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Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Information Theory and Coding

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting
atleast TWO questions from each part.**

PART - A

1.
 - a. A source emits one of the four probable messages m_1, m_2, m_3 and m_4 with probabilities $3/11, 2/11, 2/11$ and $4/11$ respectively. Find the entropy of the source and show that for the second order extension of the source $H(S^2) = 2 H(S)$ by listing the symbols of second extended source along with their probabilities. **(10 Marks)**
 - b. A certain data source has 8 symbols that are produced in blocks of four at a rate of 500 blocks/sec. The first symbol in each block is always the same for synchronization. The remaining three symbols are filled by any of the 8 symbols with equal probability. Find entropy rate of this source. **(06 Marks)**
 - c. Explain the block diagram of an information system. **(04 Marks)**

2.
 - a. Explain the steps in the Shannon's encoding algorithm for generating binary code. **(04 Marks)**
 - b. Show that $H(X, Y) = H(Y) + H(X/Y)$. **(04 Marks)**
 - c. The state diagram of the mark off source is as shown in the Fig.Q2(c).
 - i) Find the stationary distribution
 - ii) Find the entropy of each state and hence the entropy of the source
 - iii) Find the entropy of the adjoint source and verify that $H(S) < H(\bar{S})$. **(12 Marks)**

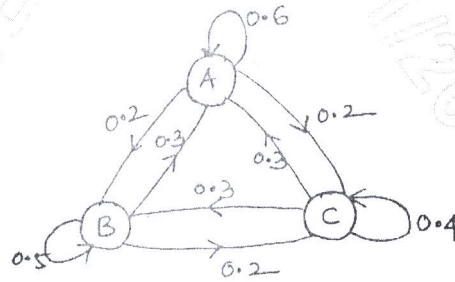


Fig.Q2(c)

3.
 - a. A discrete memoryless source has an alphabet of seven symbols with probabilities for its output as $S = \{S_1, S_2, S_3, S_4, S_5, S_6, S_7\} : P = \{0.25, 0.25, 0.125, 0.125, 0.125, 0.0625, 0.0625\}$; $x = \{0, 1\}$, compute the Huffman code for this source, moving the composite symbol as high as possible. Explain why the computed source code has an efficiency of 100%. **(12 Marks)**
 - b. Prove that the mutual information of the channel is symmetric. **(04 Marks)**
 - c. Define priori entropy, posteriori entropy, equivocation and mutual information. **(04 Marks)**

