UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Computer Science

SUPPLEMENTARY EXAMINATION 2008

Title of paper: NETWORKS AND CODING THEORY – I

Course number: CS437

Time allowed: 3 hours

Instructions: Answer any 5 of the 6 questions.

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## Question 1

a) Give an overview of the problems solved by each layer of the OSI Reference Model.

[15]

b) Give any three examples of network topologies, illustrating each with a diagram.

[3]

c) Contrast *virtual circuits* and *datagrams*.

[2]

## Question 2

a) Calculate the maximum data rate of a telephone network carrying a binary signal in the frequency range 400 Hz to 3500 Hz.

[3]

b) Define and distinguish between each of the following pairs:
   i. Bit rate and baud
   ii. Twisted pair and coaxial cable
   iii. Manchester and Differential Manchester encoding

[9]

c) Explain the concept of a *constellation diagram* with the aid of an example.

[3]

d) State the disadvantages of *naive encoding* of digital signals.

[3]

e) State any two advantages of digital signals over analogue signals.

[2]

## Question 3

a) Explain the main ideas behind the following data compression methods:
   i. Run-length encoding
   ii. Pulse Code Modulation
   iii. Lempel-Ziv

[10]

b) Give an overview of the telephone network, mentioning the role of local loops, trunks, switching methods and modems.

[10]

## Question 4

a) Explain the method of *framing* employed at the data link layer in *bit-oriented* synchronous data lines.

[8]

b) What is *character stuffing* and why is it important?

[3]

c) Contrast between forward error control and feedback error control.

[3]

d) Describe how the data link layer provides *link management* services to higher levels.

[6]

## Question 5

Give a detailed account of the Continuous RQ method of feedback error control, including error handling by *selective retransmission* and *go-back-N*.

[20]

## Question 6

a) Describe the Aloha protocol and show that it has a maximum throughput of $(1/2e)$.

[8]

b) Contrast between Aloha and slotted Aloha.

[3]

c) Draw a diagram of the IEEE 802.3 frame format and briefly describe the contents of each field.

[5]

d) List any four responsibilities of the token ring monitor.

[4]