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R. V. COLLEGE OF ENGINEERING

Autonomous Institution affiliated to VTU

III Semester B. E. Examinations Nov/Dec-16

Computer Science and Engineering**COMPUTER ORGANIZATION AND ARCHITECTURE****Time: 03 Hours****Maximum Marks: 100****Instructions to candidates:**

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B.

PART-A

1	1.1	List the different steps instruction execution.	02
	1.2	Which registers are used to communicate with memory?	01
	1.3	What is S in basic performance equation?	01
	1.4	Write a rule for subtraction of $2n$ -bit signed numbers.	02
	1.5	Give the bit-pair recoded multiplier for (-6) .	01
	1.6	What is normalized number?	01
	1.7	Registers R_1 and R_2 of a computer contains the decimal values 4000 and 2000 respectively. Calculate the effective address for the instruction $MOV R_5, 30(R_1, R_2)$	01
	1.8	List the operations performed by call instruction.	01
	1.9	Write the set of instructions to determine if the leftmost character is Z. If it is a, conditional branch to Yes is to be made. <i>ASCII</i> code for Z is 01011010 and four <i>ASCII</i> characters are contained in the 32-bit register R_0 .	02
	1.10	Draw one word instruction format.	01
	1.11	What is interrupt latency?	01
	1.12	What is privileged instruction?	01
	1.13	Write status and control word used in <i>DMA</i> controller.	01
	1.14	What is a micro instruction and a micro routine?	02
	1.15	What is the difference between the subtraction instruction <i>SUB</i> and the comparison instruction <i>COMP</i> ?	01
	1.16	State the full form of the acronym <i>RISC</i> and <i>CISC</i> .	01

PART-B

2	a	List the steps needed to execute the machine instruction given below in terms of transfers between the components of processor, memory and some control commands. $ADD LOCA, R_0$. Assume the instruction is stored in memory location "INSTR".	06
	b	Perform the following operations on the 5-bit signed numbers using 2's complement representation system. Further indicate whether overflow has occurred. i) $(-10) + (-13)$ ii) $(-10) - (+4)$ iii) $(+7) - (-15)$.	06
	c	Write the basic performance equation. Explain the role of each of the parameters in the equation on the performance of the computer.	04
OR			

3	a	Using block diagram, explain sequential multiplication and perform multiplication of $(-12) \times (10)$ by using Booth's multiplier.	10
	b	What are the differences between restoring and non-restoring division algorithm. Write the steps for restoring division algorithm.	06
4	a	Define addressing mode and explain any four addressing modes with an example for each.	08
	b	List types of operation to be performed by instruction in a computer. Express different basic types of instruction formats to represent the following 'C'-statement: $C = A + B[C \leftarrow [A] + [B]]$.	08
OR			
5	a	With the help of an assembly level program, give the illustration of subroutine linkage. Also explain the subroutine nesting and parameter passing methods.	08
	b	What is byte addressability? With the help of suitable examples, discuss Big-endian and little-endian addressability.	08
6	a	In a situation where multiple devices capable of initiating interrupts are connected to processor, explain the implementation of interrupt priority, using individual \overline{INTR} and $INTA$ and a common \overline{INTR} line to all devices.	08
	b	What is bus arbitration? Explain the different approaches to bus arbitration.	08
OR			
7	a	Draw a timing diagram and explain the input and output operation of the synchronous bus.	08
	b	Explain the architecture and addressing scheme of <i>USB</i> .	08
8	a	Design and explain $4MB \times 32$ memory organization using $512KB \times 8$ memory modules.	08
	b	Write control word where individual bits represent the various control signals for the instruction $ADD(R_3), R_1$. Assume control sequences for execution of the above instruction uses single bus architecture.	08
OR			
9	a	With a block diagram, describe the organization of a micro programmed control unit.	08
	b	Define cache memory and describe any two mapping function in cache.	08
10	a	How does unconditional branch instruction affect the pipelines stall? How can this effect be handled? Explain.	08
	b	Explain the <i>NUMA</i> architecture with a neat diagram.	08
OR			
11	a	Explain 4 -stage pipeline and show how pipelining is most effective in improving performance.	08
	b	Write a brief note on the following: i) Clusters ii) Multiprocessors.	08

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III Semester B. E. Examinations Nov/Dec-16
Common to CSE / ISE
DISCRETE MATHEMATICAL STRUCTURES

Time: 03 Hours**Maximum Marks: 100****Instructions to candidates:**

3. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
4. Answer FIVE full questions from Part B.

PART-A

1	1.1	How many arrangements are there of all letters in <i>SOCIOLOGICAL</i> ?	01
	1.2	Rewrite the following statement as an implication in if-then form "Soumya will be allowed on Suraj's motorcycle only if she wears helmet".	01
	1.3	Define an Injective function.	01
	1.4	Define group code.	01
	1.5	A student is to answer seven out of ten questions on an examination. In how many ways can he make his selection if: i) There are no restrictions ii) He must answer the first two questions.	02
	1.6	Let $p(x)$ be the open statement " $x^2 = 2x$ ", where the universe comprise of all integers. Determine whether each of the following statements is true or false: a) $p(0)$ b) $p(1)$ c) $p(2)$ d) $\exists x p(x)$.	02
	1.7	If there are 2187 functions $f: A \rightarrow B$ and $ B = 3$, what is $ A $?	02
	1.8	Find a recurrence relation with initial condition, that uniquely determines the following geometric progression: 6, -18, 54, -162, ...	02
	1.9	Determine whether $R = \{(x, y) x, y \in Z, y = x^2 + 7\}$, a relation from Z to Z , is a function. Find its range if it is a function.	02
	1.10	Let C be a set of code words, where $C \subseteq Z_2^7$. In the following, two of e (error pattern), r (received word) and c (code word) are given with $r = C + e$. Determine the third term: i) $c = 1010110, r = 1011111$ ii) $c = 1010110, e = 0101101$.	02
	1.11	Define cyclic group with an example.	02
	1.12	Show that $n^3 - n$ is divisible by 3, where n is positive integer.	02

PART-B

<div>2</div> <div>a</div> <div>b</div> <div>c</div>	<p>Three students write an examination. Their chances of passing are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$, respectively. find the probability that:</p> <ol style="list-style-type: none"> All of them pass Atleast one of them pass Atmost two of them pass. <p>Consider the following program segment, where i, j, and k are integer variables:</p> <pre>for i ← 1 to 20 do for j ← 1 to i do for k ← 1 to j do print (i * j + k).</pre> <p>How many times is the print statement executed in this program segment?</p> <p>Find and list all the dearrangements of 1,2 3,4.</p> <p style="text-align: center;">OR</p>	<div>06</div> <div>06</div> <div>04</div>
<div>3</div> <div>a</div> <div>b</div> <div>c</div>	<p>In a survey of 260 college students the following data were obtained: 64 had taken machine learning course, 94 had taken cloud computing, 58 had taken big data, 26 had taken both machine learning and cloud computing , 28 had taken machine learning and big data, 22 had taken cloud computing and big data and 14 had taken all the three courses. In the survey:</p> <ol style="list-style-type: none"> How many students had taken none of the three courses? How many had taken only cloud computing course? <p>Define the cartesian product of two sets. For non empty sets A, B and C, prove that $A \times (B - C) = (A \times B) - (A \times C)$.</p> <p>Find the rook polynomial for the standard 8×8 chess board. State for $n \times n$ chess board too.</p> <p style="text-align: center;">OR</p>	<div>06</div> <div>06</div> <div>04</div>
<div>4</div> <div>a</div> <div>b</div> <div>c</div>	<p>State the induction principle. Prove by induction that $6^{n+2} + 7^{2n+1}$ is divisible by 43 for each positive integer n.</p> <p>For the sequence $\{a_n\}$ defined recursively by $a_1 = 8, a_2 = 22, a_n = 4(a_{n-1} - a_{n-2})$ for $n \geq 3$, prove that $a_n = (5 + 3n)2^{n-1}$ for $n \geq 1$.</p> <p>Find a_{12} if $a_{n+1}^2 = 5a_n^2$.</p> <p style="text-align: center;">OR</p>	<div>06</div> <div>06</div> <div>04</div>
<div>5</div> <div>a</div> <div>b</div> <div>c</div>	<p>If F_0, F_1, F_2, \dots are fibonacci numbers, prove that $\sum_{i=0}^n F_i = F_{n+2} - 1$.</p> <p>Solve the recurrence relation $2a_n = 7a_{n-1} - 3a_{n-2}$; $a_0 = 2, a_1 = 5$.</p> <p>Show that $2^n > n^2$ whenever n is a positive integer greater than 4.</p> <p style="text-align: center;">OR</p>	<div>06</div> <div>06</div> <div>04</div>
<div>6</div> <div>a</div> <div>b</div> <div>c</div>	<p>Define the converse and the inverse of a conditional. State the converse and inverse of the following statement "If Suraj can solve then puzzle ten Suraj can solve the problem".</p> <p>Prove that $(p \rightarrow (q \vee r)) \leftrightarrow ((p \wedge \sim q) \rightarrow r)$ is a tautology.</p> <p>Establish the validity of the argument</p> <p>$(q \vee \sim r) \vee s$ $\sim q \vee (r \wedge \sim q)$ therefore $r \rightarrow s$</p> <p style="text-align: center;">OR</p>	<div>06</div> <div>06</div> <div>04</div>

7	a	Test the validity of the argument: All employers pay their employees <u>Mukesh is an employer</u> therefore Anil pays his employees.	06
	b	Prove by contradiction that “ if n^2 is an odd integer then n is odd “.	06
	c	Prove that for all real numbers x and y if $x + y \geq 100$ then $x \geq 50$ or $y \geq 50$.	04
8	a	If $A = \{1,2,3,4\}$ and R is a relation on A defined by $R = \{(1,2), (1,3), (2,4), (3,2), (3,3), (3,4)\}$ find R^2 and R^3 . Also draw their digraphs.	06
	b	Find the number of equivalence relations that can be defined on a finite set A with $ A = 6$.	06
	c	Let $A = \{1,2,3,4\}$, f and g be functions from A to A given by: $f = \{(1,4), (2,1), (3,2), (4,3)\}$ $g = \{(1,2), (2,3), (3,4), (4,1)\}$ Prove that f and g are inverses of each other.	04
OR			
9	a	Let $A = \mathbb{R}, B = \{x x \text{ is real and } x \geq 0\}$. Is the function $f: A \rightarrow B$ defined by $f(a) = a^2$ an onto function? a one to one function?	06
	b	Let $A = \{1,2,3,4,5,6,7\}$ and R be an equivalence relation on A that induces the partition: $A = \{1,2\} \cup \{3\} \cup \{4,5,7\} \cup \{6\}$. find R .	06
	c	Draw the Hasse diagram representing the positive divisors of 36.	04
10	a	The parity check matrix for an encoding function $E: \mathbb{Z}_2^3 \rightarrow \mathbb{Z}_2^6$ is given by $H = \begin{pmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 \end{pmatrix}.$	
	b	i) Determine the associated generator matrix. ii) Does this code correct all single errors in transmission?	06
	c	i) Define cyclic group. ii) Prove that the group $(\mathbb{Z}_4, +)$ is cyclic. Find all its generators.	06
OR			
11	a	A binary symmetric channel has probability $p = 0.05$ of incorrect transmission. If the word $c = 011011101$ is transmitted, what is the probability that i) A single error occurs ii) A double error occurs iii) A triple error occurs.	06
	b	Show that any group G is abelian iff $(ab)^2 = a^2b^2$ for all $a, b \in G$.	06
	c	Prove that every subgroup of a cyclic group is cyclic.	04