2 BEC DC1

Final Assessment Test (FAT) - May 2024

Programme	B.Tech.	Semester	WINTER SEMESTER 2023 - 24
Course Title	EMBEDDED C PROGRAMMING	Course Code	BECE320E
Faculty Name	Prof. KEERTHIK DHIVYA RAJAKUMAR	Slot	G1
Time	3 Hours	Class Nbr	CH2023240503230
General Instructions:		Max. Marks	100

- Write only Register Number in the Question Paper where space is provided (right-side at the top) & do not write any other details.

Section - I

Answer all questions (3 X 15 Marks = 45 Marks)

01. Kithan, a mathematical genius, wants his friend Krishna, a coder, to write a C program for generating magic squares. However, Krishna is not familiar with the concept. Kithan decides to explain it to Krishna step by step. [15]

Explanation:

User Input:

The program should prompt the user to input a natural number (e.g., 5, 6, 7, 9, etc.).

Size of Square:

If the input number is odd (e.g., 5), the program should create a square with that number of rows and columns. For example, if the input is 5, the program should create a 5x5 square.

Property of Magic Square:

In a magic square, the sum of each row, column, and diagonal should be the same.

Condition:

The program should only work for odd numbers. Magic squares are not possible with even numbers.

02. A. Compare polling and interrupts.What are the steps a microcontroller performs upon activation of Interrupt? **[8 Marks]** [15]

B. Explain how interrupt priority can be changed using the IP register. Also, explain the default priorities assigned to interrupts in the 8051 microcontroller. **[7 Marks]**

03. Design an 8051 C program that satisfies the requirements described in the following scenario. [15]
The system operator wishes to implement a visual indicator and data transfer functionality simultaneously. Every 2 seconds, the LED connected to pin P2.7 should blink four times, with each blink lasting 50 milliseconds, while the microcontroller must continuously receive data from pin P1 and immediately send it to pin P0.The clock frequency of the microcontroller is 11.0592MHz.

Section - II

Answer all questions (3 X 10 Marks = 30 Marks)

04. Given three values, write a program to read three values from the keyboard and print out the largest of them without using an if statement. [10]

05. The Legendre polynomials can be calculated by means of the formulas $P_0 = 1$, $P_1 = x$, $P_n = [(2n - 1) / n] x P_{n-1} - [(n - 1) / n]P_{n-2}$ where $n = 2, 3, 4, \ldots$ and x is any floating-point number between -1 and 1. (Note that the Legendre polynomials are floating-point quantities.) Write a C program to generate the first n Legendre polynomials using recursive functions. Let the values of n and x be input parameters. If the given x value is not between -1 and 1 or the given n value is not a positive integer, display an error message. [10]

06. Design an 8051 C program to interface with a temperature sensor (LM35) and send the temperature readings to a PC via serial communication with a baud rate of 9600 bps. The program should also calculate and transmit statistical data (average, minimum, maximum) for a defined sampling period (e.g., 100 readings). [10]

Section - III

Answer all questions (5 X 5 Marks = 25 Marks)

07. Describe the output of the following C program. [5]

```
#include <stdio.h>
int main() {
 int a[5] = {5, 1, 15, 20, 25};
 int i, j, k = 4, l, m;
 i = ++a[1];
 j = a[1]++;
 l = a[k--];
 m = a[i++];
 printf("%d %d %d %d %d\n", i, j, k, l, m);
 return 0;
}
```

08. A program intended to blink an LED connected to Port 1 of the 8051 microcontroller does not work as expected. Your task is to identify and correct the errors in the code below. Consider the setup, logic, and syntax as potential error sources. Assume a standard clock frequency of 11.0592MHz. [5]

```
#include <reg51.h>
void delay() {
int i;
for(i = 0; i < 1000; i--);
}
void main() {
P1 = 0x01; // Setup for LED blinking
while() {
P1 != P1; // Attempt to toggle the LED
delay();
}
}
```

09. Provide an Embedded C code snippet that sends the ASCII characters '8051' one by one through a byte-addressable I/O port. Assume you have a function sendChar(char c) available. [5]

10. Write an Embedded C Program that uses logical operations to set, clear, and toggle the least significant bit of an I/O port. [5]

11. Write an 8051 C program to generate a 50Hz sawtooth wave using a DAC. Assume the DAC is connected to Port 1 of the 8051 microcontroller. [5]