



UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (*EXTERNAL*)

Academic Year 2005/2006 – 2nd Year Examination – Semester 4

IT4102 – Data Communications and Networks
PART 1 - Multiple Choice Question Paper

18th August, 2007
(ONE AND A HALF HOURS)

Important Instructions:

- The duration of the paper is **1 ½ (one and a half) hours**.
- The medium of instruction and questions is English.
- The paper has **40** questions and **9** pages.
- All questions are of the MCQ (Multiple Choice Questions) type.
- All questions should be answered.
- Each question will have 5 (five) choices with **one or more** correct answers.
- All questions will carry equal marks.
- There will be a penalty for incorrect responses to discourage guessing.
- The mark given for a question will vary from -1 (*All the incorrect choices are marked & no correct choices are marked*) to +1 (*All the correct choices are marked & no incorrect choices are marked*).
- Answers should be marked on the special answer sheet provided.
- Note that questions appear on both sides of the paper.
If a page is not printed, please inform the supervisor immediately.
- Mark the correct choices on the question paper first and then transfer them to the given answer sheet which will be machine marked. **Please completely read and follow the instructions given on the other side of the answer sheet before you shade your correct choices.**

1) Which of the following parameters can be used to characterize a communication channel?

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|-------------------|---------------------------|----------------------|
| (a) bandwidth | (b) signal to noise ratio | (c) delay distortion |
| (d) sampling rate | (e) modulation type | |

2) The upper bound for the data rate over a noisy channel as expressed by Shannon's formula is usually unreachable because

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| (a) it does not take into account the delay distortion of channel. |
| (b) the signal to noise ratio of channel cannot be accurately measured. |
| (c) the channel noise may not be of Gaussian type. |
| (d) it is only valid for binary transmission. |
| (e) it does not take into account the attenuation distortion of channel. |

3) Which of the following statements is/are true about a unit amplitude rectangular pulse train with a pulse width τ and a pulse period T , where $T=3\tau$?

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| a) The shape of the envelope of the frequency spectrum is of a $(\sin x / x)$ function. |
| b) Frequency components of the spectrum will be spaced at $\frac{1}{\tau}$ intervals. |
| c) Frequency components of the spectrum will be spaced at $\frac{1}{T}$ intervals. |
| d) If the signal is to be sent over a channel of bandwidth $\frac{4}{\tau}$, the channel would only carry five, non-zero amplitude frequency components. |
| e) If the signal is to be sent over a channel of bandwidth $\frac{4}{\tau}$, the channel would only carry four, non-zero amplitude frequency components. |

4) Which of the following statements is/are true about in-building copper wiring standards?

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| (a) For any given signal frequency, attenuation levels decrease with higher category cabling. |
| (b) Data rates beyond 100Mbps are possible over category 5E and above of cabling. |
| (c) Tighter levels of twisting reduces crosstalk levels. |
| (d) Shielding is expensive, but allows for higher data rates to be supported. |
| (e) It allows for voice and data integration. |

5) Consider the following statements about fibre optic transmission media.

- (i) Typically there are at-least four 'transmission windows' where attenuation is at a minimum.
- (ii) Single mode fibres offer lower dispersion and therefore higher data rates.
- (iii) It offers less electromagnetic interference, but is limited by the physical bend radius.

Which of the above statements is/are true?

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|------------------------|-----------------------|-------------------------|
| (a) (i) only | (b) (i) and (ii) only | (c) (ii) and (iii) only |
| (d) (i) and (iii) only | (e) All | |

6) A binary NRZ signal has period T and is coded with 1 bit per signal level (sample). This signal is then encoded using the Manchester code. Which of the following statements is/are true about the original signal and the encoded signal?

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| (a) NRZ signal has a baud rate of twice that of the Manchester coded signal. |
| (b) Both NRZ signal and the Manchester coded signal have the same baud rate. |
| (c) Manchester coded signal has the same data rate (bps) as that of the NRZ signal. |
| (d) NRZ signal has a data rate which twice that of the Manchester coded signal. |
| (e) Manchester coded signal occupies a larger bandwidth than the NRZ signal. |

7) Consider the following statements about analogue to digital encoding.

- (i) In generating a digital signal, sampling rate must be at least twice the maximum analogue frequency.
- (ii) The bandwidth occupied by a digitized signal would be higher than that of the analogue signal.
- (iii) A digitized signal may be restricted to the same bandwidth occupied by the analogue signal, if the channel has a higher signal to noise ratio.

Which of the above statements is/are true?

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|------------------------|---------------|-----------------------|
| (a) (i) only | (b) (ii) only | (c) (i) and (ii) only |
| (d) (i) and (iii) only | (e) All | |

8) Consider the following statements on data transmission modes.

- (i) Simplex mode allows for both error detection and error correction.
- (ii) Simplex mode is typically used in situations where channels are noisy and have limited bandwidth (e.g., battle field conditions).
- (iii) Unlike asynchronous transmission, synchronous transmission allows for multiple bit error detection.

Which of the above statements is/are correct?

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|----------------|-----------------------|-------------------------|
| (a) (i) only | (b) (i) and (ii) only | (c) (ii) and (iii) only |
| (d) (iii) only | (e) All | |

9) Consider the following statements with regard to data and real time traffic.

- (i) Real time traffic (e.g., voice and video) is sensitive to errors but not sensitive to delay variations.
- (ii) Data traffic can be subjected to lossy compression
- (iii) Real time traffic requires reservation of bandwidth and/or queue resources unlike data traffic which does not require such bandwidth reservation

Which of the above statement(s) is/are true?

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|-----------------------|----------------|------------------------|
| (a) (i) only | (b) (iii) only | (c) (i) and (iii) only |
| (d) (i) and (ii) only | (e) all | |

10) Which of the following characterizes the datagram mode of packet delivery?

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| (a) Frame header contains the next hop node address, rewritten at each hop. |
| (b) Any packet loss between hops will be ignored. |
| (c) Packets belonging to an end-to-end connection will flow through a fixed path. |
| (d) Each packet correctly delivered between hops will be acknowledged. |
| (e) Packet header contains a flow identifier. |

11) Which of the following characterizes a virtual circuit (VC)?

- (a) Packet header can contain end-point identifiers to identify a particular flow.
- (b) Packet header can contain a VC identifier tag.
- (c) If used for data, the VC could guarantee delivery with acknowledgements.
- (d) A connection establishment phase precedes data transmission.
- (e) If used for real time traffic, bandwidth reservation takes place by default, guaranteeing delay bounds.

12) Consider the following statements about the Cyclic Redundancy Check (CRC).

- (i) CRC is generated by polynomial division over modulo 2 arithmetic.
- (ii) It allows the detection of multiple bit and burst errors.
- (iii) It can be computed fast using simple hardware.

Which of the above statement(s) is/are true?

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|-------------------------|---------------|-----------------------|
| (a) (i) only | (b) (ii) only | (c) (i) and (ii) only |
| (d) (ii) and (iii) only | (e) All | |

13) Which of the following statements is/are true about packet error properties and their recovery?

- (a) The ability to recover from multiple bit errors is increased when the number of check bits is increased.
- (b) The ability to recover from bit errors is increased when the data block is compressed.
- (c) Wireless channels are likely to introduce burst errors.
- (d) Fibre optic channels are likely to introduce burst errors.
- (e) Hamming codes are a class of single bit error correcting codes.

14) Consider the following statements about parity bit based error recovery.

- (i) It can only detect 1-bit errors.
- (ii) It can be generated by an “exclusive-OR” logical operation.
- (iii) 1011010 has odd parity.

Which of the above statements is/are true?

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|------------------------|-------------------------|-----------------------|
| (a) (i) only | (b) (ii) only | (c) (i) and (ii) only |
| (d) (i) and (iii) only | (e) (ii) and (iii) only | |

15) A data source emits four symbols P, Q, R and S at random with associated probabilities 0.4, 0.25, 0.25 and 0.1, respectively. Which of the following statements is/are true with regard to Huffman coding of the symbols?

- (a) P=1, Q=01, R=000, S=001 is a possible code.
- (b) P=0, Q=10, R=111, S=110 is a possible code.
- (c) The average bit length of the Huffman encoding is 2.
- (d) The average bit length of the Huffman encoding is 1.95.
- (e) Huffman code saves 0.05 bits/symbol over any 2-bit code.

16) Which of the following statements is/are true about flow and error control in general?

- (a) On half-duplex links, sliding window flow control cannot be used.
- (b) Links with a large roundtrip propagation delay will be heavily underutilized if sliding window flow control is used.
- (c) Links with a large roundtrip propagation delay will be heavily underutilized if stop-and-wait flow control is used.
- (d) Implementing selective-reject flow control is more complex than go-back-N flow control
- (e) Selective-reject flow control would be only marginally better than go-back-N when there are burst errors.

17) Consider the following statements with regard to multiplexing.

- (i) On a 2.048Mbps standard Level 1 Synchronous TDM link, there could be a maximum of 30 channels of voice and signalling.
- (ii) Statistical TDM would be more bandwidth efficient than Synchronous TDM for probabilistic data sources.
- (iii) Wavelength Division Multiplexing is a form of FDM employed only on optical fibre links.

Which of the above statements is/are true?

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|-------------------------|---------------|----------------|
| (a) (i) only | (b) (ii) only | (c) (iii) only |
| (d) (ii) and (iii) only | (e) All | |

18) Consider the following statements about the significant difference(s) between Statistical TDM and Synchronous TDM.

- (i) Statistical TDM does not use synchronization and signalling bits.
- (ii) Statistical TDM uses a packetised frame structure with addresses and a Frame Check Sequence.
- (iii) Synchronous TDM is good for continuous rate digital sources.

Which of the above statements is/are true?

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|-------------------------|---------------|----------------|
| (a) (i) only | (b) (ii) only | (c) (iii) only |
| (d) (ii) and (iii) only | (e) All | |

19) Consider the following statements that characterize(s) standard ADSL as a last mile access technology.

- (i) ADSL is deployed on the same copper pair used by the PSTN.
- (ii) ADSL can carry analogue PSTN and data traffic up to 9Mbps.
- (iii) ADSL provides a lower data rate towards subscriber (downstream) and a higher rate away from subscriber (upstream).

Which of the above statements is/are true?

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|-------------------------|-----------------------|----------------|
| (a) (i) only | (b) (i) and (ii) only | (c) (iii) only |
| (d) (ii) and (iii) only | (e) All | |

20) Which of the following is/are true with regard to dynamic routing algorithms in packet switched networks?

- (a) Dijkstra's algorithm finds the least cost path between two nodes.
- (b) Bellman-Ford algorithm finds the least cost path between two nodes subject to number of hops.
- (c) Flood based route discovery may be the only option available for mobile ad-hoc networks.
- (d) Dijkstra's algorithm does not require each node to have the full topological knowledge.
- (e) Bellman-Ford algorithm requires each node to have the full topological knowledge.

21) The proper order of corresponding OSI layers for having the functionalities of end to end error recovery, media-access resolution, resource reservation and flow metering and translation between heterogeneous data representations is

- (a) network, data link, presentation, application.
- (b) network, data link, transport, presentation.
- (c) transport, data link, application, presentation.
- (d) transport, data link, network, presentation.
- (e) transport, network, application, presentation.

22) A hub based Ethernet is different to a Layer 2 Ethernet switch based Ethernet in that

- (a) each physical port of the switch is a separate collision domain.
- (b) all physical ports of the switch belong to one collision domain.
- (c) all physical ports of the hub belong to one broadcast domain.
- (d) all physical ports of the switch belong to one broadcast domain.
- (e) each physical port of the hub is a separate broadcast domain.

23) Which of the following statements on Layer 3 Ethernet switches is/are true?

- (a) They are most effective when used for routing between VLANs.
- (b) They use table based routing between subnets is employed.
- (c) Each physical port of switch belongs to a distinct subnet.
- (d) They most effective when used for routing between LANs.
- (e) Server farms are typically connected to a L3 switch.

24) Which of the following statements is/are true with regard to multi-access protocols?

- (a) In random access protocols, the performance worsens as the ratio of propagation delay (between far end nodes) to packet transmit time gets larger.
- (b) Probabilistic access protocols perform better under heavy loads.
- (c) CSMA/CA depends on centrally determined precise timing unlike CSMA/CD.
- (d) CSMA/CD depends on centrally determined precise timing unlike CSMA/CA.
- (e) TDMA depends on centrally determined timing in a wide area network setting.

25) Which of the following statements about CSMA/CD protocol on shared media as specified in IEEE 802.3 standard is/are true?

- (a) At heavy loads, access delay increases exponentially.
- (b) At low loads, CSMA/CD access time is superior to the access time of a token ring under low load.
- (c) The minimum packet transmit time must be at least one round trip propagation delay.
- (d) Exponential backoff, if replaced with a linear backoff, would give the same performance at all loads.
- (e) Performance worsens when packet transmit time becomes larger with respect to propagation delay.

26) Which of the following is/are true with regards to the IEEE 802.11 specification of wireless LAN media access control protocol?

- (a) Contention based access protocol used is CSMA/CD as CSMA/CA cannot be utilized on wireless links.
- (b) A contentions free polled access protocol is also provided for centralized hub (access point) based configurations.
- (c) An RTS/CTS signed pair is used as part of the CSMA mechanism.
- (d) Polled access is intended for real time applications.
- (e) All channels are full duplex.

- 27) Consider the following statements with regard to peer-to-peer wireless networks
- (i) Bluetooth and Zigbee are two types of short range mobile wireless technologies targeting device connectivity.
 - (ii) IEEE 802.11 WLANs can operate on a 'mobile adhoc' basis without an access point support.
 - (iii) IEEE 802.15 devices are interoperable with the IEEE 802.11 devices.

Which of the above statements is/are true?

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|-----------------------|---------------|----------------|
| (a) (i) only | (b) (ii) only | (c) (iii) only |
| (d) (i) and (ii) only | (e) All | |

- 28) Which of the following can be considered as a standard function(s) of a typical IPV4 router?

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| (a) Maintaining a route look up table |
| (b) Discarding time out packets |
| (c) Traffic class based marking and rate policing |
| (d) IP address re-writing at each hop |
| (e) Packet reordering based on sequence number |

- 29) Which of the following can be considered as a/significant feature(s) of IPV6 as compared to IPV4?

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| (a) A 256 bit address space of IPV6 as opposed to a 32 bit address space of IPV4 |
| (b) An explicit "traffic class" field to identify and classify traffic |
| (c) Routing based on 'flow labels' in addition to address based routing |
| (d) Ability to explicitly visit specified routers |
| (e) Support for virtual circuit mode in addition to datagram mode |

- 30) Which of the following statements is/are true about IP Multicast?

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| (a) Multicast group membership is managed by the ICMP protocol. |
| (b) IPV4 Class-D addresses are used to identify the multicast groups. |
| (c) Multiparty video conferencing and distributed database applications are two of the applications which require group communication. |
| (d) Multicasting within a single LAN can be effectively carried out using the MAC level multicast address. |
| (e) Multicast group membership is managed by the IGMP protocol. |

- 31) Which of the following statements is/are true about Quality of Service (QoS) over IP networks?

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| (a) QoS can be supported by intermediate routers reserving bandwidth using a protocol such as RSVP |
| (b) QoS can be supported by intermediate routers servicing real time traffic in a prioritized manner |
| (c) Parameters defined in a QoS connection may include the peak rate, burst interval and delay variation (jitter) |
| (d) IPV4 TOS field or the IPV6 traffic class field in the respective headers implement the "differentiated services" model |
| (e) RSVP implements the 'integrated services' model |

32) In an IP router configuration, the 'default route' refers to

- (a) a missing response from a neighbour router to a HELLO message request from a router.
- (b) a designated router for all subnets other than those specified in the routing table.
- (c) a route entry which is statically configured.
- (d) an error message generated by loop configuration of the routing protocol.
- (e) a configuration parameter in the OSPF protocol.

33) Which of the following is/are true with regard to IPV4 subnetting?

- (a) VLSM allows subnet sizes to be different and minimises wastage of IP addresses.
- (b) In standard subnetting, the network address and the broadcast address are reserved, and cannot be assigned to a host.
- (c) Class C signifies a multicast address.
- (d) A Class B network can have 64 usable subnets of 1022 hosts each.
- (e) The host address part of a network address block can be further subdivided into a sub network part and a host part.

34) Given that the electromagnetic propagation velocity in optical fibre is 3×10^8 m/s and that in copper is 2×10^8 m/s, what is the proportion of number of bits in transit on a switched 1 Gbps/UTP Ethernet link of 100m to that on a switched 1 Gbps Ethernet fibre link of 500m?

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|---------|----------|---------|
| (a) 3:2 | (b) 3:10 | (c) 1:5 |
| (d) 2:3 | (e) 2:15 | |

35) Which of the following is/are true with regard to commonly used network utilities?

- (a) *nslookup* is used to query a DNS server.
- (b) *ping* command is used to test the functioning of the Ethernet interface of a host.
- (c) *ifconfig* is used to configure static routes on a router.
- (d) *netstat* lists all route entries on a router.
- (e) *traceroute* traces all intermediate routers along the path from source to destination, along with path delay.

36) Which of the following is/are true with regard to packet forwarding in an Ethernet based IP network?

- (a) Source host employs ARP to discover the physical address of the nearest router, given its IP address.
- (b) Source host employs RARP to discover the physical address of the remote host, given its IP address.
- (c) Where the source host and the remote host are on different VLANs, source host employs ARP if VLANs are mapped to different subnets.
- (d) The destination physical address in the frame header corresponds to that of the nearest hop address.
- (e) On a VLAN based switched Ethernet router configuration, VLAN ID will replace any ARP use.

37) Which of the following applications to (a) protocol mapping(s) is/are correct?

- (a) User File Transfer : UDP : IP
- (b) Network File System : UDP : IP
- (c) Voice over IP : RTP : UDP : IP
- (d) Distributed database update : UDP : IP
- (e) SNMP query : TCP : IP

38) Which of the following statements is/are true about TCP?

- (a) It provides an in-order, error-free, packet transport mechanism to the application layer
- (b) The connection establishment phase identifies the correct sequence and acknowledgment numbers to start the session
- (c) The dynamic window control mechanism will not adversely affect the throughput on long propagation delay paths
- (d) Due to dynamic window control mechanism, channel noise will not adversely affect the TCP throughput
- (e) The header format allows space for 2^{16} possible source and destination port numbers

39) Which of the following is/are true about a typical IP based client-server application?

- (a) A socket data structure defines a client-server connection where the socket is the 5-tuple: source port, destination port, source IP address, destination IP address, address family.
- (b) To find out the server application port, the client application could refer to a 'lookup server'.
- (c) An Email can be sent using SMTP commands over a Telnet connection.
- (d) Client application could contact the server application automatically if server application runs on a 'well known' port.
- (e) A File transfer application can be implemented using FTP commands over a Telnet connection.

40) Consider the following statements with regard to network application security.

- (i) Secure socket layer (SSL) is a preferred alternative to Telnet for remote login to servers.
- (ii) Client-server applications can be implemented over HTTP to avoid port blocking for security reasons.
- (iii) Systems can be attacked (i.e., denial-of-service) targeting weakness in the TCP connection establishment phase.

Which of the above statements is/are true?

- (a) (i) only
- (b) (ii) only
- (c) (iii) only
- (d) (ii) and (iii) only
- (e) All
