No. of Printed Pages: 2

Subject Code: I M A 3 0 3

ODD CARRY OVER

B.Tech. ~~END~~ SEMESTER EXAMINATION, 2018-19 (2019-20)

DISCRETE MATHEMATICAL STRUCTURES

Time: 3 Hrs. **Max. Marks: 100**

Note: 1. Attempt *all* questions.
2. All questions carry marks as shown against them.

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1. (a) Find the principal ~~disjunctive~~ conjunctive normal form of the statement formula: 5

$P \wedge \neg(Q \wedge R) \vee (P \rightarrow Q)$

Use the method of contradiction

(b) Derive ~~$\neg R \rightarrow S$~~ $\neg P$ from the premises: ~~$P \rightarrow R,\ \neg P \rightarrow Q$ and $Q \rightarrow S$.~~ $p \rightarrow q,\ r \rightarrow \neg q$ and r 5

(c) Establish the validity of the argument : 5

~~No mothers are males. Some males are politicians. Therefore, some politicians are not mothers.~~ A horse is an animal. Therefore, the head of a horse is the head of an animal.

(d) Examine the premises: ~~$P \rightarrow Q,\ Q \rightarrow R,\ S \rightarrow \neg R$ and $P \wedge S$~~ for consistency. 5

$a \rightarrow (b \rightarrow c)$, $d \rightarrow (b \wedge \neg c)$ and $a \wedge d$

2. (a) Examine the set $\mathbb{N}^{+} \times \mathbb{N}^{+} \times$ ~~$\mathbb{N}$~~ for a countable set: 5

(b) Determine which amounts of postage can be formed using just 4-cent and 5-cent stamps only. Prove your answer using strong induction. 5

(c) Examine a relation R defined on $\mathbb{R} \times \mathbb{R}$ by $_{(a,b)}R_{(c,d)}$ if $a + \cancel{d}\,2b = \cancel{b+c}\ c+2d$ for an equivalence relation. Determine $[(3,5)]$. 5

(d) Explain how the generalized pigeonhole principle can be used to show that among any 91 integers, there are at least ten that end with the same digit. 5

3. (a) An encoding function is defined by the ~~parity check~~ generator matrix: 10

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix} \qquad G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

(i) Examine whether the matrix is useful in correcting single errors in transmission.

(ii) Examine the encoding function for a group code and a Hamming code.

(iii) Comment on the error-detection and error-correction capabilities of the code and find its rate.

(iv) Decode the received words : ~~001111~~, ~~110001~~ and find the original words.

011010 111111

(b) The operations ⊕ and ⊙ on $R = \{\cancel{s, t, x, y}\}$ a, b, c, d are defined in the table below: 10

⊕	~~s~~ a	~~t~~ b	~~x~~ c	~~y~~ d
~~s~~ a	~~y~~ a	~~x~~ b	~~s~~ c	~~t~~ d
~~t~~ b	~~t~~ b	~~y~~ a	~~t~~ d	~~s~~ c
~~x~~ c	~~s~~ c	~~t~~ d	~~x~~ b	~~y~~ a
~~y~~ d	~~t~~ d	~~s~~ c	~~y~~ a	~~x~~ b

⊙	~~s~~ a	~~t~~ b	~~x~~ c	~~y~~ d
~~s~~ a	~~y~~ a	~~y~~ c	~~x~~ a	~~x~~ a
~~t~~ b	~~y~~ a	~~y~~ a	~~x~~ b	~~x~~ a
~~x~~ c	~~x~~ a	~~x~~ b	~~x~~ c	~~x~~ d
~~y~~ d	~~x~~ a	~~x~~ a	~~x~~ d	~~x~~ a

(i) Examine (R,⊕ , ⊙) for a commutative ring. (ii) Does it have a unity?
(iii) Find a pair of zero divisors. (iv) Is it an integral domain/field?

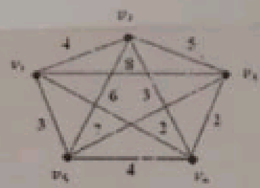
4. (a) (i) Use Quine-McCluskey's method to find a minimal sum-of- products representation for 10

$$f(a,b,c,d) = \sum m\,(0,1,2,3,4,6,7,8,9,11,15)\ \cancel{(2,3,7,9,11,13) + d(1,10,15)}$$

Design a minimal logic circuit for the same.

(b) Develop a partially ordered structure on the set of all positive ~~even factors~~ divisors of ~~308~~ 30 and examine it for a partially ordered set , well ordered set , lattice with its types and Boolean algebra 10

5. (a) ~~Use~~ Illustrate Prim's algorithm (matrix version) to find MST for the weighted graph : 4



(b) There are two kinds of particles inside a nuclear reactor. In every second, an α particle will split into three α particles and one β particle, and a β particle will split into two α particles and one β particle. If there is a single β particle in a reactor initially, 8

MCQ not 17-26

(i) Develop a recurrence- relation model for the number of α and β particles in the reactor at time n.

(ii) Use generating functions to solve the model.

(c) ~~Illustrate applications of (i) Euler formula for planer graphs~~ (ii) ~~graph coloring.~~ 4

(i) Examine planarity of $K_{m,n}$ Find chromatic No. of C_n & W_n

(d) ~~Solve~~ Illustrate how the Chinese postman problem for the following weighted graph can be solved. 4