Question Paper

Exam Date & Time: 29-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. DEGREE EXAMINATIONS - MAY/JUNE 2023
SUBJECT: CSE 2253/ CSE-2253 EMBEDDED SYSTEMS
(SPL: COMPUTER SCIENCE AND ENGINEERING - CYBER SECURITY/COMPUTER SCIENCE/COMPUTER AND COMMUNICATION/ INFORMATION TECHNOLOGY/COMPUTER SCIENCE AND ENGINEERING - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A)	Elaborate the importance of subroutines along with instructions in ARM assembly programming. Using the concept of subroutine programming write an assembly program to find the factorial of an unsigned number.	(5)
1B)	Explain the concept of conditional execution with respect to the ARM assembly programming. Write the code snippet for the following and demonstrate the conditional execution: Store two numbers in R1 and R2 registers. Perform addition if the numbers are equal else perform subtraction. Explain the operation of the conditional execution instructions used in the code snippet.	(3)
1C)	With a suitable example, distinguish between RSB and RSC instructions.	(2)
2A)	What is bit addressable memory region? Write a program to set LOW the D7 bit of the SRAM location 0x20000002 using a) the byte address and b) the bit alias address. Address 0x2200005C is the bit address of D7 of SRAM location 0x20000002.	(5)

2B)	Analyze the following code snippet and write the contents of each register when the following program is being executed.
	LDR R0, =0xF62562FA
	LDR R1, =0xF412963B
	MOV R2, #0x21
	MOV R3, #0x35
	UMUL R4, R5, R1, R0
	UMUL R6, R7, R3, R2
		(3)

2C)	Distinguish the burst and software modes in ADC. Determine the output of 10-bit ADC when the input voltage is 5 V and the reference voltage is 8 V.	(2)
3A)	i) Compose a LPC1768 compliant program to configure Timer 0 with a pre-scaler value of 23 and a match value of 1000, which gives a timer frequency of 1 kHz to generate delay function for an application that operates in a low power mode. Discuss the steps for the required register setting. ii) What are the different types of registers used in LPC1768 PWM programming and how are they configured to control the frequency and duty cycle of the PWM signal?	(5)
3B)	Write an embedded C program using LPC1768 to read the two switches from the keyboard connected to the microcontroller's GPIO port 1 pins 0 and 1?	(3)
3C)	Determine the address space range for memory of a 32-bit ARM chip for 2KB of EEPROM starting at address 0x90000000.	(2)
4A)	i) Discuss the steps for configuring DAC (Digital-to-Analog Converter in ARM Cortex-M3 LPC1768 microcontroller. ii) Write an embedded C program to utilize the pin P0.26 on the LPC1768 microcontroller as the	(5)

	DAC output pin to generate a square wave with a frequency of 1 Hz. Use delay of 500ms.	
4B)	Describe the ALIGN directive in ARM LPC1768 programming. How does it ensure that instructions or data are aligned to specific boundaries? Provide an example to demonstrate its usage.	(3)
4C)	Explain the purpose and usage of the EXTMODE (External Interrupt Mode Register) and EXTPOLAR (External Interrupt Polarity Register) registers in the LPC1768. How are these registers used to configure the triggering mode and polarity of external interrupts?	(2)
5A)	Calculate the values to be stored in UART Fractional Divider Register (FDR), Divisor Latch LSB (UxDLL) and Divisor Latch MSB (UxDLM) registers to obtain a UART baudrate of 9600 at a peripheral clock frequency of 125 MHz in UART0 module of LPC1768. Explain with neat steps. Write down the C statements to configure the appropriate registers with the calculated values.	(5)
5B)	Construct an ISR (ADC_IRQHandler) to store the analog value of the signal provided at ADC channels 5 and 6 along with the channel number in two different strings. The analog signal ranges from 0 to +5 Volts. Use A/D data registers to extract the results.	(3)
5C)	Develop an ISR (EINT3_IRQHandler) to toggle all the LEDs in the LED unit using external interrupt 3. Connect port pins 0.4 to 0.11 in the LED unit.	(2)

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