DESK No.

FAMILY NAME:

GIVEN NAMES:

SIGNATURE:

STUDENT NUMBER:

THE UNIVERSITY OF
WESTERN
AUSTRALIA

SEEK WISDOM

Semester 1, 2023 EXAMINATIONS

School of Physics, Mathematics and Computing

CITS3002
Computer Networks
Examination Duration: 2 hours

This is an examination WITH permitted materials

Provided by the University
1 x 10 Page Answer Booklet

Supplied by the Student
1 x double-sided A4 page of notes (printed or handwritten)

Calculator
No calculators are permitted

Instructions to Students
THIS PAPER HAS FOUR QUESTIONS
EACH QUESTION HAS ONE OR TWO PARTS
EACH QUESTION IS MARKED OUT OF 10 MARKS
STUDENTS SHOULD ATTEMPT THREE OF THE FOUR QUESTIONS
IF YOU ATTEMPT ALL FOUR QUESTIONS, THE LAST QUESTION ATTEMPTED WILL NOT BE MARKED

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1) Develop an implementation in pseudo-code, with a syntax similar to C, Python, or Java, that simulates the behaviour of the 1-persistent CSMA/CD protocol over 100Mbps Ethernet.

The simulation should support *N* identical nodes, each wishing to transmit a frame to other nodes at random intervals. Assume that Ethernet employs a fixed slot-time, and that collision detection and resolution takes exactly one slot-time.

With reference to your simulation's implementation, explain how the maximum observed channel utilization may be determined from your simulation.

Do not be overwhelmed by this problem. You are not being asked to develop a protocol using the *cnet* framework. A correct solution requires only about 30-50 lines of pseudo-code.

(10)

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2a) The numeric addresses used within a computer network are not numbers simply chosen at random. They have a number of properties that facilitate their use.

With reference to current Internet Protocol (IPv4) addressing scheme, briefly describe three such properties, and explain their role in addressing.

(5)

2b) Draw a diagram showing the packet structure of a single Ethernet frame carrying an HTTP request using TCP/IP.

Highlight all header fields that identify any forms of source/destination connectivity.

(5)

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3) Consider the common situation of a home desktop computer, connected to a router provided by an Internet Service Provider (ISP). The router employs Network Address Translation (NAT) to enable multiple devices within the home to share the connection to the ISP, leading to the wider Internet.

Using one or more diagrams, show a *sequence* of packets from an already established TCP/IP session, that deliver an HTTP request in a single (self-contained) packet from the desktop computer, via the router and ISP, to a web-server (software) running on *www.csse.uwa.edu.au* (130.95.1.1), and receiving a single (self-contained) response packet via the same path but in reverse.

In each of the packets in your sequence, clearly show source and destination IPv4 addresses and transport-layer ports. Where each of these (numeric) values is specified by this question, use those specific values; where required values are not specified, choose your own values and use them consistly in your answer.

No other fields need to be shown.

(10)

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4a) The Network File System (NFS) employs Remote Procedure Calls (RPCs) over the User Datagram Protocol (UDP).

With reference to traditional file-system semantics, what problems does this choice of interprocess communication scheme introduce?

What solutions have been implemented to address these issues?

(5)

4b) Of great importance in client/server computing is the speed with which the server process is able to service each client process's request. Depending on the anticipated number of clients and the anticipated time to service each request, the server may adopt a variety of strategies to give each client the impression that its request is being handled immediately.

With the aid of diagrams, outline three distinct models of server process construction. In each case, highlight the advantages and disadvantages of the model.

(5)

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END OF PAPER