Heaven's Light Is Our Guide

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
2nd Year EVEN Semester Examination 2020

COURSE NO: CSE 2203 COURSE TITLE: Digital Techniques

FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

Marks

Q.1. (a) What is meant by radix of the number system? 2

(b) Convert the following (i) $(68)_8=(?)_2$ (ii) $(1101011)_2=(?)_{16}$. 2

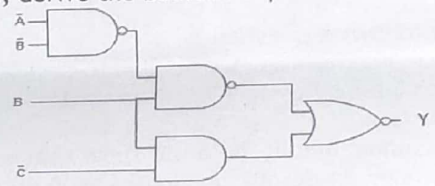
(c) What are the essential characteristics of hexadecimal number system over binary number system? 2

(d) What is the usage of the 8th bit of ASCII 7 bit code? 4

(e) Explain a single bit error detection technique with suitable example and figure in case of data transmission through a medium. 8

Q.2. (a) Consider a combinational logic circuit that controls the passes of a signal. According to the following requirement:
1. Output X will be HIGH when B and C are different.
2. X will remain equal to A when control inputs B and C are same.
Now answer the following question:
(i) Construct the truth table according to the question.
(ii) Generate an expression for X from the truth table in SOP (Sum of Products) format.
(iii) Express the output variable expression in POS (Product of Sums) format.
(iv) Simplify the expression of X and draw the circuit diagram before and after simplification.

(b) For the given figure, derive the boolean expression of Y. 4



Q.3. (a) Given the following truth table: 5

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

(i) Obtain the simplified function in Sum-of-Product.
(ii) Draw the equivalent simplified boolean circuit.

(b) Simplify the following boolean function. 4
$F(A,B,C,D)=\Sigma(0,1,5,8,9,13,15)$
$d(A,B,C,D)=\Sigma(4,6,12,14)$

(c) Design a logic circuit with three inputs A,B,C. Output will be high only when a majority inputs are high. 3

Q.4. (a) Draw a circuit diagram that can add or subtract two 4-bit numbers simultaneously also explain the control input of the circuit. 3

(b) Describe the working principle of 2-bit by 2-bit binary multiplier with a suitable figure. 3

(c) Construct a 5×32 decoder using (i) 4×16 decoder only (ii) 3×18 decoder only. 4

(d) Implement the following function with a suitable multiplexer: 2
$F(A,B,C)=\Sigma(0,2,3,7)$.

SECTION : B

Q.5. (a) What is meant by Edge Triggered Flip-flop and Level Triggered Flip-flop? 2

(b) Draw the truth table for the following flip-flops. (i) J-K (ii) D (iii) R-S (iv) Clocked R-S. 4

(c) What is a clocked J-K flip-flop? What improvement does it have over a clocked R-S flip-flop? 4

(d) Differentiate D and T flip-flop. 2

Q.6. (a) Define parallel counter. Draw the logic diagram for synchronous counter that count from 0000_2 to 1111_2. 5

(b) Is PRESET and CLEAR are asynchronous inputs? Justify your answer. 3

(c) What is a modulus of a counter? Show the method to determine the number of flip-flops for a MOD 46 counter. 4

Q.7. (a) Consider the counter module 74LS293. Show how to wire 74LS293 as a MOD-13 counter. 3

(b) Consider a ring counter that is composed of four D-type flip-flops also assume that the ring counter initial state is 1010. Now answer the following question: (i) Draw the ring counter according to the question. (ii) What will be the output state after four pulses? (iii) Draw the timing diagram of the designed counter. (iv) What will be the output state after three pulses if the initial state is 0000? 4

(c) Consider the fig. -7(c). 5

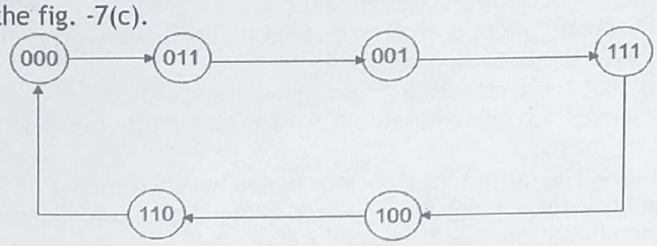


fig:- 7(c)

Now answer the following questions:

(i) Find out how many flip-flops are needed to design the counter.

(ii) Design the counter by using T flip flop for MSB and LSB, whereas use D-flip-flop for other(s).

Q.8. (a) Find out the maximum amplitude noise spike that can be tolerated when a Low output is driving an output. Assume that $V_{IL}(max)=0.9V$, $V_{IH}(min)=0.3V$. $V_{OL}(max)=0.4V$ and $V_{OH}(min)=2.6V$. 2

(b) Prove that CMOS acts as an inverter with necessary figure. 4

(c) Implement the function, F=AD+BCD by using CMOS technology. 4

(d) Prepare a question carrying 04 marks on the topic CMOS but the question will not be similar to Q.8 (b) and (c). Based on the depth of the question, you will get the mark of this question. 2

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2nd Year EVEN Semester Examination 2020

COURSE NO: **Math 2213** COURSE TITLE: **Complex variable, Differential Equation and Harmonic Analysis**
FULL MARKS: **72** TIME: **3 HRS**

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

			Marks
Q.1.	(a)	Separate the real and imaginary parts of $f(z) = ize^{-z}$.	4
	(b)	Find the roots of $f(z) = (-1+i)^{\frac{1}{3}}$ and locate them in the complex plane.	4
	(c)	Describe vector interpretation of complex number.	4
Q.2.	(a)	What is the difference between complex differential function and analytic function? Indicate the function $f(z) = \frac{\hat{z}}{z}$ whether or not analytic.	4
	(b)	Let $f(z) = u(x,y) + iv(x,y)$be an analytic function. If$u = 3x - 2xy$, then find v and express $f(z)$in term of$z$.	4
	(c)	Prove that in polar form the Cauchy-Riemann equation can be written as $\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{\partial v}{\partial r} = -\frac{1}{r}\frac{\partial u}{\partial \theta}$.	4
Q.3.	(a)	State and prove the Cauchy's Integral formula.	4
	(b)	Evaluate $\oint_c \frac{z^3 dz}{(9-z^2)(z+i)}$ where c is the circle$\|z\| = 1$.	4
	(c)	Expand the function $f(z) = \frac{1}{1+z}$ in a Taylor's series about z=1 and determine the region of convergence.	4
Q.4.	(a)	Find a bilinear transformation which maps points z=0,-i,-1 into w=i,1,0 respectively.	3
	(b)	Evaluate the following Contour integration (any two.) (i) $\int_0^\infty \frac{dx}{1+x^6}$ (ii) $\int_0^{2\pi} \frac{\cos^2 2\theta}{5-4\cos 2\theta} d\theta$ (iii) $\int_0^\infty \frac{\ln(1+x)dx}{1+x^2}$	9

SECTION : B

Q.5.	(a)	Verify that x=0 is a regular singular point of $2x^2y''+xy'-(x+1)y=0$ and find the solution of it in series using Frobenius method.	9
	(b)	Prove that $\frac{d}{dx}(x^n \mathcal{T}_n) = x^n \mathcal{T}_{n-1}$.	3
Q.6.	(a)	For Bessel's integral prove that $\mathcal{T}_n(x) = \frac{1}{\pi}\int_0^\pi \cos(n\theta - x\sin\theta)\, d\theta$	4
	(b)	Show that $(1-2xyz+z^2)^{-\frac{1}{2}}$ is a generating function for Legendre Ploynomial $P_n(x)$.	4
	(c)	Find the integral surface of the differential equation $2y(z-3)p + (2x-z)q = y(2x-3)$ which passes through the circle $z = 0, x^2 + y^2 = 2x$.	4
Q.7.	(a)	Define odd and even function. Show that an even function can have no sine term in its Fourier expansion.	6
	(b)	Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$ under the condition: $u(0,t) = u(\pi,t) = 0$ and $\frac{\partial u}{\partial t} = 0$ when $t = 0$ and $u(x,0) = x,\ 0 < x < \pi$.	6
Q.8.	(a)	Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ using Fourier transform subject to the conditions (i) $u = 0$ when $x = 0,\ t > 0$ (ii) $u = \begin{cases} 1, & 0 < x < 1 \\ 0, & x \geq 1 \end{cases}$ $when\ t = 0$ (iii) $u(x,t)$ is bounded.	6
	(b)	Using laplace transformation, solve the following initial value problem, $y''+2y'+2y=5\sin t$ where y(0)=0 and y'(0)=0.	6

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2nd Year EVEN Semester Examination 2019

COURSE NO: **CSE 2201** COURSE TITLE: **Computer Algorithms**
FULL MARKS: **72** TIME: **3 HRS**

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

Marks

Q.1. (a) Define computer algorithm. Describe the important characteristics of a computer algorithm. 3

(b) Find out the big "O" and big "θ" notation of the following equations: 5
(i) $n^{1.001}$+nlogn (ii) $2n^2 2^n$+nlogn (iii) n^{2n}+6*2^n (iv) $6n^3/(\log n+1)$

(c) Find the asymptotic upper bound for following recurrence: $T(n) = T\left(\frac{n}{2}\right) + \frac{1}{2}n^2 + n$. 4

Q.2. (a) Find the sorted array from following unsorted array using counting sort. Explain the steps. a[6]={20,10,50,70,55,35}. 6

(b) Explain the problem of using Quick Sort without randomized partitioning. 6

Q.3. (a) How to find the convex Hull surface points from a set of given points (2D) using divide and conquer approach. 6

(b) Produce an optimal Huffman tree and corresponding Huffman codes for representing letters with following alphabet and frequencies: 6
A-2, B-3, C-4, D-7, E-8, F-12, G-20, H-30, I-75, J-100.

Q.4. (a) Describe the best case, average case and worst case of resource allocation for a computer algorithm. 4

(b) Given a priority queue with N elements, find the complexity of inserting a new item into the tree if the queue is implemented using (i) Sorted array (ii) Unsorted array (iii) Binary Heap. 6

(c) Show by induction that a binary tree with n-node has height at least $[\log 2^n]$ 2

SECTION : B

Q.5. (a) Given some pair of vertices representing edges. How to use the union by Rank and Path compression algorithm to efficiently perform disjoint set operations? Explain briefly. 7

(b) Compute the complexity of counting sort algorithm. 3

(c) What is stable sorting? 2

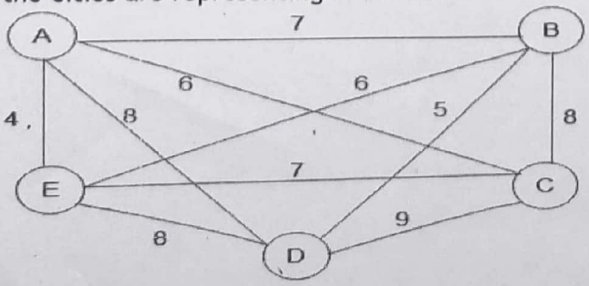
Q.6. (a) Define sum of subset problem and Greedy approach. Why is it ~~is~~ not suitable to apply Greedy method in 0/1 knapsack problem? 4

(b) Consider the following knapsack problem: n=4 (total no of objects), m=20 (capacity of knapsack), profit (p_1,p_2,p_3,p_4)=(25,15,10,12) and weight (w_1,w_2,w_3,w_4)= (10,8,9,8). Find out (i) at least three feasible solutions when the weight is 20. (ii) The subset of elements for optimal solution. 6

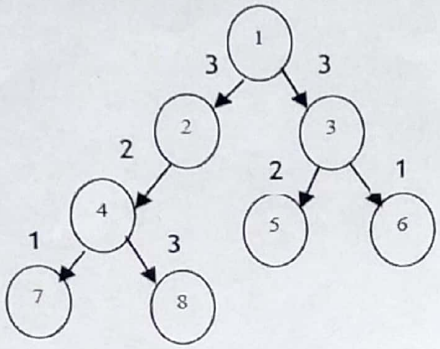
(c) What is prefix code? How Huffman tree can be used to generate prefix code? 2

Q.7. (a) Define P, NP, NP-complete and NP-Hard problem with required diagram. Why are they called so? 3

(b) Describe the Travelling Salesman Problem (TSP). Consider the following graph and find the Shortest Distance using TSP-row, column minimization method. Here the cities are representing in circle. 7



(c) For the following tree solve the TVSP when δ=4. 3



Q.8. (a) Distinguish between P problems and NP hardness. 2

(b) How to sort following items using any non deterministic algorithms? 5

a[6]={10,20,30,40,50,60}

(c) Is it better to use radix sort than Bubble sort? Why? 3

(d) Why do we use the concept of Redection? 2

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2nd Year Even Semester Examination 2020
COURSE NO: **CSE 2205** COURSE TITLE: **Finite Automata Theory**
FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

Marks

Q.1. (a) Summarize the central concepts of Automata Theory. 3

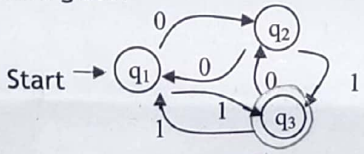
(b) Infer the notation for deterministic finite automata (DFA). Formulate DFA considering the following: 5
$\Sigma = \{H: Happy,\ S: Sad,\ N: Neutral\}$; It is a set of emotion. Accept all strings that end with either H or N.

(c) Give DFA's accepting the following language over the alphabet {0,1}. The set of all strings that when interpreted in reverse as a binary integer is divisible by 5. Examples of strings in the language are: 4
0, 10011, 1001100 and 0101 .

Q.2. (a) Formulate an ϵ-NFA considering the format of "Bangladeshi phone number". The following examples cover all possible combination: 7
{+8801XY| X represents any number between 3 to 9 and Y is the set if string from [0-9] with length 8}.
Finally compute +88017Y using extended transition function.

(b) Interpret the following quotation with suitable example, "An NFA may have no equivalent DFA with fewer than 2^n states". 5

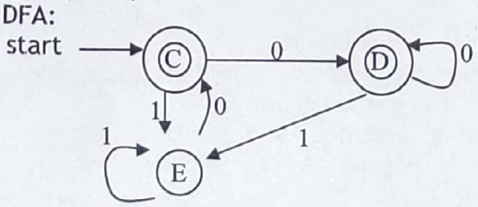
Q.3. (a) Consider the following DFA 6



(i) Give all the regular expressions $R_{ij}^{(0)}$.
(ii) Give all the regular expressions $R_{ij}^{(1)}$, and
(iii) Give all the regular expressions $R_{ij}^{(2)}$.
Try to simplify the expressions as much as possible.

(b) Convert the following regular expressions with ϵ-transitions: 6
(i) $(a+b)ab(a+b)^*$, (ii) $aa(a+b)^*b$

Q.4. (a) Consider the following DFA: 6



Draw the table of distinguishabilities for the DFA mentioning all the equivalent states. Also give a minimized equivalent DFA that accepts the same language.

(b) Formulate an equivalent DFA from the following table: 6

	50(Hz)	60(Hz)
→K-1	V-1	V-2
K-2	V-2	V-1
*L-1	I-2	V-2
L-2	I-2	V-1
*V-1	K-2	V-2
V-2	K-2	V-2
*I-2	L-1	L-2

SECTION : B

Q.5. (a) Define the sequence for- i) L^+, ii) L? 2

(b) Consider the following grammar: 6

$$S \rightarrow AB|C$$
$$A \rightarrow aAb|ab$$

$$B \rightarrow cBd|cd$$
$$C \rightarrow aCd|aDd$$
$$D \rightarrow bDc|bc$$

Determine whether the grammar is ambiguous or not for the string $aabbccdd$. If ambiguous then remove ambiguity from this grammar.

(c) Simply transform the following NFA to an equivalent DFA: 4

	A	B
→Load-1	φ	{Load-2}
Load-2	{Load-4}	{Load-3}
*Load-3	{Load-3}	φ
Load-4	{Load-1}	{Load-4}

Q.6. (a) Consider the following grammar: 7

$$S \rightarrow AAA|B$$
$$A \rightarrow aA|B$$
$$B \rightarrow \in$$

(i) Eliminate ∈-production.
(ii) Eliminate any unit production in the resulting grammar.
(iii) Eliminate any useless symbols in the resulting grammar.
(iv) Put the resulting grammar into CNF.

(b) Define the terms: i) Generating symbols, ii) Reachable symbols, iii) CNF, iv) Unit pair. 3

(c) Prove that (L*M*)*=(L+M)* 2

Q.7. (a) Formulate a push down automaton(PDA) data structure with suitable example and figure. 3

(b) Consider the following PDA 9

p=({q,p},{0,1},{z_0,X},δ,q,z_0,{p}) has the following transition function:

1. δ(q,0,z_0)={(q,Xz_0)}
2. δ(q,0,X)={(q,XX)}
3. δ(q,1,X)={(q,X)}
4. δ(q, ∈,X)={(p, ∈)}
5. δ(p, ∈, X)={(p, ∈)}
6. δ(p,1,X)={(p,XX)}
7. δ(p,1,z_0)={(p, ∈)}

Show all the execution trace, when input is: 0011.

Q.8. (a) Define Chomsky normal form (CNF). Consider the following grammar: 6

$$S \rightarrow aAa|bBb| \in$$
$$A \rightarrow C|a$$
$$B \rightarrow C|b$$
$$C \rightarrow CDE| \in$$
$$D \rightarrow A|B|ab$$

i) Eliminate ∈-Productions.
ii) Eliminate unit productions and useless symbols.
iii) Convert the grammar into CNF.

(b) State Turing machine and Halting. Express the notation for Turing machine(TM). Formulate a Turing machine (TM) for the following: 6

$a^n b^n c^n | n \geq 1$

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2nd Year EVEN Semester Examination 2020

COURSE NO: **EEE 2251** COURSE TITLE: **Electrical Machines and Instrumentation**

FULL MARKS: **72** TIME: **3 HRS**

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

			Marks
Q.1.	(a)	Why is a transformer rated in kVA instead of kW?	2
	(b)	What are the purposes of open circuit and short circuit tests of transformer? Obtain the open circuit equivalent parameters of a 200/400-V, 50Hz, 1-phase transformer from the following test data: O.C test: 200V, 0.7A, 80W-on L.V. side.	5
	(c)	Explain the losses of a transformer. How can these losses be reduced? What are the possible connections of a 3-phase transformer?	3
	(d)	How can the direction of rotation of a dc motor be reversed?	2
Q.2.	(a)	Why does a single-phase induction motor is not self-starting?	3
	(b)	How can a 1-phase induction motor be made self-starting? Explain any one of the methods.	4
	(c)	Describe the functions of transformer oil, bushing and breather of a transformer.	3
	(d)	What is the function of CT? Explain Fleming's right hand rule for dc generator.	2
Q.3.	(a)	State Faraday's law of electromagnetic induction in terms of the equation, giving all factors in the equation.	3
	(b)	Why the terminal voltage of a self excited shunt generator will decrease with application of increased load.	3
	(c)	If a low resistance load is connected across the armature terminals, will self excited shunt generator build up? Explain.	3
	(d)	A 50KW, 250V dc shunt generator has a field circuit resistance of 62.5Ω, a brush voltage drop of 3V, and as armature circuit resistance of 0.025Ω. When rated current is delivered at rated speed and voltage, calculate (i) Load, field and armature current. (ii) Generator armature voltage.	3
Q.4.	(a)	Explain the effect on speed of a shunt motor when (i) Armature current is increased (ii) Counter EMF is decreased (iii) Field flux is increased.	5
	(b)	Explain why the series motor must be started with a mechanical load coupled to its armature.	3
	(c)	A 230V shunt motor running at 1800 rmp develops a counter EMF of 222V. Ifs armature resistance is 0.1Ω and the brush voltage drops 3V. Calculate (i) The armature current at 1800 rmp (ii) The speed when the armature current is 75A.	4

SECTION : B

Q.5.	(a)	Explain the working principle of alternator with necessary diagram.	4
	(b)	With electrical equivalent circuit, explain the working principle of synchronous motor.	4
	(c)	Write some advantages of stepper motor and disadvantages of BLDC.	4
Q.6.	(a)	Describe the contructional details and principle of operation of a d'Arsonval galvanometer. Derive the expression for steady state deflection.	4
	(b)	How is the current range of a PMMC instrument extended with the help of shunts?	4
	(c)	A 1mA meter d'Arsonval movement with an internal resistance of 100Ω is to converted into a 0-100mA ammeter. Calculate the shunt resistance required. What particulars should be specified on the shunt?	4
Q.7.	(a)	Describe the general requirements for a material to be used for shunts for ammeters and multipliers for voltmeter for PMMC instruments.	4
	(b)	What are the factors influencing the choice of a transducer for measurement of a physical quantity. Explain briefly.	4
	(c)	Explain the measurement of pressure using Bourden tulee and LVDT with the help of necessary diagram.	4

Q.8. (a) What is the basic operating principle of an optical transducer? With necessary sketch, explain the working principle of a solar-photovoltaic cell. 4

(b) Draw and explain the illumination characteristics of a typical photoconductive cell along with its limitations. 4

(c) Write down the name of 6 basic devices which are used to measure temperature. Draw the electrical equivalent circuit of a potentiometer mentioning its input and output terminals. 4

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