COLLEGE OF ENGINEERING, PUNE
(An Autonomous Institute of Government of Maharashtra.)

(MA - 20005) Multivariate Calculus and Differential Equations

Course: Direct Second Year, Semester IV
Academic Year: 2022-2023
Duration: 3 Hours

Branch: All Branches
Max.Marks: 60
Date: 13/06/2023

Student MIS NO. : ☐☐☐☐☐☐☐☐

Instructions:

(1) Figures to the right indicate maximum marks and course outcomes.
(2) Mobile phones and programmable calculators are strictly prohibited.
(3) Writing anything on question paper is not allowed.
(4) Exchange/Sharing of stationery, calculator etc. not allowed.
(5) Write your MIS Number on Question Paper.

Q1. Attempt the following questions:

(a) Find the Wronskian for the set of functions $f_1 = 1 - x, f_2 = 1 + x, f_3 = 1 + 3x$. [2](CO2) 0

(b) Check whether the following differential equation is exact. If not, find an integrating factor. [3](CO3) 3

$$(x^4 + y^2)dx - xydy = 0.$$

(c) Using the method of undetermined coefficients, obtain a general solution of non-homogeneous differential equation [5](CO3) 5

$$y'' + 6y' + 9y = 50e^{-x}\cos x.$$

Q2. Answer the following:

(a) State and prove linearity principle of the Laplace transform. [2](CO4) 1

or

Is $\mathscr{L}\{f(t)g(t)\} = \mathscr{L}\{f(t)\}\mathscr{L}\{g(t)\}$? Explain. [2](CO4)

(b) Solve the following linear integral equation: [4](CO3) 2½

$$y(t) = 1 - \sinh t + \int_0^t (1 + \tau)y(t - \tau)d\tau.$$

Q3. Answer the following:

(a) Write the domain and range of the function $f(x, y) = \dfrac{1}{4x^2 + 9y^2}$. [3](CO2) 2½

(b) Show that the function $f(x, y) = \dfrac{2x^2y}{x^4 + y^2}$ has no limit as (x, y) approaches (0,0). [2](CO3) 0

(c) (i) Find the derivative of $f(x,y) = xe^y + \cos(xy)$ at the point (2,0) in the direction of $\bar{v} = 3\hat{i} - 4\hat{j}$. [3](CO3)

or

(ii) Find the local extreme values of the function $f(x,y) = xy - x^2 - y^2 - 2x - 2y + 4$. [3](CO3)

3

Q4. Attempt the following:

(a) Sketch the region of integration for the integral [3](CO2)

$$\int_0^2 \int_{x^2}^{2x} (4x+2)\,dy\,dx$$

and write an equivalent integral with the order of integration reversed.

(b) (i) Find the area enclosed by the lemniscate $r^2 = 4\cos 2\theta$. [3](CO3)

or

(ii) Evaluate the integral $\int_0^1 \int_0^{\sqrt{1-x^2}} (x^2+y^2)\,dy\,dx$. [3](CO3)

(c) Using the transformation $u = x - y,\ v = 2x + y$, evaluate the integral [4](CO3)

4

$$\iint_R (2x^2 - xy - y^2)\,dx\,dy$$

for the region R in the first quadrant bounded by the lines $y = -2x+4,\ y = -2x+7,\ y = x - 2,\ y = x + 1$.

Q5. Answer the following questions:

(a) Find the volume of the smaller region cut from the solid sphere $\rho \le 2$ by the plane $z = 1$. [4](CO3)

3½

(b) (i) Show that the integral $\int_C F \cdot dr = \int_C (2x\,dx + 2y\,dy + 2z\,dz)$ is path independent in any domain in space and find its value in the integration from $A : (0,0,0)$ to $B : (2,2,2)$. [4](CO4)

1

or

(ii) Let $f : \mathbb{R}^3 \to \mathbb{R}$ be a real valued function and $v : \mathbb{R}^3 \to \mathbb{R}^3$ be a vector valued function then prove that [4](CO4)

(A) curl(grad f) = 0 (B) div(curl v) = 0

(c) State Green's theorem. Verify the same for $F = [x^2e^y, y^2e^x]$ defined over the closed rectangle with vertices $(0,0), (2,0), (2,3), (0,3)$. [6](C01,CO3)

3

Q6. Attempt the following questions:

(a) (i) Compute the flux of water through the parabolic cylinder $S : y = x^2, 0 \leq x \leq 2, 0 \leq z \leq 3$ if the velocity vector is $\bar{v} = [3z^2, 6, 6xz]$, velocity being measured in meters/second. [4](CO3)

or

(ii) Find the line integral when $F(\bar{r}) = [-x, -xy]$ and the curve $C : \bar{r}(t)$ is the circular arc of the circle with center at origin and radius 1 in first quadrant. [4](CO3)

(b) Solve the following PDE by method of separation of variables. (Any one) [3](CO3)

(i) $u_{xx} + u_y = 3u$ and $u(0, y) = e^{-5y}$

(ii) $u_{xt} = e^{-t} cos x$ and $u(x, 0) = 0$

(c) (i) State the standard assumptions and derive the one dimensional wave equation which governs the transverse vibrations of an elastic string of length L. [5](CO5)

or

(ii) Consider the heat equation: $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ along with the conditions:

$$u(x, 0) = f(x) = k \sin(\pi x/5), \quad u(0, t) = 0, \quad u(L, t) = 0,$$

where $L = 10\ cm, \rho = 10.6\ gm/cm^3, K = 1.04\ cal/cm\ sec°C, \sigma = 0.056\ cal/gm°C$.

(a) Find the value of c. [1](CO1)

(b) State the standard assumptions to derive the solution of heat equation. [1](CO1)

(c) Find the solution of the above heat equation. [3](CO3)

** Good Luck **

COLLEGE OF ENGINEERING, PUNE
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Multivariate Calculus and Differential Equations

Test I

Course: Direct Second Year, Semester IV
Academic Year: 2022-2023
Duration: 1 Hour

Max. Marks: 20
Date: 31/03/2023

Student MIS NO. : ☐☐☐☐☐☐☐☐☐

Instructions:

(1) All questions are compulsory.
(2) Figures to the right indicates full marks.
(3) Mobile phones and programmable calculators are strictly prohibited.
(4) Writing anything on question paper is not allowed.
(5) Exchange/Sharing of stationery, calculator etc. not allowed.
(6) Write your MIS Number on Question Paper.

Attempt the following questions.

(1) State the order of the differential equation $y''' = \cos x$. Verify that the function $y = -\sin x + ax^2 + bx + c$, where a, b, c are constants, is a solution to the given differential equation. [CO2][3]

(2) Solve the following differential equations: [CO3][5]
(a) $2xyy' = y^2 - x^2$.
(b) $y'' + 4y' + (4 + \omega^2)y = 0$, where ω is a constant.

(3) When do we say a first order differential equation is an exact differential equation? Check whether the differential equation $\left(2x + \frac{1}{y} - \frac{y}{x^2}\right) dx + \left(2y + \frac{1}{x} - \frac{x}{y^2}\right) dy = 0$ is exact or not. Justify your answer. [CO1,CO3][3]

(4) Find an integrating factor to the following differential equation and hence solve [CO3][4]

$$(e^{x+y} + ye^y)dx + (xe^y - 1)dy = 0. \quad y(0) = -1.$$

(5) Find general solution of the ODE $3y'' + 10y' + 3y = 9x + 5\cos x$, using the method of undetermined coefficients. [CO3][5]

** Good Luck **

MIS Number 1 4 2 2 0 3 0 1 3

COLLEGE OF ENGINEERING, PUNE

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END SEMESTER EXAMINATION

(CT-20015) DATA COMMUNICATION

Programme : S. Y. B. Tech.	Semester : Autumn
Course Code : CT- 20015	Course Name : Data Communication
Branch : Computer Engineering	Academic Year : 2022-23
Duration : 3 Hours	Max Marks : 60

Instructions:

1. *Figures to the right indicate the full marks.*
2. *Assume suitable data wherever necessary.*
3. *Writing anything on question paper is not allowed.*
4. *Exchange/Sharing of stationery, calculator etc. not allowed.*
5. *Write your MIS Number on Question Paper*

			CO	PO
Q.1. A	Compare star, mesh, bus and ring network topologies w.r.t. 1. Cost-effectiveness 2. Robustness 3. Speed of communication 4. Security/privacy 5. Scalability / flexibility	[05]	2, 4	1,5
Q.1. B	Why is protocol required in data communication? Explain any four functions of a protocol.	[05]		
Q. 2. A	Assume that a voice channel occupies a bandwidth of 4 kHz. We need to multiplex 10 voice channels with guard bands of 500 Hz using FDM. Calculate the required bandwidth.	[04]	1, 3	2,3
Q. 2. B	Explain multilevel multiplexing. Show how multiple slots are allocated to single input line. Also discuss pulse stuffing.	[06]		
Q. 3. A	How does blocking happen in multistage switch? Discuss Clos' criteria to avoid blocking.	[05]	3,4	2,4
Q. 3. B	Compare and contrast circuit-switched network and a packet-switched network.	[05]		

Q. 4. A Generate the checksum for the data

01111100 **[04]**

2

dividing the data into 4-bits.
Show whether data is accepted or rejected at receiver. 2,5 4,5

Q. 4. B Explain the encoding and decoding mechanism in Cyclic Redundancy Check (CRC). **[04]**

Q. 5. A Illustrate with a neat diagram the control field format for instructional frame (I-frame) in HDLC protocol. **[05]**

3,5 1,4

Q. 5. B What is framing? Why is framing important service at Data Link Control layer? **[05]**

Q. 6. A Discuss the working of ALOHA protocol. How does the protocol work after frame collide? Elaborate the time in which there is possibility of collision. **[06]**

1

1,4 2,3

Q.6. B With a neat sketch explain select and poll functions in polling-access method. **[06]**

1

MIS Number | | | | | | | | | |

COLLEGE OF ENGINEERING, PUNE

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Test T1 Examination

DATA COMMUNICATION

Programme : S. Y. B. Tech.	**Semester : Autumn**
Course Code : CT-20015	**Course Name : Data Communication**
Branch : Computer Engineering	**Academic Year : 2022-23**
Duration : 1 Hr	**Max Marks : 20**

Instructions:

1. ***Figures to the right indicate the full marks.***
2. ***Mobile phones and programmable calculators are strictly prohibited.***
3. ***Writing anything on question paper is not allowed.***
4. ***Exchange/Sharing of stationery, calculator etc. not allowed.***
5. ***Write your MIS Number on Question Paper***

Marks

Q.1. What do you mean by data communication? Identify and explain the components of a data communications system. **[06]**

Q.2. For each of the following four networks, discuss the consequences if a connection fails. **[04]**

a. Five devices arranged in a mesh topology.
b. Five devices arranged in a star topology (not counting the hub).
c. Five devices arranged in a bus topology.
d. Five devices arranged in a ring topology.

Q. 3. A. A signal travels from point A to point B. At point A, the signal power is 100 W. At point B, the power is 90 W. What is the attenuation in decibels? **[02]**

B. Calculate Propagation and Transmission Time for a message of size 3 Kb assuming that the bandwidth of network is 1 Gbps, distance between sender and receiver is 15000 km and light travels at 2.4×10^8 m/s. **[03]**

Q. 4. Why is multiplexing needed in transmission of signals? Describe any one multiplexing technique. **[05]**

MIS Number

COLLEGE OF ENGINEERING, PUNE

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Test T2 Examination

DATA COMMUNICATION

Programme : S. Y. B. Tech.	**Semester : Autumn**
Course Code : CT-20015	**Course Name : Data Communication**
Branch : Computer Engineering	**Academic Year : 2022-23**
Duration : 1 Hr	**Max Marks : 20**

Instructions:

1. *Figures to the right indicate the full marks.*
2. *Assume suitable data wherever necessary.*
3. *Writing anything on question paper is not allowed.*
4. *Exchange/Sharing of stationery, calculator etc. not allowed.*
5. *Write your MIS Number on Question Paper*

Q.1. How is packet switching done in a Virtual Circuit Network (VCN)? Explain its three phases in detail. **[05]**

Q.2. Why the minimum Hamming distance between the valid codes must be **(s + 1)** for the system to detect up to s errors? Justify your answer with suitable example. **[05]**

Q. 3. Explain the encoding and decoding mechanism in Parity check code. (Assume for even parity) **[05]**

Q. 4. In a data link protocol following character encoding is used. **[05]**

A – 01000111
B – 11100011
FLAG – 01111110
ESC – 11100000

Show the arrangement of 4-character frame

A B ESC FLAG

to be sent by the sender to the receiver.

COLLEGE OF ENGINEERING, PUNE

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END Semester Examination

Programme: B.Tech
Course Code: CT16002
Branch: Mechanical Group
Duration: 180 min
Student PRN No.

Semester: III
Course Name: Biology for Engineers
Academic Year: 2022-23 (ODD)
Max Marks: 60

Instructions:

1. Figures to the right indicate the full marks
2. Mobile phones and programmable calculators are strictly prohibited
3. Writing anything on question paper is not allowed except your PRN number
4. Exchange/Sharing of stationery, calculator etc. not allowed
5. Support your answers with diagram/ diagrammatic representation/ flow chart etc.
6. Please attempt all the sub-questions together under each question
7. Scratching or overwriting or re-writing attempts to objective questions would not be assessed

			Marks	CO
Q 1	a)	**Solve the following questions**	02 2	1
	i	Which of the following element is NOT a component of amino acids? a-S; b- C; c- H; d: I		
	ii	There are two DNA samples A and B of same length 1260 base pairs. If A has 260 adenines; and B has 360 Guanines answer the following questions – a. What is the concentration of all other nucleotides in sample A? b. What is the concentration of all other nucleotides in sample B? c. If sample A and B are subject to denaturation via increase in temperature; which of them will melt faster?		
	b)	**Draw and label ANY ONE of the following**	02 2	1
	i	Draw a schematic of stages of protein structures in its assembly.		
	ii	Draw a DNA double helix.		
	c)	**Attempt ANY TWO from the following.**	06 5	1
	i	Explain how the saturated and unsaturated lipids can have structure-based functions		
	ii	Mention various types of RNA and elaborate their roles as biomolecule.		
	iii	Describe the diversity of protein functions with reason.		
	iv	Elaborate on the classification of carbohydrates		
Q 2	a)	**Compare the following among prokaryotes and Eukaryotes**	02 0	1,2
	i	Ribosomes		
	ii	ATP generation		
	iii	Outermost layers of cell		
	iv	Organisation of genetic material		
	b)	**Draw ANY ONE from the following.**	02 0	1
	i	A cell with primitive nucleus		
	ii	A cell with advanced nucleus		
	c)	**Answer ANY TWO from the following.**	06 1	1,2
	I	Name the semi-autonomous cell organelles exclusively from plant and explain the ultrastructure.		
	ii	Similarities and differences between plant and animal cell.		

	iii	Events of endosymbiosis for evolution of plant and animal cell.		
	iv	Explain the role of cell organelles: Ribosomes, Lysosomes, Endoplasmic reticulum, Golgi		
Q 3	a)	**Write reactants (input) and products (output) of the following processes**	02 0	2
	I	Electron transport chain		
	ii	Glycolysis		
	iii	Reaction involving PS-I only		
	iv	Curdling of milk		
	b)	**Draw ANY ONE of the following**	02 0	2
	I	Site of cellular respiration		
	ii	Schematic for light independent reactions of photosynthesis		
	c)	**Elaborate on (ANY TWO)**	06 5	2
	i	Summary of number of ATP's generation in cellular respiration.		
	ii	Non Cyclic Photophosphorylation		
	iii	Kreb's cycle		
	iv	Explain first and second law of thermodynamics with suitable biological examples.		
Q 4	a)	**Solve the following**	02 1	3,5
		Following are the sequences are from 'Anticoding' strand of a gene- Sequence 1: 5'- CCGATT-3' Sequence 2: 5'-TATTAC-3' Answer the following questions		
	i	What are the fragments of mRNA that can be formed from these sequences?		
	ii	Out of the two sequences, which one belongs to the beginning of the coding frame for protein synthesis? Why?		
	iii	Which one belongs to the of end of the coding frame? Why?		
	iv	What are the sequences of the corresponding fragments from 'template/coding' strand?		
	b)	**Draw schematic representation of ANY ONE of the following**	02 2	3,5
	I	Steps in DNA hybridization		
	ii	Steps in cloning		
	c)	**Discuss the following (ANY TWO)**	06 5	3,5
	I	Transcription and translation		
	ii	Procedure and application of DNA microarray		
	iii	Features of DNA replication		
	iv	Application areas of PCR		
Q 5	a)	**Match the minerals to their involvement in complex biological processes**	02 1	4
	i	Ca part of ribosomes		
	ii	Mg functioning of thyroid		
	iii	I role in nerve impulse		
	iv	Na role in blood coagulation		
	b)	**Draw a schematic of ANY ONE:**	02 0	4
	i	Active transport mechanism		
	ii	Fluid mosaic model		
	c)	**Elaborate on .. (ANY TWO)**	06 5	4
	i	Adaptive immunity		
	ii	Role of hypothalamus in thermoregulation		
	iii	Distinguish between Xylem and Phloem		
	iv	Haemoglobin		
Q 6	a)	**Identify the statements as True or False and correct the False statements**	02 1	5

	i	There are similarities between cancer cells and Stem cells.		
	ii	Materials which degrade because of biological substances and fluids are not good candidates for scaffold synthesis		
	iii	DNA microarray can tell differences in proteome of cells with same genetic material		
	iv	DNA cannot be visualised even after PCR based amplification.		
	b)	**Draw ANY ONE from the following**	02	5
	i	Schematic diagram of process of cell culture		
	ii	Components of Tissue engineering		
	c)	**Discuss ANY TWO from the following with suitable examples/s ..**	06	5
	i	Use of biological patterns in industrial design		
	ii	Contribution of engineering to medical/biological sciences		
	iii	Role of CAD/CAM in Tissue engineering		
	iv	Survival strategy of your favourite living form and its adaptations for enabling survival.		

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COLLEGE OF ENGINEERING PUNE

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END Semester Examination

Programme: B.Tech
Course Code: CS 401
Branch: Computer Engineering
Duration: 3 hours
Student PRN No. | 1 | 4 | 2 | 2 | 0 | 3 | 0 | 1 | 3 |

Semester: IV
Course Name: Theory of Computation
Academic Year: 2022-23
Max Marks: 60

Instructions:

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper/Hall Ticket is not allowed.
4. Exchange/Sharing of stationery, calculator, etc. not allowed.
5. Write your PRN Number on the Question Paper.
6. Answer all six complete questions.

			Marks	CO	PO
Q 1	a	Design a DFA that recognizes the language L = {w ∈ {a, b}* |w| ≥ 2 and the second-to-last symbol of w is b }.	3	1	1
	b	Let L_1 = {w| w ends with a 0}. Let L_2 = {w | w has an odd number of 1's}. Construct a DFA for $L_1 U L_2$. Which of the following strings are in $L_1 U L_2$? i) 000100101 ii) 1110011 iii) 010111101 iv) 101111 v) 0011011	4	1	1
	c	"The odd length strings over the alphabet {a, b} under Kleene star is closed". State whether the statement is true or false. Also, justify your answer.	3	2	1
Q 2	a	Given the language over {a, b}, L = $(abb)^+aba$. Find NFA for L.	2	1	1
	b	Obtain the DFA for L from the NFA obtained in question 2a	3	2	1
	c	Consider the homomorphism, h(0) = aba, h(1) = abb. For the DFA in question 2b, find the DFA for $h^{-1}(L)$.	3	2	1
	d	What is the regular expression to represent the $h^{-1}(L)$ in question 2b?	2	2	1
Q 3	a	Construct Regular Expression ~~for the~~ or CFG language over {a, b}, i) L = {xyx^R | x ∈ $\{a, b\}^+$, y ∈ $\{a, b\}^*$} ii) L= {a^{2n} | n ≥ 1}.	2 1	3	1
	b	Is $(((a^*b^*)^* (b^*a^*)^*)^* = (a+b)^*$? Justify your answer.	2	2	1

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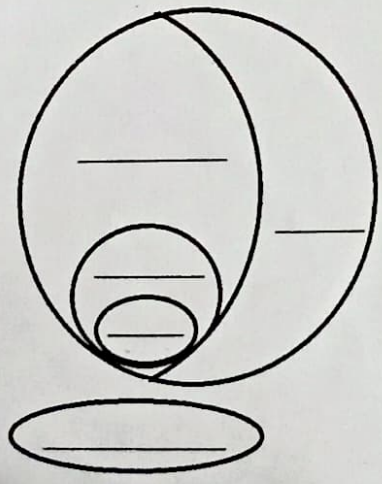
	c	For the Language over {a, b}, L= {a^+}, do the following: i) Find the complement DFA. ii) Find the simplified regular expression for the result DFA of question 3(i) using the state elimination method.	2 3	2	
Q 4	a	Show that the language L = {$\|w\|_a = \|w\|_b$ | w ∈ {a, b}*} is not inherently ambiguous. Here, $\|w\|_a$ represents the number of a's in w.	3	1	1
	b	Prove that the language L= $a^n b^n c^i$| i ≤ n is not CFL.	3	1	1
	c	Provide a Push Down Automata that generates the language 00*1*. Write the S productions for the equivalent Context Free grammar. Also, write the production rules for consuming the first 0 of the string in the language.	4	2	1
Q 5	a	Let L1, L2, and L3 be languages defined over the alphabet Σ = {a, b}, where • L1 consists of all possible strings over Σ except the strings w1, w2, . . . , w100; i.e., start with all possible strings over the alphabet, take out 100 particular strings, and the remaining strings form the language L1; • L2 is recognized by an NFA; and • L3 is recognized by a PDA. What type of language is (L1 ∩ L2)L3? Justify your answer.	2	1	1
	b	Prove that L = {$a^m b^k c^n$ | m ≥ k ≥ n } ~~(where $\|w\|_a$ means the number of a's in w)~~ is recursively enumerable. Demonstrate the moves with the string instances: i. aaabbc ii. aabbcc	5	2	1
	c	Design a Turing machine that will perform $q_0 w \vdash q_f ww$, where q_0 is the start state, q_f is the final state and w belongs to {a, b}*.	3	3	1
Q 6	a	Mark each language's name in the appropriate set in the diagram below. 	2	1	1

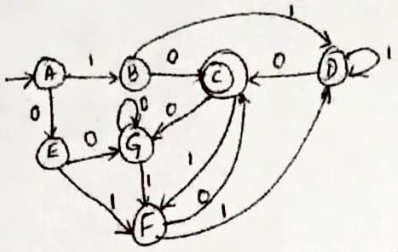
b	Assume that there exists a reduction ≤ from language A to language B., represented as A ≤ B. Fill in the following: i. If A ≤ B and _____ is recursive, then _____ is also recursive. ii. If A ≤ B and _____ is Recursively Enumerable, but not recursive then _____ is also Recursively E, but not recursive. iii. If A ≤ B and _____ is Non- Recursively Enumerable, then _____ is also Non- Recursively Enumerable.	2	4	1
c	Say true or false. i. The complement of the Universal Turing Machine is TM-recognizable. T ii. The language { ⟨M⟩ | L(M) is finite or infinite } is undecidable. F iii. If A reduces to B and A is decidable, then B is decidable. T iv. A function f(x, y) = x*y is TM decidable. F v. The below given function for some integer input parameters is not decidable, but, TM recognizable. F mystery(x,y) if (x > y) then mystery((x - y), y) else mystery((y - x), x) vi. Define a language L as: ⟨A, k⟩ where A is an NFA, k is an integer and A rejects all strings of length ≤ k. Then L is decidable. T	3	1	1
d	Prove that A = {<M> | M is a DFA that doesn't accept any string containing an odd number of 1's} is decidable.	3	1	1

College of Engineering Pune
Dept of Computer Engineering and Information Technology
Second Year B.Tech Computer Engineering
Theory of Computation – Test1

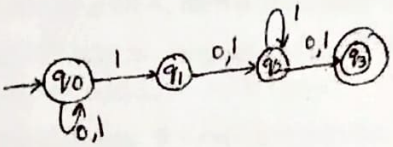
15/04/2023 Time-11 pm to 12 pm Max Marks - 20

Answer all Questions.
Marks for each question are given along with

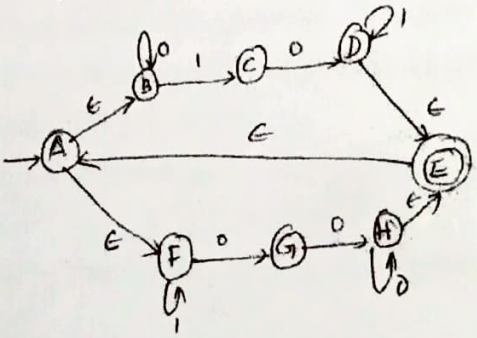
1. Obtain a DFA that will accept all strings in {0, 1} ending in 1 and not containing the substring 00. (2 marks)
2. Is the language L over {a, b} regular? Why? (3 marks)
   L= {w| $n_a(w)$ mod 3 > $n_b(w)$ mod 3}, where $n_a(w)$ is the number of 'a' in w.
3. Give NFA with six states for recognizing the strings over {0, 1} containing at least two 0s or exactly two 1s. (3 marks)
4. Minimize the below given DFA (4 marks)



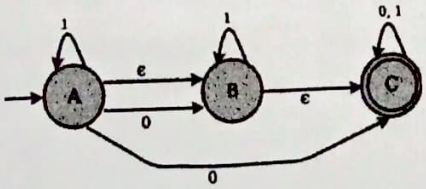
5. Find δ^(q_0, 0011). Show the steps clearly using a tree of threads. (2 marks)



6. Find δ^(A, 010). Show the steps clearly. (3 marks)



7. Find the equivalent DFA (3 marks)



College of Engineering Pune

Dept of Computer Engineering and Information Technology

Second Year B.Tech Computer Engineering

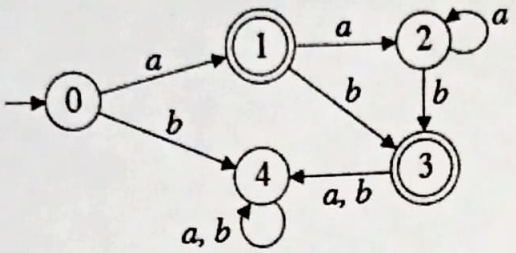
Theory of Computation – Test2

14/05/2023 Time-3 pm to 4 pm Max Marks 13/20

Answer all Questions.

Marks for each question are given along with

1. Prove that $L = \{a^{2k}w \mid w \in \{a, b\}^*, |w| = k\}$ is not regular. (3 marks) 3
2. Find the regular expression using the state elimination method and simplify it. (3 marks) 3



3. Say true or False. (3 marks) 2
   a. Let $A = \{1^{k!} \mid k \geq 0\}$. Then A^* is regular.
   b. If a language is acceptable by a DFA, then it is context-free.
   c. The string "002111302211" is in the language of the CFG over {0, 1, 2} with productions: $S \rightarrow AB$, $A \rightarrow 0A1 \mid 2$, $B \rightarrow 1B \mid 3A$.
   d. Language defined by the grammar: $S \rightarrow abS \mid \varepsilon$ is regular.
   e. The language generated by the grammar with productions defined by $S \rightarrow aSbS \mid bSaS \mid \varepsilon$ is same as the grammar with productions defined by $S \rightarrow aSb \mid bSa \mid SS \mid \varepsilon$.
   f. Given the alphabet $\Sigma = \{a, b, x, y, z, 0, 1\}$ and the regular expression:

      $RE = (a+b+\varepsilon)\,(x+y+(0+1)^*)\,z\,(0+1)^*$,

      The string yxz belongs to the language of the regular expression.
4. Design CFG for $L = \{wa^n a^n w^R \mid w \in \{a, b\}^* \text{ and } n > 0\}$ (2 marks) 0
5. Prove that the CFG $S \rightarrow SaS \mid \varepsilon$ is ambiguous. Remove the ambiguity by eliminating the left recursion. (3 marks) 1.5
6. Covert to Chomsky Normal Form (3 marks) 2

   $S \rightarrow XYZ$, $X \rightarrow Zb$, $Y \rightarrow bW$, $Z \rightarrow AB$, $W \rightarrow Z$, $A \rightarrow aA \mid bB \mid \varepsilon$, $B \rightarrow Ba \mid Bb \mid \varepsilon$
7. Construct a PDA to recognize the language: $\{a^i b^j c^k \mid i, j, k \geq 0, i + k = j\}$. Find the configurations for the string abbbcc. (3 marks) 1.5

COLLEGE OF ENGINEERING, PUNE

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END Semester Examination

(CT-20013) **Microprocessor Techniques**

Course: B.Tech , Semester IV

Branch: Computer Engineering

Academic Year: 2022-2023

Max.Marks:60

Duration: 3 Hours

Date: 21/06/2023

Instructions:

Student MIS Nr

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of stationery, calculator etc. not allowed.
5. Write your MIS Number on Question Paper

			Marks	CO	PO
Q 1	a	Explain the architecture of 8086 with suitable diagram	4	2	1
	b	Write program in assembly language of 8086 to add two 32 bit numbers. First number is stored at 20000H onwards, second number is stored at 30000H onwards and store the result from 40000H onwards	4	3	2
	c	Explain the interrupt structure of 8086 from its type numbers to complete vectoring information. In one sentence each, describe operation and use of all dedicated interrupts with associated instructions wherever necessary. Explain the difference between Call and INT instruction.	4	4	3
Q 2	a	Explain vectored and non vectored hardware interrupts of 8086 with associated flags and instructions, if any	4	1	2
	b	What is the function of RESET signal in the CPU. Explain its importance in light of a general comment that, RESET allows software instructions to give meaningful output by entering into the hardware	4	2	4
	c	Explain with example the addressing modes of 8086	4	2	1
Q 3	a	Interface 64 kbyte of RAM and 32 Kbyte of ROM to 8086. Show how address and data lines are demultiplexed and separate control signals for memory and I/O are generated. Starting address of ROM is 0000:0000H and starting address for RAM is 0000:4000H. Draw the address maps 4000:0000	6	2	5
	b	Write short note on Direct Memory Access signals of 8086	3	4	4
	c	Write a program in assembly language of 8086 to move the contents of a data string of bytes from 40000H to 50000H using MOVSB and LOOP instructions	3	3	2
Q4	a	Interface 8259 in non buffered cascaded specially fully nested mode for edge triggered interrupts with slaves connected to IR4 and IR5 of master 8259. Base addresses of three 8259s are 40H(Master), 50H(Slave4), 60H(Slave5) respectively. Draw the complete interfacing diagram assuming de-multiplexed address and data lines and already decoded IOR and IOW signals are available. Show connections of INT, INTA and SP/EN signals	6	5	5

	b	For Q.4.a above, Initialize all 8259s for relevant parameters through control words. Base type numbers for master 8259 is 30H. Base type number of slave4 is 40H and slave5 is 50H. Write Interrupt Service Subroutines (ISS) of IR4 of Slave4 and Slave5. When IR4 at Slave4 occurs increment contents of memory location 20000H by 1 and when IR4 at slave5 occurs decrement contents of memory location 20000H by 1. Ensure resetting of corresponding bit in the In Service Register before the ISS ends	6	3	4
Q5	a	Design a 4x4 key matrix and 4 digit seven segment common cathode type display interfacing to 8086 through 8279 in encoded mode. Prepare a lookup table for seven segment codes of 0 to F. Explain the difference between encoded and decoded scan mode of 8279	4	4	5
	b	Compare AEOI and non specific EOI in 8259. What is Specially Fully Nested mode	4	4	4
	c	Compare Asynchronous and Synchronous modes of serial communication	4	4	1

Q.4: 8259 Relevant data:

X	X	X	1	LTIM	ADI	SNGL	IC4

ICW1

T7	T6	T5	T4	T3	X	X	X

ICW2

S7	S6	S5	S4	S3	S2	S1	S0

ICW3(MASTER)

0	0	0	0	0	ID2	ID1	ID0

ICW3(SLAVE)

0	0	0	SFNM	BUF	M/S	AEOI	µPM

ICW4

M7	M6	M5	M4	M3	M2	M1	M0

OCW1

R	SL	EOI	0	0	L2	L1	L0

OCW2

R	SL	EOI	
0	0	1	NON SPECIFIC EOI
0	1	1	SPECIFIC EOI
1	0	1	ROTATE ON NON SPECIFIC EOI
1	0	0	ROTATE IN AEOI MODE (SET)
0	0	0	ROTATE IN AEOI (CLEAR)
1	1	1	ROTATE ON SPECIFIC EOI
0	1	0	NO OPERATION

COEP Technological University
Department of Computer Science and IT

S.Y. B. Tech. (Computer Engineering)

MID Semester Examination I

Duration: One Hour **Sub: Microprocessor Techniques** **Max Marks: 20**

(All questions are Compulsory)

Q.1 Draw and Explain the Architecture of 8086 with reference to segmented memory and pipelined architecture. **04**

Q.2 Interface RAM with total capacity of 16 kilobyte, and ROM with total capacity of 32 kilobytes to 8086, by separating the data and address buses and creating even and odd memory banks. Starting address for ROM is FFFF:0000H and starting address of RAM 0000:0000H **04**

Q.3 Explain execution of following instructions of 8086, by taking appropriate example with relevant operands in the registers/memory **04**

a) **REP: MOVSB**

b) **CWD**

c) **IDIV CX**

d) **SS: MOV AX, [BX]**

Q.4 Write a program in assembly language of 8086 to find number of even elements in a byte series. The series starts from 0000:1000, length of the series is stored at 0000:2000, store the result at 0000:3000. **03**

Q.5 Write a program in assembly language of 8086 to set the TRAP flag **02**

Q.6 Draw the diagram of last bus cycle of **MOV AX, [2000H]** and explain the instruction execution details for every bus cycle of the instruction if following data is known: **03**

No. of bus cycles

DS=8000H **[82000]=9AH** **[82001]=8BH** **CS=1000HT**

IP=0000H **AX=1234H**

COEP Technological University
Department of Computer Science and IT
S.Y. B. Tech. (Computer Engineering)
MID Semester Examination II

Duration: One Hour **Sub: Microprocessor Techniques** **Max Marks: 20**

(All questions are Compulsory)

Q.1 Explain in detail interrupt structure of 8086. Describe relevant flags from the flag register. Explain the functions of dedicated interrupts. **04**

Q.2 Interface 8255 to 8086 with the base address of 8000H. Write a program to configure 8255 port A in mode 1 input in interrupt driven data transfer and port B in mode 0 output. Connect $INTR_A$ to NMI for interrupt. **04**

Q.3 For 8255 interfacing design in **Q.2** above, Read port A and output compliment of data read on port A to port B. Explain the operational sequence of handshake and interrupt signals. You may assume data for INTE bits for appropriate port lines. **04**

Q.4 Explain memory mapped I/O and I/O mapped I/O with instructions to access I/O devices in both modes. Explain the relevant pins of 8086 and design of external hardware to generate separate signals for I/O. **04**

Q.5 Draw interfacing diagram and write a program in assembly language of 8086 to display 0123 on multiplexed seven segment displays of common cathode type to 8255 ports. Prepare lookup table for segment ports for display of 0123. Assume all segment LEDs as standard TTL devices. **04**

COLLEGE OF ENGINEERING, PUNE

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End Semester Examination

Programme: B.Tech.

Course Code: ICE(IF)20002

Branch: Electrical, Civil, CSE

Duration: 3 hrs

Student PRN No.

Semester: IV

Course Name: Sensor and Automation

Academic Year: 2022-23

Max Marks: 60

Instructions:

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of stationery, calculator etc. not allowed.
5. Write your PRN Number on Question Paper.

		Marks	CO	PO
Q 1	A chemical manufacturing plant assigned different areas for control of certain processes like raw material storage, CSTR control, packaging of products. DCS scheme is to be chosen for the automation. Discuss different levels of automation in DCS which can be used for the plant. Draw a complete architecture for above DCS system and write down the specifications for the system.	10	3	5,10
Q 2	Explain the aspects of Industry 4.0. Mention the difference between Industries 4.0 and 3.0. Explain the Horizontal and Vertical value chain for Industry 4.0. Discuss Relation between automation pyramid and Industry 4.0.	10	4	3,5,10
Q 3	Considering a suitable example/ application, Review the following points about IoT. 1. Definition and concept 2. Architecture 3. Advantages/Utility 4. Challenges/limitations 5. Applications and examples	10	4	3,5,10
Q 4	**Solve any two questions** A. Name the linear displacement transducer based on change in mutual inductance. Elaborate its working principle with the help of suitable block diagram. What do you mean by residual voltage? Explain it. Can we use the same transducer to identify the direction	10	1,2	1,2,3

	of the displacement? Justify your answer. (5 marks) B. A strain gauge is bonded to abeam of 0.1 m long and has cross-sectional area of 0.4x10-3 m2. Youngs modules of elasticity for steel is 207 GN/ m2. The strain gauge has a unstrained resistance of 240 Ω and gauge factor of 2.20. When is the load applied the gauge resistance changes by 0.013 Ω. Calculate the change in length of the steel beam and the amount of force applied to the beam? (5 marks) 2036 C. The temperature –resistance relationship of platinum is given by the equation below. $R_2=R_1+R_0 \times (\alpha)\ (t_2-t_1)$ with a temperature coefficient of 0.0039 °C. It has a resistance of 140Ω and 100Ω at 100°Cand 0°C respectively. When it is in contact with the hot gas, its resistance becomes 305 Ω. Determine the temperature of the hot gas. Comment on characteristics. (5 marks)			
Q 5	Develop a ladder diagram with defined input and outputs for the given three- motor system: 1. Motor M1 will start by START push button. 2. After M1 is started, Motor M2 will start after 7 seconds. 3. When M2 is running, Motor M3 will be started. 4. When M2 is turned off, M3 will also turn off. 5. When M1 is turned off, both M2 and M3 will stop Make detail analysis of the logic sequence to solve the problem.	10	3	5,10
Q 6	With the help of neat diagram, explain sourcing and sinking operation relation with PLC module. Develop a ladder for following logic gates with truth table and logic equations: 1. NAND gate 2. NOR gate 3. XOR gates	10	3	5,10

----------ALL THE BEST----------

COEP TECHNOLOGICAL UNIVERSITY (COEP Tech)
A Unitary Technological University of Government of Maharashtra
(Formerly College of Engineering Pune (COEP))

School of Electrical and Communication Engg.

Department of Instrumentation and Control Engineering

Test 1

[ICE(IF)-20002] Sensors and Automation

Course: SY (CSE)
Semester: IV
Duration: 1 Hour

Marks: 20
Date: 01-04-2023
Academic Year: 2022-23

Instructions **MIS No.**

1. **Figures to the right indicate full marks.**
2. **Mobile phones are not allowed.**
3. **Exchange/Sharing of anything like stationery, Calculator not allowed.**
4. **Assume suitable data if necessary.**

Q.N.		Marks	Co	Level
Q1	Draw block diagram of Generalised Measurement system. Explain with suitable application. **OR** What are different static characteristics? Explain Precision, Sensitivity and Hysteresis.	05	1	2
Q2	In a test temperature is measured 100 times with various apparatus and procedures. After applying the corrections, the results are **Temp. (°C)**: 397, 398, 399, 400, 401, 402, 403, 404, 405 **Frequency of occurrence**: 1, 3, 15, 20, 37, 15, 5, 2, 2 Calculate 1. Arithmetic Mean 2. Standard deviation 3. Probable error of one reading 4. Variance.	05	2	5
Q3	A thermistor has a nominal resistance of 10 kΩ at 25 °C. To evaluate the thermistor, the resistance at 0 °C is measured as 29.49 kΩ. Calculate and plot the resistance of the thermistor between -40 °C to + 40 °C	05	2	5
Q4	What is self-generating Inductive transducer? With neat schematic diagram and characteristics explain working of LVDT **OR** What is working principal of strain gauge? Derive the equitation of gauge factor.	05	2	4

Best of Luck

COLLEGE OF ENGINEERING PUNE

(An Autonomous Institute of Government of Maharashtra.)

END Semester Examination

Programme: B.Tech ~~/ M.Tech~~

Semester: IV

Course Code:

Course Name: Data Structures and Algorithms II

Branch: Computer Engineering and IT

Academic Year: 2022 - 2023

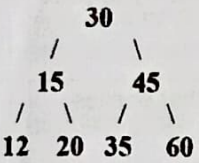
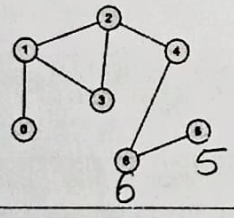
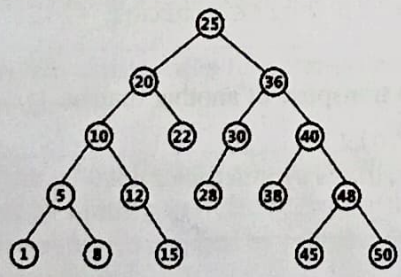
Duration: 3hrs

Max Marks: 60

Student PRN No.

Instructions:

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of stationery, calculator etc. not allowed.
5. Write your PRN Number on Question Paper.
6. Write answer of each section on separate answer scripts. Clearly mention Section on the top.
7. Make suitable assumptions in case of any missing information.

		SECTION A	Marks	CO	PO
Q1	a	 Node 12 is deleted from the Red-Black tree having all black nodes as in the adjoining figure. State the type of imbalance caused. Redraw the tree after deletion clearly indicating color of the nodes.	2	2, 3	1, 2
	b	Consider a min heap with 1023 distinct integers. If root is at level 0, then 10th minimum element will be at what maximum level? Explain.	2	3	1, 2
	c	 List all possible BFS and DFS of the adjoining Graph starting from vertex 2.	2	3	1, 2
	d	 Write post-order and pre-order traversal of this tree.	2	3	1, 2, 3
	e	List the data structure(s) required to implement each of the below algorithms: i. Level Order Traversal of a Binary Tree ii. DFS iii. Kruskal's Algorithm	2	1, 3	1, 2, 3

		iv. Dijikstra			

Q2	a	Write non-recursive code for level order traversal of a binary tree.
		Using type definition:
		`typedef struct node {`
		`  int key;`
		`  struct node *left, *right;`
		`}node;`
		`typedef node *BT;`
		Assume that a suitable data type (like stack, queue, list, etc.) is available and don't write code for it.
			4	1, 2, 3, 4	1, 2, 3

	b	Objective is to sort contents of a file in ascending order using heapsort and store the result in another file. Answer the following: Write complete driver code accepting both files as command line argument. (1 marks) Write initHeap( ) function. (2 mark) + insert of elements Write heapsort( ) function. (2 marks) Write statement to execute this program from Ubuntu terminal. (1 mark) *//Assume other required functions of heap datatype are available.* *//Use suitable prototype for all functions.*	6	1, 2, 4	1, 2, 3, 4
Q 3	a	Write a C function to implement Kruskal's algorithm. Assume availability of required data types like – stack, queue, heap, linked list etc. do not write code for them	4	3	1, 2, 3

	b	Given following type definitions for a sparse matrix, and given that entries are stored in the array 'arr' in *unsorted* order,
		`typedef struct row {`
		`  int r, c, v;`
		`}row;`
		`typedef struct spm {`
		`  row arr[128];`
		`  int nr, nc, n;`
		`}spm;`
		`// r, c, v: row, column, value of a non zero entry`
		`//in the matrix`
		`//  nc = no. of columns, nr = no. of rows of matrix;`
		`//n = no. of elements in 'arr'`
		`//Note entries in` **`arr`** `are not in sorted order`
		
		Write a function to check if one matrix is a transpose of another matrix.
		`int istranspose(spm *a, spm *b);`
		Also write a function to check if a given matrix is symmetric or not
		`int issymmetric(spm *a);`
			6	1, 2, 3, 4	1, 2, 3, 4

COLLEGE OF ENGINEERING, PUNE

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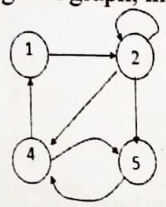
Endsem Examination

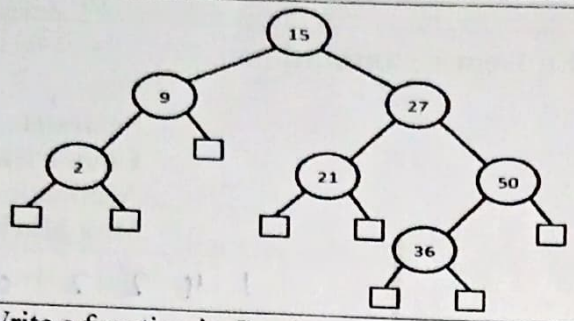
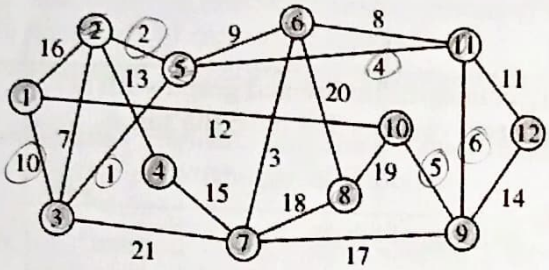
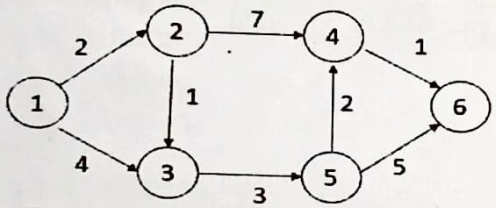
Programme: SY B.Tech
Course Code:
Branch: Computer Engineering
Duration: 3 hour
Student PRN No.

Semester: IV
Course Name: DSA II
Academic Year: 2022- 2023
Max Marks: 60

Instructions: Write answer of each section in separate sheet. Clearly mention the section on the top

SECTION B

Q. No			Marks	CO	PO
4.	a.	State true or false: In any strongly connected undirected graph with at least two vertices, there are always two vertices that have the same degree.	1	1, 2	1, 2
	b.	Complete graph has _____number of edges.	1	1, 2	1, 2
	c.	State true or false: In any undirected graph, the sum of degrees of odd-degree vertices is always an even.	1	1, 2	1, 2
	d.	In given graph, in degree and out degree of 2 is ____ and ____ 	1	1, 2	1, 2
	e.	Using Red Black Tree, insertion or deletion can be implemented using in _____ time.	1	1, 2	1, 2
	f.	If number of nodes 'n' are given in binary tree then minimum and maximum height of the tree will be _____ _____	2	1, 2	1, 2
5.	a.	Explain construction of Expression tree for given postfix expression: ab+cde+*/	3	2, 3	1, 2
	b.	Write a function in C to recover Binary Search Tree. You are given the root of a binary search tree, where the values of exactly two nodes of the tree were swapped by mistake. Recover the tree without changing its structure.	4	3,4	1, 3
6.	a.	Show the AVL tree that results after deletion of the integer keys 9 and 27. Explain process to re-balance after deletion of the given keys.	3	2, 3	1, 2

					
	b.	Write a function in C to insert element in a min heap using array.	3	3,4	1, 3
7.	a.	Consider the graph in figure 1. If we start with node 10 in graph as the starting node and use Prim's algorithm to construct the minimum spanning tree give the order in which nodes enter. Also, give the minimum total weight. 	3	1, 3	1, 2
	b.	Find shortest path between any two vertices using Dijkstra's algorithm for given graph and explain each update of path. 	3	2, 3	1, 2
	c.	Write a function in C to initialize graph from a file and perform BFS from a randomly selected vertex.	4	3,4	1, 3

COLLEGE OF ENGINEERING, PUNE

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T1 Examination

Programme: B.Tech
Course Code:
Branch: Computer Engineering
Duration: 1 hour
Student PRN No.

Semester: IV
Course Name: DSA II
Academic Year: 2022- 2023
Max Marks: 20

Instructions: Write answer of each section in separate sheet. Clearly mention the section on the top

SECTION A

1. Write a function to display the path from root to the farthest leaf of a binary tree of integers. Assume array implementation of the tree. Also assu.ne all required data structures are available. 3

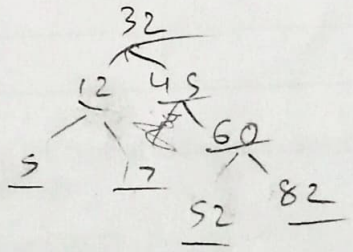
2. Draw the tree before and after each deletion of the node, if following function calls are made in succession. 3

```
Init(&t); insert(&t,80); insert(&t,180); insert(&t, 32);
insert(&t,91); insert(&t,40);insert(&t, 44); insert(&t,
12);insert(&t,80); insert(&t,66); insert(&t,175);
insert(&t,10); insert(&t,20); insert(&t,85);insert(&t,200);
insert(&t,38);
remove(&t, 32);remove(&t, 80)
```

On deleting a node with two children, the replacemcnt is done by the in-order successor.

3. Write the output of the following function: 2

```
void function1(tree t) {
    stack a, b;
    init(&a);
    init(&b);
    push(&a, t);
    while(!empty(&a)) {
        t = pop(&a);
        push(&b, t);
        if(t->left != NULL)
            push(&a, t->left);
        if(t->right != NULL(
            push(&a, t->right);
    }
    while(!empty(&b))
        printf("%d ", pop(&b)->data);
}
```



5 17 12 52 82 60 45 32

The **tree t** is a binary search tree of integers, having data inserted in the given order:
32, 45, 60, 12, 5, 82, 17, 52
Make suitable assumptions wherever required.

4. What would be the complexity of printing all leaf nodes of a BST in ascending order? Explain in brief. 2

SECTION B

6. How many binary trees can be constructed with 5 unlabelled nodes? 1

7. How many leaf nodes will be there in a full binary tree with the n internal nodes? 1

8. How many numbers of minimum and maximum nodes will be there if height 'h' is given for binary tree? Justify. 2

9. Construct binary tree for the following preorder and inorder traversals 2

   Inorder: E A C K F H D B G

   Preorder: F A E K C D H G B

10. Write a C function to delete a node from a BST stored using linked representation. 4

COLLEGE OF ENGINEERING, PUNE

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T2 Examination

Programme: B.Tech
Course Code:
Branch: Computer Engineering
Duration: 1 hour
Student PRN No.

Semester: IV
Course Name: DSA II
Academic Year: 2022- 2023
Max Marks: 20

Instructions: Write answer of each section in separate sheet. Clearly mention the section on the top.

SECTION A

1. An AVL Tree contains the nodes inserted in the given order: 4
10, 7, 40, 3, 8, 30, 45, 1, 5, 20, 35, 60, 20
Following additional operations were performed on the AVL Tree in succession. Clearly state the imbalanced node, type of imbalance after the operation and redraw the re-balanced tree after each operation:

Operation	Imbalanced node and type of rotation	Re-balanced Tree
insert 29		
remove 8		
insert 15		
remove 45		

2. Write a C function to return an integer indicating the type of imbalance caused due to the insertion in an AVL Tree, assuming suitable prototype. 3

3. a. What is the advantage of an AVL tree over a BST? (1 mark) 3

b. Fill in the blank. Show working. (2 marks)

AVL tree of height 4 can have _____ maximum nodes and _____ minimum node.

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SECTION B

Q. No		Marks
4.	Using Heaps, insert () can be implemented using in _____ time.	1
5.	Consider the array A representing a min-heap below (only keys are shown) and answer the question that follows:	2

Array Index	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Key	2	9	4	12	16	7	15	13	14	17	18	8	10	19

Give the array after performing one removeMin() operation.

6.	Show the Red-Black tree that results after each of the integer keys 12, 20, 6, 18, 19, 25 and 23 are inserted, in that order, into an initially empty Red-Black tree. Show each step.	3
7.	Write a function in C to insert element in a max heap using array.	4