Question Paper

Exam Date & Time: 25-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH(CCE) END SEMESTER EXAMINATIONS, MAY-JUNE 2023

EMBEDDED SYSTEMS DESIGN [ICT 3271]

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

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions. Missing data may be suitably assumed.

1) Write an assembly language program to sort an array of 10 unsigned 32-bit hexadecimal numbers available in the code memory using bubble sort and store the sorted array in the data memory. (5)

A)

B) Assume that the registers R0, R1, R2, and R3 are loaded with -4, 3, -3, and -1 respectively and the following error free program is executed: (3)

```
    smlal r2,r3,r0,r1
    mvn r2,r2
    add r2,r2,#1
up  rrx r2,r2
    tst r2,#1
    add r3,r3,#1
    bne up
```

What is the content of register r3? Justify.

C) Given the contents of registers R1= -3, R2= -9, R3= -11, R4= -25 and R13=0x10000020. Write the content of the stack pointer and 32-bit data stored in the address 0x10000018 after the execution of the instruction STMDB R13!,{R1-R4}. (2)

2) What is the the role of UART and MAX32 in serial communication? Write an embedded C program using serial interrupt to receive a character serially on RxD0 (P0.3, function 1) and transmit the received character on TxD0 (P0.2, function 1). Assume 1-start bit, 1- stop bit, 8-bit data, and 9600 baud. Assume PCLK=3 MHz. (5)

A)

B) Write an embedded C program to simulate a 2-4 decoder with active HIGH outputs using P0.6 and P0.5 as inputs and P0.3- P0.0 as decoder outputs. (3)

C) What are the advantages and disadvantages of Memory mapped IO over IO mapped IO? (2)

3)		Identify the type of the following instructions and write the possible addressing modes for source and destination operands. Show the operations performed with suitable examples.	(5)
	A)	(i) MLS (ii) SMULL (iii) LSR (iv) MOVT (v) LDRB	
	B)	Write an embedded C program to generate a square waveform of frequency 10 kHz and duty cycle 75% on P2.3. Assume PCLK = 3 MHz.	(3)
	C)	What is the value to be loaded to each of the following registers to accomplish the task mentioned: (i) EMR register to toggle MAT1.2 upon match event (ii) CTCR register to count at both the edges of CAP1.1	(2)
4)		Assume that columns of a 2x2 matrix keyboard are connected to P2.10-P2.11 and rows are connected to P1.0-P1.1. Explain the interfacing with the help of a neat diagram. Write an embedded C program to display the keycode of the key pressed on the seven-segment display connected to P0.7-P0.0.	(5)
	A)		
	B)	Compare and contrast the software mode of ADC with the burst mode. List the various steps in converting multiple analog channels into digital using software mode.	(3)
	C)	Given MR0 =300, MR3 =180, MR4 = 120, MR5 = 150. What is the width of the double edge PWM pulse on PWM1.4?	(2)
5)		Develop an application software to glow a LED connected to P1.23 (PWM1.4, function 2) with 30% intensity whenever the switch connected to P2.12 is pressed and 60% intensity whenever the switch is released.	(5)
	A)		
	B)	Write an embedded C program using interrupt to turn ON an LED connected to P0.4 whenever the switch connected to P2.10 (EINT-2, function 1) is pressed. The LED should remain ON as long as the switch is pressed.	(3)
	C)	Given PCLK=6 MHz and PR=0. Determine the value that is to be loaded to MR0 to get a square waveform of frequency 100 Hz on MAT 1.0.	(2)

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