

**Department of Higher Education**  
**University of Computer Studies, Yangon**  
**Fourth Year (B.C.Tech.)**  
**Final Examination**  
**Introduction to Embedded Systems (CT-403)**  
**September, 2018**

**Answer ALL Questions**

**Time allowed: 3 hours**

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1. Answer **ALL** questions. (20 marks)
- (i) Which of the following is an (are) examples embedded systems for data communication?  
(a) USB Mass storage device    (b) Digital camera  
(c) Cell phone    (d) Network hubs
- (ii) Which of the following is (are) example(s) for the input subsystem of an embedded system dealing with digital data?  
(a) ADC    (b) Optocoupler  
(c) DAC    (d) only (a) and (b)
- (iii) In the ZigBee network, which of the following ZigBee entity stores the information about the network?  
(a) ZigBee Coordinator    (b) ZigBee Reduced Function Device  
(c) ZigBee Router    (d) All of them
- (iv) The Mean Time Between Failure (MTBF) of an embedded product is 4 months and the Mean Time To Repair (MTTR) of the product is 1 month. What is the availability of the product?  
(a) 80%    (b) 91%  
(c) 89%    (d) 100%
- (v) Which of the following is (are) example(s) of Silicon providers for automotive applications?  
(a) Analog Devices    (b) Atmel  
(c) Maxim/ Dallas    (d) All of these
- (vi) What is the size of an internal program memory supported by the standard 8051 architecture?  
(a) 128 bytes    (b) 1024 bytes  
(c) 2 Kbytes    (d) 4 Kbytes
- (vii) The standard 8051 controller is built around  
(a) Harvard Architecture    (b) Von Neumann Architecture  
(c) All of these    (d) None of these
- (viii) Which is the addressing mode for the instruction MOV A, 50H  
(a) Direct    (b) Indirect  
(c) Immediate    (d) None of these
- (ix) How many 'program memory fetches' are skipped during the execution of MOVX instruction?  
(a) 1    (b) 2  
(c) 3    (d) 4
- (x) Which of the following is a multiprocessor architecture?  
(a) SIMD    (b) MIMD  
(c) VLIW    (d) All of these

2. Answer **ANY FOUR** of the followings: (20 marks)
- (a) Explain the different classifications of embedded systems.
  - (b) What is the memory shadowing?
  - (c) What is the big-endian processor?
  - (d) What is the different between operational and non-operational quality attribute.
  - (e) Briefly explain the different communication buses used in automotive application.
  - (f) What is interrupts?
  - (g) Advantage of assembly language based development

- 3(a) What is the difference between embedded systems and general computing systems?
- (b) List the various interfaces for external communication. Write down any two interfaces for this communication. (20 marks)

- 4(a) Design an 8051 microcontroller based control system for controlling a 5V, 2-phase 6-wire stepper motor. The system should satisfy the following:
- (i) Use Atmel's AT89C51/52 or AT89S8252 (Flash microcontroller with In System (ISP) support) for designing the system.
  - (ii) Use a 12MHz crystal resonator for generating the necessary clock signal for the controller.
  - (iii) Use on-chip program memory for storing the program instructions.
  - (iv) The wires of the stepper motor are marked corresponding to the coils (A, B, C & D) and Ground (2 wires)
  - (v) Use the octal peripheral driver IC ULN2803 from National semiconductors for driving the stepper motor.
  - (vi) Step the motor in 'Full step' mode with a delay of 1 sec between the steps.
  - (viii) Connect the coil drives to Port 2 in the order Coil A to P1.0, Coil B to P2.1, Coil C to P2.2, and Coil D to P2.3 of unipolar stepper motors and the coil energizing sequence for 'Full step' mode. (20 Marks)

- (b) Write an 8051 assembly program to convert the packed BCD number '98' store in the accumulator to corresponding binary number and store the result in accumulator.

- 5(a) Design an automatic vending machine based on FSM model for the following requirement:
- (i) The vending is initiated by user inserting a 500 kyats coin.
  - (ii) After inserting the coin, the user can either select "Snacks" or "Coffee" or "Tea" or press "Cancel", to cancel the order and take back the coin.
- (b) What is the preemptive scheduling? Three processes with process IDs P1, P2, P3, P4 wait estimated completion time 7, 4, 10, 5 milliseconds and priorities 1, 3, 2, 4 (0- highest priority, 4- lowest priority) respectively enters te ready queue together. A new process P5 with estimated completion time 6 ms and priority 0 enters the "Ready" queue after 10 ms. Calculate the waiting time and Turn Around Time (TAT) or each process and the Average waiting time and Turn Around Time in preemptive scheduling. Assume all te process contain only CPU operation and no I/O operations are involved. (20 Marks)

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