THE UNIVERSITY OF AUCKLAND

SECOND SEMESTER, 2014
Campus: City

COMPUTER SCIENCE

Modern Data Communications

(Time Allowed: 40 minutes)

Note:
- Read these instructions carefully.
- Compare the exam version number on the Teleform sheet supplied with the version number printed in the top left corner of this page. If they do not match, ask the examination supervisor for a new sheet.
- No books, calculators or other electronic aids are allowed.
- Enter your name and student ID on the Teleform sheet. Your name should be entered left aligned. If you have a middle initial, enter it under M. If your name is longer than the number of boxes provided, truncate it.
- Use a dark pencil to mark your answers in the multiple choice answer boxes on the Teleform sheet. Check that the question number on the sheet corresponds to the question number in this question book. If you spoil your sheet, ask the supervisor for a replacement. Writing on the sheet will NOT be marked.
- Each question should have exactly one correct answer and carries 1 mark.
- If you believe that a question erroneously may have no correct answer, choose the one you believe comes closest to a correct answer. If you believe that a question erroneously has more than one correct answer, choose whichever you believe may have been intended as the correct answer. In either case, please notify the course supervisor immediately after the exam.
- Take your question book home with you and keep it in a safe place. Writing on the question book will not be marked.
- This term test is marked out of 20 marks and is worth 20% of your final mark for this course.

Question 1
Which of the following data links has the lowest latency?

    (a) A 29 km twisted pair cable
    (b) A 30 km fibre optic cable
    (c) A 31 km coaxial cable
    (d) A 40 km microwave radio link
    (e) A geostationary satellite link

Question 2
A carrier signal is amplitude modulated with a sinusoidal baseband signal of 10 kHz or less. Considering the resulting signal, how many carriers modulated in this way could you accommodate in a bandwidth of 300 kHz without having the resulting power spectra overlap?

    (a) Around 3000
    (b) Less than 15
    (c) About 30
    (d) Only one
    (e) Between 15 and 30

Question 3
Consider a QAM signal with a quadratic arrangement of the constellation points. Suppose that we have a signal-to-noise ratio of 18 dB at the receiver. How many constellation points can we roughly accommodate without getting an unduly large number of symbol errors?

    (a) 8 x 8
    (b) 256
    (c) 32 x 32
    (d) 4 x 4
    (e) 12 x 12

Question 4
Given the target bit rate of a communication channel, the signal strength at the receiver, and the noise power per unit (Hertz) of bandwidth, the Shannon-Hartley capacity theorem lets us compute:

    (a) The signal-to-noise ratio (SNR)
    (b) The theoretical minimum bandwidth required to achieve the target bit rate.
    (c) The baud rate.
    (d) The bit error rate.
    (e) The required transmit power.

Question 5
A power ratio of 37 dB corresponds to an absolute power ratio of approximately

    (a) 5000:1
    (b) 370:1
    (c) 7000:1
    (d) 64:1
    (e) 37+10

Question 6
Which of the following does not lead to signal degradation?

    (a) Spreading

    (b) Attenuation

    (c) Distortion

    (d) Noise

    (e) Latency

Question 7
Consider a QPSK constellation diagram with four constellation points at 0, 90, 180, and 270 degrees and at equal distance to the origin. Labelling the constellation points in a clockwise direction from the constellation point at 0 degrees, which of the following is a Gray code?

    (a) 01, 11, 00, 10

    (b) 00, 01, 11, 10

    (c) 10, 00, 11, 01

    (d) 00, 01, 10, 11

    (e) 11, 00, 01, 10

Question 8
Consider a simple parity code consisting of 8 data bits and one parity bit, with odd parity. Which of the following codewords contains an error?

    (a) 110010100

    (b) 010110011

    (c) 110110010

    (d) 011110100

    (e) 101110001

Question 9
In the following parity check matrix, the rows indicate the parity bits $p1$ to $p4$ from top to bottom and the columns indicate the data bits $m1$ to $m8$ from left to right.

11011010
10110110
01110001
00001111

If we have an error in data bit $m5$, which parity bits are affected?

    (a) $p1$, $p2$, and $p3$

    (b) $p1$, $p2$, and $p4$

    (c) $p1$ and $p4$

    (d) $p3$ only

    (e) $p2$ and $p3$

Question 10

A transmitter sends the bit sequence 0010010110 using NRZ. If the receiver clock is slower than the transmitter clock, which bit sequence might result at the receiver?

(a) 00100101110
(b) 001100100110
(c) 00100101010
(d) 0010110110
(e) 001000110

Question 11

The bit stream below contains framing with bit stuffing. How many actual data bits (including any checksum) does it contain?
10011111100011101011101111101000001001111110110

(a) 25
(b) 30
(c) 24
(d) 26
(e) 28

Question 12

LDPC codes are especially suitable for error correction in applications with

(a) High transmit power
(b) Low latency
(c) Low SNR
(d) Low bit error rates
(e) Low bit rates

Question 13

Which of the following statements about UDP and TCP is FALSE?

(a) TCP makes sure that lost data segments are resent
(b) UDP delivers datagrams in the order they were sent
(c) A TCP session must start with a three-way handshake
(d) Link capacity is shared fairly among competing TCP sessions
(e) TCP delivers a sequence of bytes in the order they were passed to the session

Question 14

Statistical Multiplexing can be used to carry several data streams over a common communications link. A stream's data is assembled into frames, the frames can then be sent over the link. Which of the following statements about Statistical Multiplexing is FALSE?

(a) A stream may use the common link if no other stream has a frame to send
(b) A Statistical Multiplexing receiver must be able to identify incoming frames
(c) A Statistical Multiplexing system must make sure that all streams share the link fairly when the load is heavy
(d) If stream A has more frames to send than stream B it will use more of the available time
(e) Statistical Multiplexing uses fixed time slots

Question 15

A communications session is using the Selective Repeat protocol, with a sliding window size of 6 frames. The system has just sent frames 10, 11 and 12, and has received ACKs for frames 8, 9 and 11, and a NAK for frame 10. What should the sender do next?

   (a) Move its window forward to frame 10, send frame 13

   (b) Move its window forward to frame 9, send frame 9

   (c) Move its window forward to frame 10, send frame 10

   (d) Move its window forward to frame 10, send frames 10, 11 and 12

   (e) Move its window forward to frame 9, send frame 10

Question 16

Assume that a fibre from Auckland to Wellington is 600 km long, and provides a 10 Mb/s link. Approximately how long does it take for a 1500-byte frame to be sent and acknowledged? (Ignore the time needed to send the short ACK frame)

   (a) 1.2 ms

   (b) 3 ms

   (c) 4.2 ms

   (d) 6 ms

   (e) 7.2 ms

Question 17

Ethernet MAC (Medium Access Control) addresses are usually displayed as six two-digit hexadecimal numbers separated by colons or dashes. Which part of a MAC address is specific to a single device?

   (a) Bytes 2 to 5

   (b) Bytes 1 to 2

   (c) Bytes 0 to 2

   (d) Bytes 3 to 5

   (e) The two low-order bits of byte 0

Question 18

Gigabit Ethernet allows collisions in half-duplex links; what feature of 10 Mb/s Ethernet had to be changed to allow this?

   (a) Decrease max segment length to 10 m

   (b) Only allow collisions on fibre links

   (c) Require switches to detect collisions

   (d) Increase inter-frame gap to 192 bits

   (e) Increase minimum segment size to 512 bytes

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Question 19
802.11 interfaces allow hosts to communicate without using wires. Two hosts may connect to each other via an Access Point ("infrastructure" mode), or ad hoc (without using an Access Point). Which of the following statements is FALSE?

    (a) Infrastructure mode allows communication with other (wired or wireless) networks

    (b) Ad hoc mode allows communication between any two hosts

    (c) Different wireless networks can support different sets of hosts using a different network identifier (SSID) for each

    (d) Infrastructure mode allows communication between hosts that cannot receive each other's signals reliably

    (e) Infrastructure mode allows roaming (moving hosts) between Access Points

Question 20
An Ethernet bridge is used to connect two collision domains via its ports A and B. It has seen packets from host addresses a1 and a2 on port A, and from host addresses b1, b2 and b3 on port B. What must it do if it receives a packet from host a3 to host b4 on port A?

    (a) Add a3 to its list of known hosts for port A, send it out on ports A and B

    (b) Send it out on port A

    (c) The bridge doesn't know where to send it, discard the packet

    (d) Send it out on port B

    (e) Add a3 to its list of known hosts for port A, send it out on port B

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Rough Working – This page will not be marked
(You may detach this page from the question booklet and use it for rough working)

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