SRM Institute of Science and Technology
College of Engineering and Technology
School of Computing
(Common to all Branches)

| Mode of Exam |
|---|
| **OFFLINE** |

**DEPARTMENT OF COMPUTING TECHNOLOGIES**
**SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu**
**Academic Year: 2023-24(ODD)**

**Test: CLA-1** — **Date: 18-08-2023**
**Course Code & Title: 21CSS201T& Computer Organization & Architecture** — **Duration: 100 Minutes**
**Year & Sem: II &IV** — **SET C** — **Max. Marks: 50**

**Course Articulation Matrix:**

| Course Learning Outcomes (CLO) | At the end of this course, learners will be able to: | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO-1 | Identify the computer hardware and how software interacts with computer hardware | H | M | - | | - | - | - | - | - | - | - | - |
| CO-2 | Apply Boolean algebra as related to designing computer logic, through simple combinational and sequential logic circuits | H | H | - | | - | - | - | - | - | - | - | - |

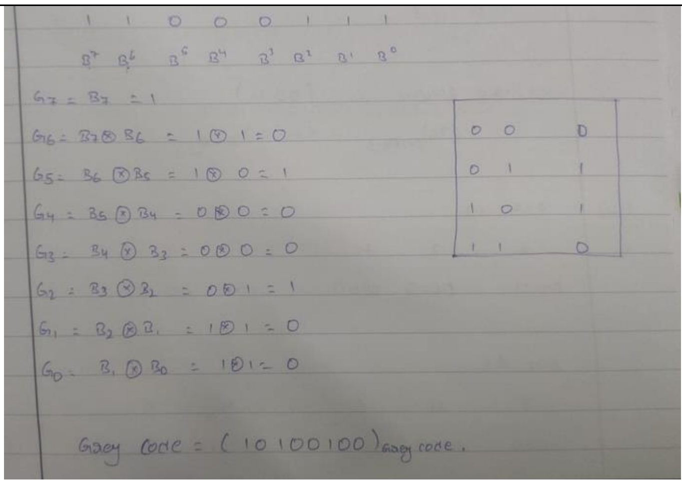
**Part – A**
**( 10 x 1 = 10 Marks)**

**Instructions: Answer all**

| Q. No | Question | Marks | BL | CO | PO | PI Code |
|---|---|---|---|---|---|---|
| 1 | The output of a NOR gate is HIGH if ________.<br>a.all inputs are HIGH<br>b.any input is HIGH<br>c.any input is LOW<br>d.all inputs are LOW | 1 | 1 | 1 | 2 | 2.1.2 |
| 2 | Base of octal number system is<br>a.10<br>b.2<br>c.8<br>d.16 | 1 | 1 | 1 | 2 | 2.1.2 |
| 3 | Decimal equivalent of hexadecimal no. $(44A)_{16}$ is :<br>a.825<br>b.1098<br>c.870<br>d.1100 | 1 | 3 | 1 | 2 | 2.1.2 |
| 4 | Binary equivalent of $(542)_{10}$ is :<br>a.101010101<br>b.1110101101<br>c.101011001<br>d.1000011110 | 1 | 3 | 1 | 2 | 2.1.2 |
| 5 | Convert the binary number 1011011 to hexadecimal.<br>a.5A<br>b.5D<br>c.5B<br>d.5C | 1 | 3 | 1 | 2 | 2.1.2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | Octal representation of $(0101)_2$ is :<br>a.5<br>b.3<br>c.4<br>d.6 | 1 | 2 | 1 | 2 | 2.1.2 |
| 7 | Cache memory acts between<br>a.CPU and RAM<br>b.RAM and ROM<br>c.CPU and Hard Disk<br>d.ROM and CPU | 1 | 2 | 2 | 2 | 2.1.2 |
| 8 | Which of the following is lowest in memory hierarchy<br>a.Cache memory<br>b.Registers<br>c.RAM<br>d.Secondary memory | 1 | 1 | 2 | 2 | 2.1.2 |
| 9 | Which of the following is the correct BCD representation of the decimal number 89?<br>a.10001001<br>b.10011001<br>c.10100001<br>d.10100101 | 1 | 1 | 2 | 2 | 2.1.2 |
| 10 | Which instruction is used for moving the data from accumulator to memory?<br>a.Move B<br>b.Store D<br>c.Load D<br>d.PUSH A | 1 | 1 | 2 | 2 | 2.1.2 |
| Part – B<br>( 4 x 4 = 16 Marks)<br>Instructions: Answer any 4 | | | | | | |
| 11 | Convert the given binary number $(01100100)_2$ to ASCII text conversion.<br>$(01100100)_2 = (100)_{10}$<br>$2^7$ $2^6$ $2^5$ $2^4$ $2^3$ $2^2$ $2^1$ $2^0$<br>128 64 32 16 8 4 2 1<br>0 1 1 0 0 1 0 0<br>64 + 32 + 4 =100 | 4 | 3 | 1 | 2 | 2.1.2 |
| 12 | Utilize 1's complement and 2's complement method for the following subtraction $(11011)_2 - (10011)_2$ | 4 | 3 | 1 | 2 | 2.1.2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Subtraction by 2's complement.<br>eg:- $(A)_2 - (B)_2$<br>→ $I^{st}$ find 2's complement of B i.e, B'<br>$II^{nd}$ add A to B' i.e, A+B'<br>$III^{rd}$ if carray is produced in the addition, then drop carry.<br>$IV^{th}$ If there is no carry then take 2's complement of sum and asign -ve sign.<br>problem :-<br>$(11011)_2 - (10011)_2$<br>⇒ Step 1 :-<br>10011<br>01100 → 1's compliment<br>1<br>01101 → 2's complement.<br>Step 2:-<br>11011<br>+ 01101<br>carry ① 01000<br>Step 3:- drop carry.<br>∴ answer is ⇒ 01000 | | | | | |
| **13** | **Convert the decimal number $(8)_{10}$ to excess 3 code.**<br>**<u>Answer:</u>**<br>Binary number of 8: 1000<br>Binary number of 3: 0011<br>Adding results : 1011 | **4** | **2** | **1** | **2** | **2.1.2** |
| **14** | **What are the functional units of a computer?**<br>**<u>Answer:</u>** A computer in its simplest form comprises five functional units namely input unit, output unit, memory unit, arithmetic & logic unit and control unit. | **4** | **1** | **2** | **2** | **2.1.2** |
| **15** | **A computer has 128 MB of memory. Each word in this computer is eight bytes. How many bits are needed to address any single word in memory?**<br>**<u>Answer:</u>** The memory address space is 128 MB, which means $2^{27}$. However, each word is 8 $(2^3)$ bytes, which means that you have $2^{24}$ words. This means you need $\log_2 2^{24}$ or 24 bits, to address each word. | **4** | **2** | **1** | **1** | **1.3.1** |
| | **Part – C**<br>**(2 x 12 =24 Marks)** | | | | | |
| **16(a)** | **Obtain the following conversion**<br>**i)$(11000111)_2$ to Gray Code.(3 Marks)** | **12** | **3** | **1** | **2** | **2.1.2** |




**ii) Convert Excess-3 (36) to binary(3 Marks)**

**Answer:**

Step 1: sub ‘3’ to the individual given decimal

The Excess-3 code of given decimal (36) is $(0000\ 0011)_{\text{Excess-3}}$

Step 2 : $(0000\ 0011)_{XS3}=(0011)_2$

iii)Perform BCD addition **for the decimal 324.13 and 846.46 (6 Marks)**

**Answer:**

324.13+846.46 BCD addition (Here we have consider this numbers as decimal value)

After removing 2 precision, Numbers are 32413 and 84646

For A+B

1. Add each digit of A and B using binary addition
2. If sum of two digits is more than 9 then result is Invalid BCD and add 6 to the result, Otherwise result is valid BCD.
3. If carry then add it to the next bits

Add 32413 and 84646 using BCD addition

| | | |
|---|---|---|
| BCD code for 32413 : | 0011 0010 | 0100 0001 0011 |
| BCD code for 84646 : | 1000 0100 | 0110 0100 0110 |
| Addition : | 1011 0110 | 1010 0101 1001 |
| If Invalid BCD then add 6 : | 0110 | 0110 |
| Addition : | 1 0001 0110 | 10000 0101 1001 |
| Remaining bits except carry : | 1 0001 0110 | 0000 0101 1001 |
| Carry : | | 1 |
| Addition : | 1 0001 0111 | 0000 0101 1001 |
| BCD value : | 1 1 7 | 0 5 9 |

So final answer of BCD addition is 1170.59

**16(b)**

**(Or)**

**i) Compute 2’s complement for the following binary values: a. 10011010 b. 00011001010 (4 Marks)**

a. 2’s complement representation: 0110 0110

**Steps:**

Number in Binary = 10011010

Selected Bits = **08**

Binary Number after completing bits = **1001 1010**

**Step 1:**

Taking One's complement of binary number:

Write down the binary Number

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| | | | | |
|---|---|---|---|---|
| 12 | 2 | 1 | 2 | 2.1.2 |

Invert all values (Swap each 0 with 1 and each 1 with 0):

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |

**Step 2:**

Taking Two's complement by adding 1 in the previous binary number:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | |
| + | | | | | | | | 1 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| 0 | 1 | 1 | 0 | | 0 | 1 | 1 | 0 |

Number in 2's complement with 08-bit representation

b. 2's complement representation: 1110 0110 110

**Steps:**
Number in Binary = 00011001010

Selected Bits = **11**

Binary Number after completing bits = **0001 1001 010**

**Step 1:**

Taking One's complement of binary number:

Write down the binary Number

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |

Invert all values (Swap each 0 with 1 and each 1 with 0):

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |

**Step 2:**

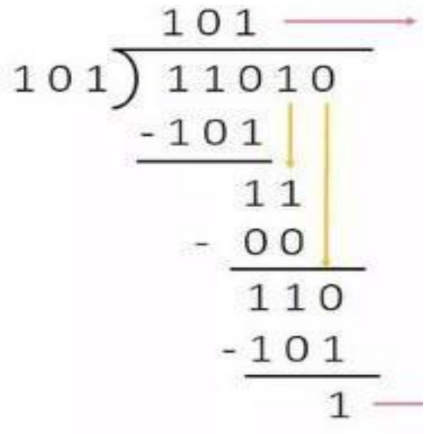
Taking Two's complement by adding 1 in the previous binary number:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | |
| | + | | | | | | | | | | 1 | |
| | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| 1 | 1 | 1 | 0 | | 0 | 1 | 1 | 0 | | 1 | 1 | 0 |

Number in 2's complement with 11-bit represantation

**ii) Divide 11010 by 101 (4 Marks)**

**Answer:**

| | | | | | | |
|---|---|---|---|---|---|---|
| | <br>Ans: $(101)_2$<br><br>**iii) List out the steps to implement the boolean expression using NAND gate. (4 Marks)**<br><br>**<u>Answer:</u>**<br>a. Represent function using AND and OR gate<br>b. Convert all OR gates to invert OR and all AND gates to NAND gates<br>c. Check all the bubbles in the representation, if not balanced, insert an inverter on the same line<br>d. Convert all invert OR and NOT to NAND gate | | | | | |
| **17(a)** | **i) A gaming controller sends input data to a console using Gray code. The last transmitted Gray code was 1101, indicating a button press. The current received Gray code is 1011. Determine which button was released after the press based on the given Gray codes. (4 Marks)**<br>**<u>Answer :</u>**<br>To determine which button was released after a button press, we need to compare the last transmitted Gray code with the current received Gray code and identify the bit position where a change occurred. The bit position that changed will correspond to the button that was released.<br>Given the last transmitted Gray code: 1101<br>Current received Gray code: 1011 Let's compare the two Gray codes bit by bit:<br>• 1st bit (leftmost): No change (1)<br>• 2nd bit: Change from 1 to 0 (released button)<br>• 3rd bit: Change from 0 to 1 (pressed button)<br>• 4th bit (rightmost): No change (1)<br>Based on the comparison, the 2nd bit changed from 1 to 0, indicating that the button associated with the 2nd bit was released after the press.<br>So, the button that was released after the press is the button corresponding to the 2nd bit of the Gray code.<br><br>**ii) Convert the hexadecimal number D4C.82C to its binary, decimal and octal equivalent using the iterative method. Show all the steps. (8 Marks)**<br><br><u>Answer:</u><br><br>**Step 1: Convert Hexadecimal to Binary** | **12** | **2** | **2** | **2** | **2.1.2** |

<table>
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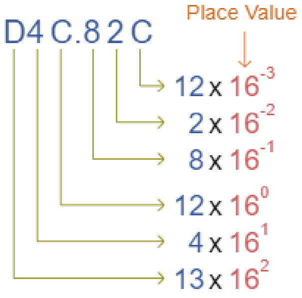
D 4 C . 8 2 C

1101 0100 1100 . 1000 0010 1100

To convert a hexadecimal number to binary, we write 4 bit binary equivalent of each hexadecimal digit in the same order.

$(D4C.82C)_{16} = (110101001100.100000101100)_2$

**Step 2: Convert hexadecimal to decimal**




We multiply each digit with its place value and add the products.

$(D4C.82C)_{16} = (13 \times 16^2) + (4 \times 16^1) + (12 \times 16^0) + (8 \times 16^{-1}) + (2 \times 16^{-2}) + (12 \times 16^{-3})$

$= 3328 + 64 + 12 + \frac{8}{16} + \frac{2}{256} + \frac{12}{4096}$

$= (3404.510742187)_{10}$

**Step 3: Convert Hexadecimal to Octal**

D 4 C . 8 2 C

1101 0100 1100 . 1000 0010 1100

To convert a hexadecimal number to binary, we write 4 bit binary equivalent of each hexadecimal digit in the same order.

$(D4C.82C)_{16} = (110101001100.100000101100)_2$

110 101 001 100 . 100 000 101 100

6 5 1 4 . 4 0 5 4

Starting from the binary point, we partition the binary number into groups of 3 bits. In the whole number part, we proceed to the left and in the fractional part, we proceed to the right.

$(110101001100.100000101100)_2 = (6514.4054)_8$

$(D4C.82C)_{16} = (6514.4054)_8$

**(Or)**

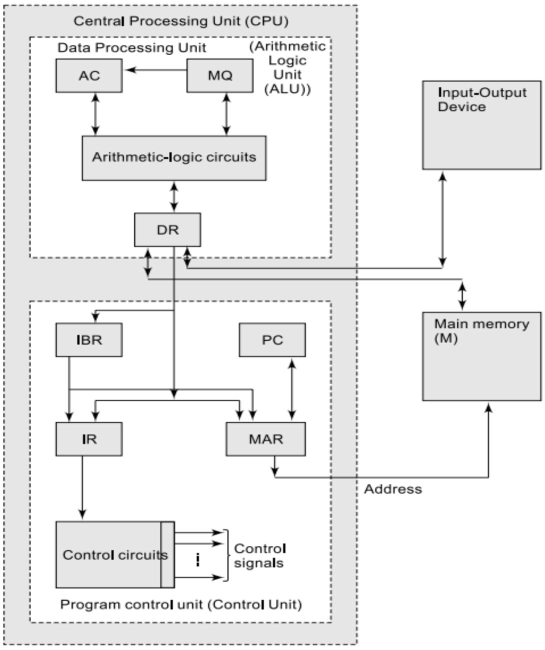
</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>17(b)</td><td>

**How can a connection be made between the processor,i/o unit and main memory to execute a simulation effectively?(12 Marks )**

Diagram (4) – CPU, Main Memory

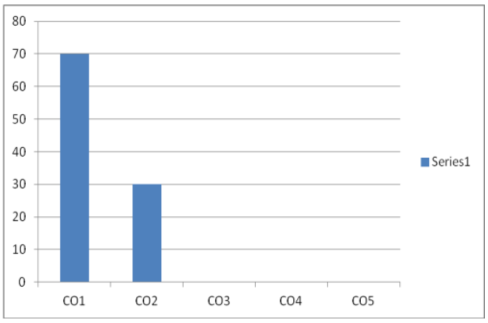
Description (8) – CPU, Control unit, Input device, Output device, main memory, Registers

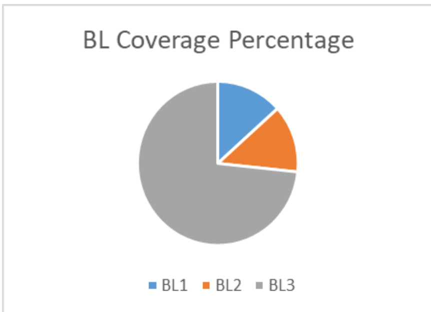
</td><td>12</td><td>2</td><td>2</td><td>1</td><td>2.1.2</td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| | <br><br>● CPU(Central processing unit)<br>○ CU(Control Unit)<br>○ ALU(Arithmetic and logic unit)<br>○ Registers<br>▪ PC<br>▪ IR<br>▪ AC<br>▪ MAR<br>▪ MDR<br>▪ BUSES<br>● I/O Device<br>● MEMORY UNIT | | | | | |

***Performance Indicators are available separately for Computer Science and Engineering in AICTE examination reforms policy.**

**Course Outcome (CO) and Bloom's level (BL) Coverage in Questions**




**Approved by the Audit Professor/Course Coordinator**