

Roll No.

MCIT-101

M.E./M.Tech. I Semester

Examination, June 2017

Mathematical Foundations for Information Technology

Time : Three Hours

Maximum Marks : 70

Note: i) Answer any five questions.
ii) All questions carry equal marks.

1. a) Explain the notion of channel mutual information capacity.
b) Write short notes on the followings:
 - i) Uncertainty
 - ii) Channel coding
2. a) Write short notes on the followings:
 - i) Error detecting and error correcting codes
 - ii) Linear codes and their description using matrices
- b) Write a short note on information capacity theorem.
3. a) Distinguish between fuzzy sets and classical sets with suitable examples.

[2]

- b) If $X = \{41, 42, 43, 44\}$ and two fuzzy sets A and B on X

are given by $A = \left\{ \frac{0.2}{41}, \frac{0.5}{42}, \frac{0.8}{43}, \frac{1}{44} \right\}$ and

$B = \left\{ \frac{1}{41}, \frac{0.8}{42}, \frac{0.5}{43}, \frac{0.2}{44} \right\}$ then find $A \cup B$ and $A \cap B$.

4. a) Define fuzzy relation and fuzzy relational matrix. Produce suitable examples.
b) What do you mean by fuzzy logic? What are its uses and applications?
5. a) Determine DFT of the sequence

$$x(n) = \begin{cases} \frac{1}{5}, & \text{for } -1 \leq n \leq 1 \\ 0, & \text{other wise} \end{cases}$$
- b) Define wavelet and mother wavelet. Also discuss briefly the various applications of wavelet transform.

6. a) Calculate the inverse DFT of $X[k] = \begin{cases} 5, & k = 0; \\ 3 - j2, & k = 1; \\ -3, & k = 2; \\ 3 + j2, & k = 3; \end{cases}$

b) Write a short note on

- i) DFT and
- ii) CWT

7. a) A pair of dice is thrown four times. Find the probability distribution of doublets.

b) There are three similar bags which contain 1 white and 2 black balls; 2 white and 1 black balls; 2 white and 2 black balls respectively. A ball is selected at random and it is found to be white. What is the probability that it came from third bag.

8. a) What do you mean by expectation of a random variable? A random variable X has the density function $f(x)$ given

$$\text{by } f(x) = \begin{cases} 16xe^{-4x}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

Find its expectation.

b) Suppose X is a continuous random variable with probability density function

$$f(x) = \begin{cases} A(3x - x^2), & 0 < x < 2 \\ 0, & \text{otherwise} \end{cases}$$

What is the value of A ? Also, find $P(X > 1)$

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