazine is RM20
 - (ii) The machine only accepts Rm10 and RM50.
 - (iii) If RM50 is deposited, the machine will not return the change but it will credit the buyer with the balance and wait for the buyer to make a second purchase.
 - (iv) Owner of the machine can monitor the sales and the machine wirelessly.

In your proposal include:

- (i) Product Specification
 - (ii) Engineering Specification
 - (iii) Hardware specification (use multichip design)
 - (iv) Software specification (60 marks)
- (b) Explain the following features in processor selection.
- (i) Wait State
 - (ii) Watch Dog timer
 - (iii) Direct Memory Access (DMA) (30 marks)
- (c) When using a timer as a counter, what are the precautions that you have to consider to ensure that the system can work robustly. (10 marks)

2. (a)

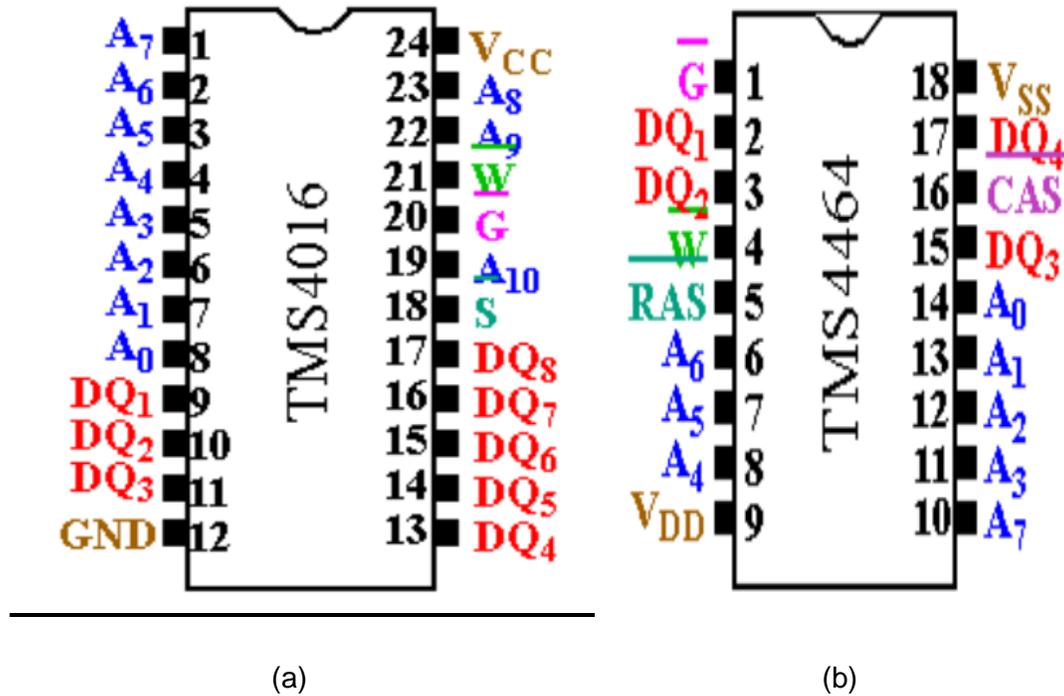


Figure 1

Figure 1 shows two different types of memory.

- (i) State two difference of these two memories in term of storage element.
- (ii) What is the capacity of each memory
- (iii) Propose and explain about interfacing between microcontroller and each of these devices
- (iv) There are some weaknesses in device (a) compared to (b). Give two weaknesses.

(50 marks)



(a)



(b)

Figure 2

- (b) Figure 2 shows two temperature sensors module with different interface protocol.
- Identify the interface protocol for each device.
 - Propose an interfacing between microcontroller and each device.
 - Discuss the advantages and disadvantages of each device.
 - Propose an interfacing between microcontroller and 3 units of each device.
 - If you want to monitor temperature in 20 different rooms, which one will you select? Give your reason.

(50 marks)

3. There are a lot of peripheral could connect to a microprocessor. The limited number of a pin for an interrupt to connect with a processor, new technique required to facilitate. Daisy chain interrupt is one of the techniques which allow unlimited number of peripheral to connect with the microprocessor.
- (a) Describe with figure in detail Daisy Chain interrupt working technique (50 marks)
- (b) There are two techniques of the signal to initialize the interrupt. Describe both of the techniques with an example (30 marks)
- (c) List down advantages and disadvantages of using daisy chain interrupt. Assign 3 peripherals which can be connected using daisy chain interrupt and describes each of them. (20 marks)
4. (a) Monitor program have some basic capabilities in order to debug embedded system. List down the capabilities of using monitor program to debug. (50 marks)
- (b) The hardware output technique depends on getting debug data to the outside world. The debug data can be either 8-bit, 16-bit or even 32-bit. Firmware will not check to see whether the with debug hardware is connected. Show with the block diagram of hardware used to acquire debug data. (50 marks)
5. (a) Real-time operating systems play an important role in the design of real-time systems. How do real-time operating systems differ from general purpose operating systems and what are the features you might expect to be provided by a real-time operating system kernel? (10 marks)
- (b) System functions with high performance requirements are very often implemented in hardware and not in software. What is the reason? Embedded processors are extremely optimized and implemented with the latest technologies, so how can an implementation in hardware (with a less advanced process technology) be faster? (20 marks)

- (c) Why scheduling is important and what are the differences between fixed and dynamic scheduling?
(10 marks)
- (d) Provide suitable descriptions for the following types of multitasking:
- (i) Co-operative Multitasking
 - (ii) Preemptive Multitasking
(20 marks)
- (e) What are the importance of shared memory and the utilisation of priority inversion and priority inheritance? Provide sufficient explanation.
(20 marks)
- (f) A task T is defined as $(p; e)$, where p is the period and e is the execution time. For all tasks we assume that the relative deadline d is equal to the period p . Given are the following sets of periodic tasks.
- (i) $T1 = (10; 2)$, $T2 = (6; 1)$, $T3 = (5; 1)$, $T4 = (3; 1)$.
 - (ii) $T1 = (20; 3)$, $T2 = (5; 1)$, $T3 = (4; 1)$, $T4 = (10; 1)$.

Determine for each set of tasks, if there exists a feasible schedule, if

- (i) the tasks are scheduled according to the rate-monotonic algorithm.
- (ii) the tasks are scheduled according to the earliest deadline-first algorithm.
(20 marks)