ADDITIONAL QUESTION BANK

THE 8051 MICROCONTROLLER
BASED
EMBEDDED SYSTEMS

1. Define the term Embedded Systems and list their characteristics.

2. Discuss the significance of bit addressability in the 8051. List the bit level instructions and their use.

3. Briefly explain the uses of following control registers: IP, IE, TMOD, TCON, SCON and PCON

4. Find the value to be loaded in TH1 to generate a baud rate of 9600. Assume suitable crystal frequency.

5. Write a program to generate a square wave of frequency 10 KHz on pin P1.0. Assume the crystal frequency of 12 MHz.

6. Explain how the TMOD register is used to control the operation of timers.

7. Explain IE and IP register formats

8. Compare polling and interrupts. List the steps taken by microcontroller upon activation of interrupt

9. Write a program to set all the byte of four register banks.

10. Write a program to load 57H into accumulator and execute RLC A three times and then add 55H. What will be the results in A and Flags? Assume CF=1?

11. Draw and explain the interface of 4x5 matrix keyboard with the 8051. Write a program to identify the pressed key.

12. Interface 16 x 2 line LCD with the 8051 microcontroller. Write an assembly program to display 'LITTLE DRAGONS'

13. Interface serial ADC MAX 1112 with the 8051 microcontroller. Write an assembly language program to read an analog signal on channel 2 through the ADC

14. Interface the MAX1112 with the 89C51. What will be the control word for converting input at CH3 and single ended, bipolar mode with internal clock and fully operational mode?

15. Use the R2 (LSByte) and R3(MSByte) as single 16 bit counter and increment the pair until they are equal.

16. Write a program to move a bit at address 22H to bit 2 of Accumulator?

17. Explain the operation of stepper motor. Interface the 8051 with unipolar stepper motor and write a program to rotate the motor in clockwise direction.

18. What is meant by bouncing and debouncing a key?

19. Explain how data and commands are issued to LCD.

20. What is busy flag in LCD? How it is useful?

21. What are the different types of seven segment LED's.

22. What are the techniques use to change the speed of a DC motor?

23. Explain the role of the pin $\overline{PSEN}$ w.r.t. program memory.

24. Write short note on RS 232 standard.

25. What are the advantages of serial communication over parallel communication?

26. What is the function of RS1 and RS0 bits in of the PSW register?

27. Using single instruction, clear the most significant bit of B

28. Write assembly language program to generate delay of 10ms using software. Assuming crystal frequency is 12MHz.

29. Write assembly language program to find the square of a number between 0 to 9 using lookup tables .

30. Interface 2 seven segment modules with the 8051 and write a program to display decimal numbers 00 to 99 with delay of 1s in between.

31. List the features of port structure of the 8051. List the alternate functions of each port.

32. Using bit processing instructions implement two input XOR gate and two input NAND gate.

33. List and discuss the reasons to use assembly language.

34. How ADC0804 differ from ADC MAX 1112?

35. Discuss the memory map of RTC chip DS 12887.

36. Draw the block diagram of 4 channel temperature monitoring and control system. Prepare a list of operations to be performed by each block.

37. List the onchip resources available in the 8051.

38. Explain 8051 signals which have different meaning at different instances?

39. What are the different fields in assembly language program.

40. Discuss the significance of comments in the program development.

41. Interface 4K of program memory and 4K of data memory with the 8051 microcontroller. Specify clearly their address range.

42. What is meant by data memory and program memory?

43. What are the advantages of programming in high level languages? What are their limitations? '

44. How timer mode 2 is helpful in minimizing the timing errors?

45. Compare SJMP, AJMP and LJMP instructions.

46. How AJMP and ACALL instructions differ from other instructions?

47. List the steps to receive data through serial port

48. Draw the pin diagram of the 8051 Microcontroller. Mention briefly the significance of each pin.

49. Write a program that swaps the bits of each nibble in register R0 i.e. swap bits 4 and 5 with bits 6 and 7, and bits 0 and 1 with bits 2 and 3.

50. What is the difference between the Microcontrollers and Microprocessors?

51. Define the term Loop. How a loop can be implemented in the 8051?

52. Discuss the rotate instructions with suitable example. How they are useful?

53. Describe the need register bank in the 8051?

54. Describe the program flow controls instructions of the 8051.

55. Show with suitable example how CJNE is useful to implement if and case statements?

56. How PUSH and POP instructions are useful for interrupt service routines?

57. Upon reset, all interrupts are disabled. How to enable these interrupts?

58. Write a program to monitor the P1.0 until it becomes high, when it become high, read data from Port 2 and send a high to low pulse on P0.0 to indicate that data has been read?

59. Write a program to toggle P1.0, P1.2, and P1.3 repeatedly without disturbing other pins of port?

60. Write a program to find the number of ones in 16 bit number. Assume that the number is stored in R2 and R3 of register bank 2.

61. List the flags corresponding to each interrupt source in the 8051?

62. How can we disable all the interrupts?

63. List the onchip peripherals of the 8051 with their features.

64. Explain the internal memory organization of the 8051.

65. Write a short note on interrupt structure of the 8051. Explain the two level priority structure of the interrupts.

66. Explain briefly serial communication modes 0 and 1 in the 8051.

67. Explain the operation of different modes of timers in the 8051.

68. List the SFRs of the 8051. Briefly explain the use of each

69. How SFRs differ from general purpose RAM?

70. What is the significance of $\overline{EA}$ pin with respect to program memory?

71. Discuss the role of IE and IP registers with respect to interrupt programming.

72. Discuss the significance of register banks with respect to interrupt response time (interrupt latency)

73. List the different address spaces of the 8051.

74. Define the term baud rate.

75. Explain the operation of mode 0 of serial port of the 8051.

76. What are the benefits of EPROM and Flash memory?

77. Explain interrupt driven data transmission and reception in the 8051.

78. How the frequency of the unknown signal can be measured using timers of the 8051? Write a program to measure the frequency of the signal applied at T0 input. Display the frequency on the ports.

79. How priority of the interrupt source can be changed using IP register?

80. List the SFRs used for Timer operation.

81. What is the significance of $C/\overline{T}$, M1, M0 bits in the TMOD register?

82. Define the terms Microcomputer, Microcontroller and Microprocessor.

83. List the features of the 8051 microcontroller.

84. What is meant by term 'Index' in the indexed addressing mode?

85. Show how we can double the baud rate in 8051.

86. Discuss the role of SCON register in the serial communication.

87. Write assembly language instruction(s) to keep monitoring the P1.1 until it becomes low.

88. Explain the difference between the instructions MOV R0, #10H, MOV R0, 10H and MOV @R0, 10H.

89. Draw the neat interfacing diagram to connect 4 x 4 keyboard with the 8051. Write a program in C to identify the pressed key.

90. Interface a unipolar stepper motor with the 8051 microcontroller and write a program to rotate the motor in anticlockwise direction. How speed of the motor can be changed?

91. Explain the data movement instructions of the 8051 microcontroller.

92. List the peripherals available as onchip in the microcontrollers

93. List the steps to initiate serial data reception.

94. Define the terms opcode, operand and machine code.

95. List the instructions used to access the external data memory.

96. Discuss briefly different operating modes of the 8051 timers.

97. Add the unsigned numbers stored at internal RAM locations 20H to 2FH and store the result at internal RAM address 31H (MSB) and 30H(LSB).

98. List the arithmetic operations supported by the 8051 with example of each operation. Show how the flags are affected by each operation.

99. Justify TRUE/FALSE with the reason. 'Microcontroller is a complete microcomputer on a chip'

100. How SBUF register is used for data transmission and reception?

101. List the applications of the timers.

102. How operation of interval timer differ from event counter?

103. Discuss the role of GATE bit in the operation of the timer/counter.

104. Classify the instructions of the 8051 based on the operation performed by them.

105. Differentiate between MOV, MOVX and MOVC instructions.

106. How PUSH and POP instructions are executed?

107. Explain the functions of the following pins: ALE, $\overline{RD}$, $\overline{PSEN}$, RST

108. Implement the bitwise XOR operation in the 8051.

109. Explain how UART mode2 can be used for the multiprocessor communications.

110. Explain briefly how the baud rate of communication is set for UART mode 1.

111. List the addressing modes of the 8051. Explain each addressing mode with suitable example.

112. Explain briefly how ACALL (or LCALL) instruction is executed.

113. Briefly explain the operation performed by instructions 'MOV C, bit' and 'MOV bit, C' with suitable example.

114. Discuss the role of Carry flag with respect to bit processing instructions.

115. List the instructions which have single operand.

116. What is meant by lookup table? How lookup table can be implemented in the 8051 based system? List the instructions used to access the lookup table.

117. What do you mean by conditional jumps? How they are useful?

118. Differentiate ACALL and LCALL instruction.

119. List the advantages of using microcontrollers.

120. What is meant by term '8-bit microcontroller'?

121. List the products (gadgets) in your home or office which uses a microcontroller.

122. Define the term flag. How they are useful? List the arithmetic flags of the 8051.

123. Discuss the significance of the stack and stack pointer with respect to subroutines.

124. How DPTR differ from other SFRs?

125. How RETI instruction differ from RET. Can we use them interchangeably?

126. Show with suitable example how delay can be generated using software. What is limitation of this method?

127. What is meant by stack overflow?

128. Where the stack is implemented in the 8051? How data can be stored in to stack?

129. How the power consumption is reduced in power down and idle modes? What is difference between power down and idle mode? How the operation is resumed to normal mode?

130. Explain the program memory and data memory is organized in the 8051 based system?

131. Explain briefly the architecture of the 8051 with neat diagram.

132. Explain briefly the programming model of the 8051 with neat diagram.

133. Write short note on ports of the 8051. Discuss the internal details of the port 0.

134. Classify the conditional jump instructions in the 8051. Explain application of each of jump them.

135. Define the term interrupt. How they are useful?

136. Classify the interrupts of the 8051, what is the vector address of each interrupt?

137. Justify TRE/FALSE with the reason. 'RESET is a special Interrupt'

138. List the signals used to access the external data memory.

139. List the signals used to access the external program memory.

140. Illustrate with suitable example how JMP @A+DPTR instruction is used to implement the jump table.

141. Compare register addressing mode with direct addressing mode with respect to speed,memory requirements and flexibility.

142. If A=7BH and CY=0, what are the contents of A and CY after execution of RR A instruction.

143. Explain the use of DPTR, PC and SP register of the 8051.

144. Explain how TMOD and TCON registers are used to control timer operations.

145. What do you mean by timer overflow? How microcontroller knows that the timer is overflowed?

146. Show how timer can be used as counter. What is the source of clock pulse for counter?

147. What is the use of T0/T1 pin of the 8051.

148. What are the different modes of the serial port? How their baud rates are configured?

149. Write short note on RS 232 standard.

150. Why level converters are used between RS 232 interface and a microcontroller?

151. What are the different classifications of serial communication?

152. How synchronous and asynchronous data transfer schemes differ?

153. Define the terms simplex, half duplex and full duplex communication.

154. Define the term frame.

155. What is relay? Explain the construction of relay. What is the application area of the relay?

156. What is optocoupler? Explain the construction of it. What is the application area of the optocoupler?

157. What are the applications of ADCs? List the parameters of the ADC.

158. What are the applications of DACs? List the parameters of the DAC.

159. Define the term clock, machine cycle and instruction cycle.

160. Discuss the behavior of PC during execution of subroutines (or interrupt service routines)

161. Write an assembly language program to multiply two 8bit numbers stored at the external RAM addresses by 1000H and 1001H. Store the result at the external RAM address 1010H(LSbyte) and 1011H (MSByte)

162. Write an assembly language program to convert a binary number (stored at external RAM address 1000H) to BCD number and send the result at on port1.

163. List the bit processing instructions available in the 8051.

164. Write assembly language statements to compliment the upper nibble of internal RAM location 10.

165. Write assembly language statements to find smaller of two numbers stored at external RAM 10H and 11H.

166. Write a program to generate square wave of 75% duty cycle on port pin P1.0

167. Describe the stack operation in the 8051. What is its limitation?

168. Classify the jump instructions in the 8051. Explain application of each type of jump instructions.

169. What are different ways for classifying the microcontrollers?

170. Show how we can implement the rotate operation in C.

171. Compare main program, subroutine, interrupt service routine.

172. What is maximum amount of external program memory and data memory that can be interfaced with the 8051?

173. Explain the bit assignment of PSW. Discuss the application of each flag. Explain with suitable example how the flags are affected?

174. Justify TRUE/FALSE with the reason 'Carry flag is used in unsigned arithmetic while overflow flag is used in signed arithmetic'

175. Interface DAC 0808 with the 8051. Write a program to generate sine wave.

176. Identify the bit addressable locations in the 8051.

177. What is RTC? Why they are name so? What are their applications?

178. Define the terms Assembler, Compiler, linker, Simulator.

179. Explain the bit assignment of TCON , TMOD and PCON Registers

180. Write a program to transfer array of 10 bytes from external RAM to internal RAM. Assume suitable addresses.

181. Explain the difference between level triggered and edge triggered external interrupts.

182. Compare the RISC and CISC architectures.

183. Distinguish between Harvard and Princeton architecture with neat diagram.

184. Explain the oscillator circuit and timing diagram of memory read cycle of the 8051 microcontroller.

185. Interface the LCD module with the 8051. Write a program to display 8 characters whose

186. ASCII codes are stored in program memory address 1000H onwards.

187. List the various LCD command codes.

188. Explain the following instructions with examples DA A, DIV AB, POP B

189. List the alternate function of each pin of port 3.

190. What are the byte and bit addresses assigned to each port?

191. What do you mean by subroutine? List the advantages and disadvantages of using subroutines. How subroutines are implemented in the 8051?

192. Write a subroutine to decrement the contents of DPTR.

193. Write a program to add 5 BCD numbers stored at memory address 50H onwards in the external RAM. Store the result at external RAM addresses 60H(LSByte) and 61H(MSByte)

194. Write a program to find square root of a number stored at top of the stack.

195. Interface a DC motor with the 8051 using optocoupler? Write a program to rotate the DC motor with 50% duty cycle pulses.

196. 'Large numbers of I/O lines are provided in the 8051 to perform external I/O operations' Justify.

197. Define the terms memory map and address decoding.

198. Describe the use of Program and Data memory.

199. Describe various bit level instructions available in 8051?

200. Write a program to compliment the upper nibble of external RAM location 2000H.

201. What is the advantage and disadvantage of serial communication?

202. Explain the function of each pin of DB-9 connector

203. List the interrupt sources of 8051? Explain briefly interrupt execution process.

204. Define the terms Interrupt service routine, Interrupt vector table and Interrupt latency.

205. Write a program to load accumulator A, DPH and DPL with F0H.

206. Write a program to add the contents of R0 of Bank 1 with the contents of R0 of Bank2.

207. 'When GATE = 0, Timer/counter will run only if TRX =1' Justify

208. How ADDC instruction differ from ADD?

209. Show with suitable example that INC instruction is a special case of ADD instruction.

210. Explain the multiply and divide instructions with suitable example. How OV flag is affected by multiply and divide instructions.

211. Discuss the role of overflow flag in signed arithmetic. How can we recover the correct result from overflow?

212. Explain briefly software and hardware control methods to start /stop the timers in the 8051.

213. Write a subroutine for delay of 10 ms using timer 1 of 8051 for 12 MHz crystal frequency.

214. What is the function of SWAP instruction? Where it is useful?

215. How Assembly language differ from machine language?

216. Compare different programming languages with respect to ease of programming, code density and portability.

217. Write the program in C language to read data from port 1 when $\overline{INT1}$ (edge triggered) signal is asserted and send the data to port 2 by complementing it.

218. Write a program in C to transmit 'The GOD' to the PC at baud rate 4800. Assume the

219. What is the status of all port SFRs on reset?

220. What is the maximum and minimum delay the Timer 1 produces when 8051 is operated at 6 MHz?

221. Explain how UART mode 0 is useful for expanding the I/O lines.

222. What do you mean by nested interrupts?

223. What do you mean by natural priority of an interrupt?

224. Interface DAC 0808 with the 8051 microcontroller. Write assembly language program to generate the sawtooth wave on port pin P1.0.

225. What are the advantages and disadvantages of using Harvard architecture?

226. Show with suitable example how CJNE and DJNZ instructions are executed.