IIITS/M1 Exams Date: March 2021

Indian Institute of Information Technology, Sri City, Chittoor

Name of the Exam: M1 End Examination Duration: 1.5 hrs Max. Marks: 25

Instructions: (Please Read all of them carefully before attempting the questions)

1. Write your Roll No. and Name on top of every page of the answer sheet. It is mandatory.
2. All questions are mandatory.
3. Marks are indicated in [ ] after each question.
4. Rough Work should be done separately, not in the answer sheet.
5. Answers should be reasoned and derived clearly, not a single word answer.
6. You are required to write the answers in A4 sheets.
7. At the end of the exam, you are expected to submit the scanned copy of the answer sheets in pdf format on provided link before the indicated closing time (not beyond 11.00 AM)
8. Preferably use a ballpoint pen. The writing should be readable after scanning. (This is very important)
9. Copying in any form will be dealt strictly.
10. This is a proctored exam. You need to keep your video on throughout the exam.
11. Please note that the total time of the written exam is 1.5 hours (after that ten minutes for scanning and 20 minutes buffer). Manage your time accordingly. No submissions are entertained after 2 hours.

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1. (i) The 9th term of an A.P. is 30 and the 17th term is 50. Find the first three terms.
   (ii) Find the eighth term in the expansion of $(2x^2 - \frac{1}{x^2})^{12}$

   [2+2]

2. Show that t is a valid conclusion from the premises $p \to q$, $q \to r$, $r \to s$, $\neg s$ and $p \vee t$.

   [3]

3. Use Gram-Schmidt process to transform the basis $(1, 0, 1)$, $(3, 1, 1)$ and $(2, -1, 3)$ into an orthonormal basis for R^3 in the same order.

   [3]

4. Find an orthonormal matrix Q and a diagonal matrix Σ such that $A = Q\Sigma Q^T$, if $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & 1 \\ 3 & 1 & 1 \end{bmatrix}$

   [3]

5. Find basis and dimension of row space and null space of the matrix A and hence find the dimension of column space and left null space if $A =. \begin{bmatrix} 1 & 3 & 0 & 0 \\ 1 & 3 & 1 & 2 \\ 1 & 3 & 1 & 2 \end{bmatrix}$

[3]

6. Suppose $A = \{1, 2, 4, 5, 10, 20\}$ and R is the partial order relation $(x, y) \in R$ iff $x|y$.

   (a) Draw the Hasse diagram for the relation.
   (b) Find the least element.
   (c) Find the greatest element.
   (d) Which elements are maximal?
   (e) Which elements are minimal?

7. Find the three elimination matrices E_{21}, E_{31} and E_{32} which put the matrix A into the upper triangular form $E_{32}E_{31}E_{21}A = U$. Using these, compute lower triangular matrix L, diagonal matrix D and upper triangular matrix U to factor $A = LDU$.

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 3 & 4 & 4 \end{bmatrix}$$

   Is A invertible? (Why? Provide reason to support your answer)