**Final Exam**

***Instructions***

* *This is a closed-book and closed note exam. You have* ***120 minutes*** *to finish the exam. Please use your own calculator (no sharing calculator, please)*
* *Please outline each step of calculation. Specify the measuring unit of each result at each step. Final figures MUST be calculated.*

**Question 1 [22 pts]**

*Select the correct answer and write in the below table.* ***Two*** *points are counted for a correct answer;* ***one point is deducted for a wrong answer****. No points are deducted for unanswered question.*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Question** | **Answer** | **Question** | **Answer** | **Question** | **Answer** | **Question** | **Answer** | **Question** | **Answer** |
| **1** |  | **2** |  | **3** |  | **4** |  | **5** |  |
| **Question** | **Answer** | **Question** | **Answer** | **Question** | **Answer** | **Question** | **Answer** | **Question** | **Answer** |
| **6** |  | **7** |  | **8** |  | **9** |  | **10** |  |
| **Question** | **Answer** | **Question** | **Answer** | **Question** | **Answer** | **Question** | **Answer** | **Question** | **Answer** |
| **11** |  | **12** |  | **13** |  | **14** |  | **15** |  |

1. For bursty data traffic, synchronous multiplexing is more efficient than statistical multiplexing

|  |  |
| --- | --- |
| **(a) True** | **(b) False** |

1. In virtual circuit switching:

|  |  |
| --- | --- |
| **(a) a dedicated path is used for all packets of the same virtual circuit** | **(b) only small-sized packets are allowed** |
| **(c) the same path is used for all packets of the same virtual circuit** | **(d) each packet may follow a different path** |

1. A LAN bridge reads the headers of the:

|  |  |
| --- | --- |
| **(a) MAC layer** | **(b) LLC layer** |
| **(c) network layer** | **(d) does not read any headers** |

1. An Ethernet hub is physically a star but is logically a:

|  |  |
| --- | --- |
| **(a) full mesh** | **(b) partial mesh** |
| **(c) shared ring** | **(d) shared bus** |

1. Datagram switching is a:

|  |  |
| --- | --- |
| **(a) type of circuit switching** | **(b) type of virtual circuit switching** |
| **(c) transport layer protocol** | **(d) type of packet switching** |

1. Broadcast radio is based on:

|  |  |
| --- | --- |
| **(a) Synchronous TDM** | **(b) WDM** |
| **(c) Statistical TDM** | **(d) FDM** |

1. Implicit congestion control is suitable for:

|  |  |
| --- | --- |
| **(a) Only datagram networks** | **(b) Low-speed networks** |
| **(c) Circuit-switched networks** | **(d) High-speed networks** |

1. The transmission speed of Fast Ethernet is:

|  |  |
| --- | --- |
| **(a) 10 Mbps** | **(b) 1 Gbps** |
| **(c) 100 Mbps** | **(d) 10 Gbps** |

1. Packet switching is based on statistical TDM:

|  |  |
| --- | --- |
| **(a) True** | **(b) False** |

1. Choke packets can be used with:

|  |  |
| --- | --- |
| **(a) Selective repeat request** | **(b) Only virtual-circuit networks** |
| **(c) Any packet switched network** | **(d) Only datagram networks** |

1. The disadvantage of cut-through switching is:

|  |  |
| --- | --- |
| **(a) Increased delay** | **(b) increase of broadcast traffic** |
| **(c) more control headers are needed** | **(d) risk of propagating bad frames** |

1. A frame relay connection of an access rate 768 Kbps; a possible value of CIR is:

|  |  |
| --- | --- |
| **(a) 64 Kbits** | **(b) 2 Mbps** |
| **(c) 10 Mbps** | **(d) 512 Kbps** |

1. A repeater operates at layer 1 while a hub operates at layer 2:

|  |  |
| --- | --- |
| **(a) True** | **(b) False** |

1. A LAN switch can have ports of different speeds if it is based on:

|  |  |
| --- | --- |
| **(a) session layer** | **(b) transport layer** |
| **(c) store and forward** | **(d) cut-through** |

1. The collision vulnerability period of slotted ALOHA is less than that of ALOHA

|  |  |
| --- | --- |
| **(a) True** | **(b) False** |

**Question 2 [14 pts]**

1. Draw the graph showing the throughput/load relation for an ideal network. [4 pts]
2. Complete the following: [10 pts]
   1. CSMA stands for . . . . . . . . . . . . . . . . . . . . . .
   2. The rule of non-persistent CSMA is: if the medium is idle then . . . . . . . ., if the medium is busy then . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   3. The rule of 1-persistent CSMA is: if the medium is idle then . . . . . . . ., if the medium is busy then . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   4. A computer on a CSMA/CD LAN knows there is a collision when it senses . . . . . . . . . . . . on the bus.
   5. To prevent loops in a LAN, each bridge may have some ports in . . . . . . . .state while other ports are in a . . . . . . .state.
   6. To prevent loops in a LAN, the . . . . . . . . . . .algorithm is used
   7. A MAC address with all bits set to 1 means a . . . . . . . . address
   8. The size of the MAC address is . . . .bytes

**Question 3 [14 pts]**

1. A bank needs to connect a new branch to the rest of branches through a frame relay network. The bank has asked the operator to provide an access line of a 2.048 Mbps data rate.
2. Given the initial small number of employees starting the new branch, the bank network administrator decided that only a CIR of 512 Kbps is sufficient to serve their needs and that the average packet size of the bank applications is 180 Kbits while the maximum packet size is 300 Kbits. What are the values of the parameters Bc, Be, and Tc? [6 pts]
3. If the number of branch employees later increased to the double that the needed CIR is now 1.024 Mbps. What are the values of the parameters Bc, Be, and Tc? [6 pts]
4. If CSMA can be described as “Listen before you talk” algorithm, what statement describes CSMA/CD? [2 pts]

**Question 4 [12 pts]**

1. Twelve 9,600 bps lines are to be multiplexed using TDM.
2. Ignoring overhead bits, what is the total capacity required for synchronous TDM? [2 pts[
3. Assuming that we wish to limit average line utilization of 0.68, and assuming that each line is busy 72 percent of the time, what is the capacity required for statistical TDM? [4 pts]
4. Answer the following questions [6 pts]
   1. What is the main difference between X.25 and frame-relay?
   2. Given a network with transmission links that are not reliable (i.e. bit errors are more probable); which protocol is better to use, X.25 or frame-relay?
   3. If back-pressure is to be used for congestion control; which protocol must be used, X.25 or frame-relay?