

# Fundamental Computer Science II Final

Course Fundamental Computer Science II, 320202

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Name:

Matriculation Number:

**INSTRUCTIONS:** Read all the problems carefully before you start working. The number of points given for a problem are a rough indication of its difficulty or the time it takes to write them down. Start with the simple problems. Most problems can be answered in a few lines of text.

## 1. Bandwidth (22P)

- a) What is to be expected if the available bandwidth for a signal is reduced and the data rate of the data that is transmitted by the signal is maintained? Distinguish different cases. (10P)
- b) What is the difference between the Nyquist Bandwidth and the Shannon Channel Capacity? (12P)

## 2. Coding (14P)

- a) What is the disadvantage of biphas coding ? Under which circumstances would you still use it? (6P)
- b) What is the quantisation SNR level for a 20-bit A/D converter? How does it compare to the quantisation SNR level of an 8-bit A/D converter? (8P)

### 3. Error Control (20P)

a) Which of the following error control schemes can detect the swapping of two consecutive bits, i.e. 01  $\rightarrow$  10? Explain why.

1. parity
2. hamming code
3. CRC

(14P)

b) What is the advantage of Go-back-N-ARQ (Automatic Repeat Request) over Stop-and-Wait-ARQ? (6P)

### 4. Data Link Layer (20P)

a) What is the function of the Flag in the HDLC frame format and how is it related to the bit stuffing scheme that HDLC implements on the frame contents ? (10P)

b) What is the function of the MAC (Media Access Control) Layer in a Local-Area-Network Protocol Architecture? (10P)

## 5. Local Area Networks (30P)

a) Compare the following different LAN interconnection techniques:

1. Repeater
2. Switch
3. Bridge
4. Router

Analyze the following points for each of them:

1. Delay and buffering
2. Protocol Layers implemented and used by the devices
3. Possible protocol responses given by the devices

(20P)

b) Explain the operation of a Carrier Sensed Multiple Access / Collision Detect (CSMA/CD) based LAN. Name such a network. What is the disadvantage of these networks over Token-Ring networks? (10P)

## 6. IP Networks (20P)

a) Can two hosts in a TCP/IP network detect whether they are on the same subnet? If yes, how? If no, why not? Can they also detect each others ethernet address (assuming the carrier is ethernet)? If yes, how? If no, why not? (10P)

b) Is it possible/useful to implement an ARQ scheme for multicast protocols? Why do routers have to be aware of multicast protocols? (10P)

## 7. TCP and UDP (20P)

a) In which kind of data transfer applications would you prefer to use UDP over TCP? Explain. (10P)

b) Why does TCP separate the ARQ mechanism from the Flow control mechanism by using independent header fields? (10P)