Math315 Assignment 4a

November 13th, 2008

Answer all questions and give complete reasons and checks for your answers. Hand in ALL of your rough working together with your final answers. The parts of the questions are weighted as shown on the right of the question. Use of Maple is encouraged where appropriate. You are reminded that plagiarism is a serious offense and when caught you will suffer the penalties specified by the University.

1. Using the standard Hamming basis ($abcd \to av_1 + bv_2 + cv_3 + dv_4$) find the three different errors in this transmission and so decode it: [5]
   11111111101001100001111111111010000011110000011110111100100101111100001111111
   01111001100110111111100100111111111111111111100110100001111111111101001

$$v_1 := \begin{pmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \quad v_2 := \begin{pmatrix} 1 \\ 0 \\ 0 \\ 1 \\ 1 \\ 0 \\ 0 \end{pmatrix}, \quad v_3 := \begin{pmatrix} 0 \\ 1 \\ 0 \\ 1 \\ 0 \\ 1 \\ 0 \end{pmatrix}, \quad v_4 := \begin{pmatrix} 1 \\ 1 \\ 0 \\ 1 \\ 0 \\ 0 \\ 1 \end{pmatrix}$$

2. Transform the decoded binary numbers into octal by grouping them into sets of 3 to produce the digits 0 to 7 with $xyz \to 4x + 2y + z$. Use Huffman coding to compress the octal data as much as possible and count the number of bits saved. [6]

3. Prove that $p := x^5 + x^2 + 1$ is a primitive polynomial by finding all the different remainders in order of x^j upon division by p. [11]

4. Find the checksum for the message consisting of the last 10 digits of your Huffman encoded message by using binary division. [3]