CSX3005 (Computer Networks) Pre-midterm Assignment 1/2023

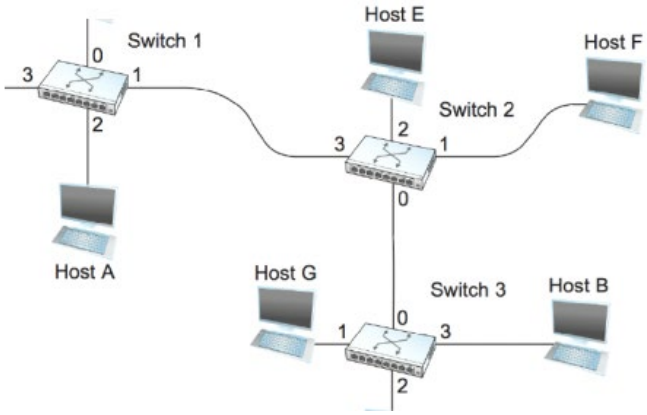
Total 68 Points

1. [20 Points] Check whether the following statements are true (T) or false (F):

1.1. Wireless links, such as those provided by cellular and Wi-Fi networks, are multiple access links.
1.2. Routing determines how to forward messages toward the destination node based on its address.
1.3. Peer-to-peer (P2P) computing or networking is a distributed application architecture that partitions tasks or workloads between peers.
1.4. The presentation layer concerns the router format exchanged between peers.
1.5. the application interacts with the transport layer protocols for calculating IP addresses in the layered Internet architecture.
1.6. In Internet architecture, the transport layer divides the data stream into small units called packets.
1.7. A network link is a physical medium carrying signals in the form of electromagnetic waves.
1.8. The Manchester encoding scheme never doubles the rate of signal transitions.
1.9. The extra bits transmitted with the message are called error-detecting codes.
1.10. A major goal in designing error detection algorithms is to maximize the probability of detecting errors using many redundant bits.
1.11. The Internet is a globally connected network system that uses TCP/IP to transmit data via various media types.
1.12. Internet technology reveals the details of network hardware and permits computers to communicate independently of their physical network connections.
1.13. Routers use the destination network, not the destination computer, when forwarding a packet.
1.14. Protocols allow one to specify or understand network communication with the knowledge of particular network hardware.
1.15. An IP address uniquely identifies the source and destination of data transmitted with the Internet Protocol.
1.16. In subnetting, the subnet mask covers the Internet and the physical network portions of the address to distinguish the network and host IP addresses.
1.17. 196.168.1.0 is a class B network address.
1.18. In a classless address scheme, subnet addressing is permitted to use the network prefix of the address to be an arbitrary length and is not fixed.
1.19. In subnetting, the subnet mask covers the Internet and the physical network portions of the address to distinguish the network and host IP addresses.
1.20. TCP/IP uses the term host to refer to an end system that attaches to the internet.

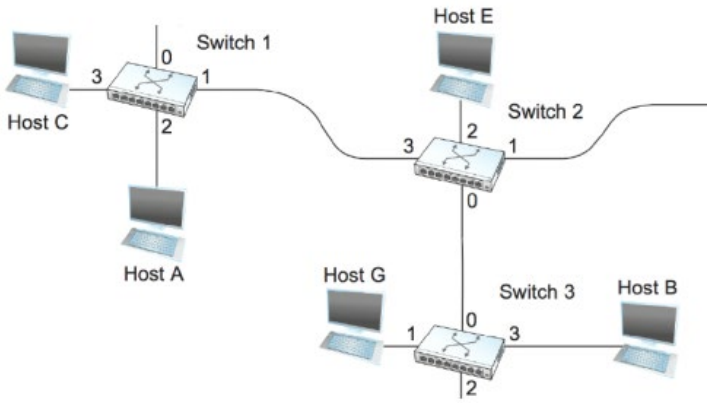
2. [3 Points] What three main stakeholders are required to develop a computer network? Briefly describe the functions of each stakeholder.

3. [2 Points] Consider a digital library program being asked to fetch a 20MB (megabyte) size. Suppose the channel has a bandwidth of 10 Mbps (millions of bits per second). Calculate the throughput of the channel (show your calculation steps).
4. [3 Points] Briefly describe the non-return to zero (NRZ) encoding issues.
5. [3 Points] Show the non-return to zero inverted (NRZI) encoding result of the following 16-bit data: **1010110011011101**
6. [4 Points] Show the 4B/5B encoding on the following 16-bit data with the help of the 4B to 5Bconversion shown in Figure1: **0110011101001010**
7. [2 Points] Find the checksum of the following two 8-bit data: **1010 1010** and **11010110**
8. [4 Points] Assume that the original transmission message (in polynomial) **M(x) = $x^7+x^5+x^4+x^3$** and the channel divisor polynomial **C(x) = x^3+x^1+1**. Calculate the **Cyclic Redundancy Check (CRC) polynomial of the network** (or show its binary equivalent).
9. [2 Points] Briefly describe how a **network switch** decides which output link to place each packet.
10. [5 Points] Consider a network with the address **211.165.13.0**. Subnetting the network with the **starting 4-bit value of the last octet** of its address. Show all of its valid subnet addresses (in dotted decimal form). What is its subnet mask?
11. [4 Points] Show all the **/25** subnets in the **132.42.6.0/23** address block.
12. [5 Points] Consider a datagram network illustrated in the Figure below. In which the hosts have addresses A, B, C, and so on. Assume that **Host A** wants to send a packet to **Host G**. Construct the **forwarding (routing) tables** for the switches that support the packet transmission from **A** to **G** (assume that during a routing process, when a data packet turns up, the forwarding table will have the right information to forward/switch the packet).



13. [5 Points] Consider a virtual circuit network illustrated in Figure below, in which the hosts have addresses A, B, C, and so on. Assume that **Host A** wants to send packets to **Host G**. Show

the **virtual circuit (VC) table entry** for switches that are involved in packet routing from **A** to **G** (assume your **virtual circuit identifier (VCI)** for each switch).



14. [6 Points] Consider a simple internetwork illustrated in **Figure (a),** where **H** denotes a **host,** and **R** denotes **a router**. Assume that a **1556-byte datagram** (**20-byte IP header** plus **1536-byte data**) is sent from **host H4** to **host H8**. The MTU of **network1, network2,** and **network3** is **1556-byte.** But the **MTU** of **network 3** is **532 bytes** (20-byte IP header plus 512-byte data). The IP datagram traversing a sequence of unfragmented and fragmented datagrams through the physical networks is shown in **Figure 4 (b)**. Show the **data, flag,** and **offset** values of fragmented and unfragmented IP datagrams in **a**, **b**, **c, d,** and **e**.