Question Paper

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. DEGREE EXAMINATIONS - APRIL / MAY 2024
SUBJECT: CSE 2223/CSE_2223 - EMBEDDED SYSTEMS
(SPL: COMPUTER SCIENCE AND ENGINEERING - CYBER SECURITY/COMPUTER SCIENCE/COMPUTER SCIENCE
AND ENGINEERING - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

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

Answer all the questions.

1A)	Identify the assembler directives in the following statements and explain each of them along with their attributes.	(4)

```
        RAM1_ADDR EQU 0x40000000
        AREA mycode, CODE, READONLY
        VAL1 RN R1
LONG_VAR SPACE 4
```

1B)	Analyse the following program and write the contents of register $R4$, $R5$ and $R6$.	(3)

```
AREA mycode, CODE, READONLY
ENTRY
        LDR R0, =0xE64578AE
        LDR R1, =0x1298EDED
        MOV R2, #0x85
        MOV R3, #0x67
        SUBS R4, R3, R1
        RSB R5, R0, #0
        MUL R6, R2,R3
STOP B STOP

        SRC1 DCD 0x44535567 , 0x67633677
        SRC2 DCD 0x11236540 , 0x6642AED5

        AREA mydata, DATA, READWRITE
DSD DCD 0
        END
```

1C)	List and explain all possible instructions used for performing push and pop operations on a fully descending stack with the help of a neat diagram.	(3)
2A)	The textile shop had a sale, but employees decided not to write down the original price of all the items. All the prices are 1/3 of their original amounts. The owner needs to compute the original amount of each item. Write an ARM assembly language program to compute the original amount of each item using subroutines.	(4)
2B)	Illustrate the importance of conditional execution of ARM assembly language instructions with a	(3)

suitable example.

2C) Assume that there is a class of ten people with the following grades: 69, 87, 96,43, 78, 84, 90, 49, 45, and 75. Write an ARM assembly language program to find the highest grade and store the highest grade in the register R8. (3)

3A) Develop an Embedded C program to implement packed BCD down counter in eight LEDs interfaced with LPC1768 microcontroller. Assume that the eight LEDs are connected to port pins *P1.10* to *P1.17*. (4)

3B) Write the code snippet using GPIO registers to perform the following: (3)
a) Configure port pins P1.0 to P1.18 as output and P1.19 to P1.31 as input.
b) Hide the values at port pins P1.13 to P1.18 and P1.5 to P1.9.
c) Set the output at port pins P1.5 to P1.18.
d) Clear the output at port pins P1.9 to P1.11.
e) Read the values from Port1.
What will be the output of the read operation after execution of all the above set of instructions? (Note: Assume the other port pins read a value of 0).

3C) Assume the values already in memory from address (3)
$0x40000FF8$ to $0x40001008$ are $0x100$ to $0x104$, respectively. Other memory locations contain zeros. The current value of the Stack *Pointer*
$(R13)$ is $0x40001000$. Write the LDM instructions with appropriate suffixes other than *EA*, *FA*, *ED* and *FD* to pop the values from the stack to the registers *R0-R4* using empty ascending, empty descending and fully ascending stack structures. Draw the stack structure before and after the pop operations for each type of stack and write the output in registers after pop operations.

4A) Write an embedded C program to utilize the pin P0.26 on the LPC1768 microcontroller as the DAC output pin to generate a sawtooth waveform using DAC. (4)

4B) Explain about MAX232 in serial communication. (3)

4C) Explain the role of UART in serial Communication. Write an embedded C program using UART to transfer the message "Hello World" serially on TXD0 (P0.2, Function 2) at a 9600 baud rate. Assume parity disabled, 1 stop bit, 8bit word length, and PCLK=3MHz. (3)

5A) Develop an embedded C program to turn on LED1 and LED2 connected to MAT2.0 and MAT2.1 output of $Timer2$ after $100ms$ and $200ms$, respectively. Note: $MAT2.0$ and $MAT2.1$ are 3rd alternate functions of *P0.6* and *P0.7*. (4)

5B) Develop an embedded C program to toggle LED connected to *P2.11* upon an external interrupt $EINT0$. Set the $EINT0$ as rising edge sensitive. Note: $EINT0$ is 1st alternate function of $P2.10$. (3)

5C) Explain the importance of *TCR*, *PR* and *MR* in the LPC1768 PWM module. (3)

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