

DUBLIN INSTITUTE OF TECHNOLOGY
KEVIN STREET, DUBLIN 8

B.Sc. in Computer Science

Year 2

Supplemental Examination 2001

Algorithms, Data Structures and Data Communications

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Attempt
2 questions from *Section A*
and
2 questions from *Section B*.

All questions carry equal marks.

Section A

Data Communications

1. (a) (i) What is meant by *layering* in computer networking?
 (ii) List the advantages of this model and outline the reasons why this model is used.
 (iii) Using a diagram, list and explain the seven layers of the OSI reference model.
- (12 marks)**
- (b) Digital data must be encoded in a certain fashion in order to be represented as a digital signal. Similarly digital data needs to be encoded correctly to be represented as an analogue signal.
- (i) Explain what is meant by *differential encoding of digital data*.
 (ii) List three different schemes that can be used for representing digital data as a digital signal. At least one of these should be a differential scheme.
 (iii) Encode the digital data given below as a digital signal using a **differential** scheme, clearly stating which scheme you are using.
 (iv) Encode the digital data given below as a digital signal using a **non-differential** scheme, clearly stating which scheme you are using.
 (v) List three different schemes that can be used for representing digital data as an analogue signal. Explain one of these by using the digital data given below as an example.

1 1 1 0 1 0 0 0 1 1 0 1 0 1
Digital Data

(13 marks)

2. (a) (i) Explain the need for *error detection* in data transmission systems.
 (ii) What is the difference between *forward* and *backward* error control?
 (iii) Describe in detail a scheme that could be used to detect single bit errors.
- (10 marks)**
- (b) (i) Explain what a *Cyclic Redundancy Check(CRC)* is.
 (ii) What advantage does it provide over the scheme described in part [2 (a) (iii)] above.
 (ii) A series of 8-bit message blocks are to be transmitted across a data link using a CRC for error detection. The generator polynomial 11001 is to be used. For the block of data 11100110 you are required to

- Generate the Frame Check Sequence
 - Demonstrate the checking of the sequence of the receiving side
- Show all workings.

(15 marks)

3. (a) The HDLC is an example of a Data Link Control Protocol. List and explain the three different modes of operation of this protocol. Clearly explain any terminology you use in your answer. **(10 marks)**
- (b) One of the functions of a data link control protocol is flow control.
- (i) Explain why a flow control mechanism is needed at the Data Link Layer.
- (ii) Two flow control mechanisms that exist are the *Stop and Wait Protocol* and the *Sliding Window Protocol*. Explain precisely the operation of each of these protocols and how they aid in flow control. Using examples outline how the Sliding Window Protocol handles missing or duplicated frames. **(15 marks)**

Section B

Algorithms and Data Structures

4. (a) What is a graph data type and when is it used? **(6 marks)**
- (b) Describe two techniques to represent a graph in memory. **(7 marks)**
- (c) Write a note on each the following:
- Hashing
 - AVL trees
 - B* trees
- (12 marks)**

(contd.)

5. (a) Write the *Search* algorithm for a Binary Search Tree. **(10 marks)**
- (b) If the *Inorder* sequence of a Binary tree is:
D H E I A C B F G
and the *Postorder* sequence of the same tree is:
D E H A B C F G I
Reconstruct the tree from the above information. **(10 marks)**
- (c) Write out the *Preorder* algorithm for a Binary Search Tree. **(5 marks)**
6. (a) Insert the following list into a B-Tree of Degree 5.
C,S,H,D,M,F,J,O,L,G,U,Y,T,Z. **(8 marks)**
- (b) Show the Tree after the deletion of "S". **(4 marks)**
- (c) Outline the steps involved in converting an *Infix* expression to *Reverse Polish Notation* **(9 marks)**
- (d) Convert the following expression to *Reverse Polish Notation* using a stack:
 $(x \wedge y - z) / (p * g) - t$ **(4 marks)**