College of Computer Sciences and Engineering

Information and Computer Science Department

ICS 343: Fundamentals of Computer Networks (3-3-4)

Quiz#3 Key

Name: **ID:**

Part I (Chapter 18)

1.1. [10 points] Distinguish (in 2 different ways) between the process of routing a packet from the source to the destination and the process of forwarding a packet at each router.

- Routing means finding a suitable path for a packet from sender to destination and
- Forwarding is the process of sending the packet toward the destination based on *routing information*
  - Routing is finding the end-to-end path
  - Forwarding is the action of sending the packet to the next-hop toward its destination
  - Routing is figuring out the *best route* among many connecting the internetwork
  - Forwarding is the action applied by each router when a packet arrives at one of its interfaces

1.2. [15 points] Explain why the classless addressing architecture was announced back in 1996. What advantages does it have over classful addressing?

The fixed boundaries of classful addressing greatly limited the flexibility and number of addresses that can be assigned. Therefore, these boundaries were made to be fluid, and instead of Classes, the Network address was allowed to take any number of bits in the 32-bit address space. They call this the "prefix" and it is denoted with a slash (/) followed by the length in bits. For example, a Class C address has 24 bits for the network address, which in the classless world would be called a /24 address.

1.3. [5x3 points] In classless addressing, what is the size of the block (N) if the value of the prefix length (n) is:

a) n = 0 b) n = 14 c) n = 32

N = 2^{32-n}. Thus: a) N = 2^{32} b) 2^{18} c) 2^{0}

1.4. [5x3 points] In classless addressing, what is the value of the prefix (n) if the size of the block (N) is:

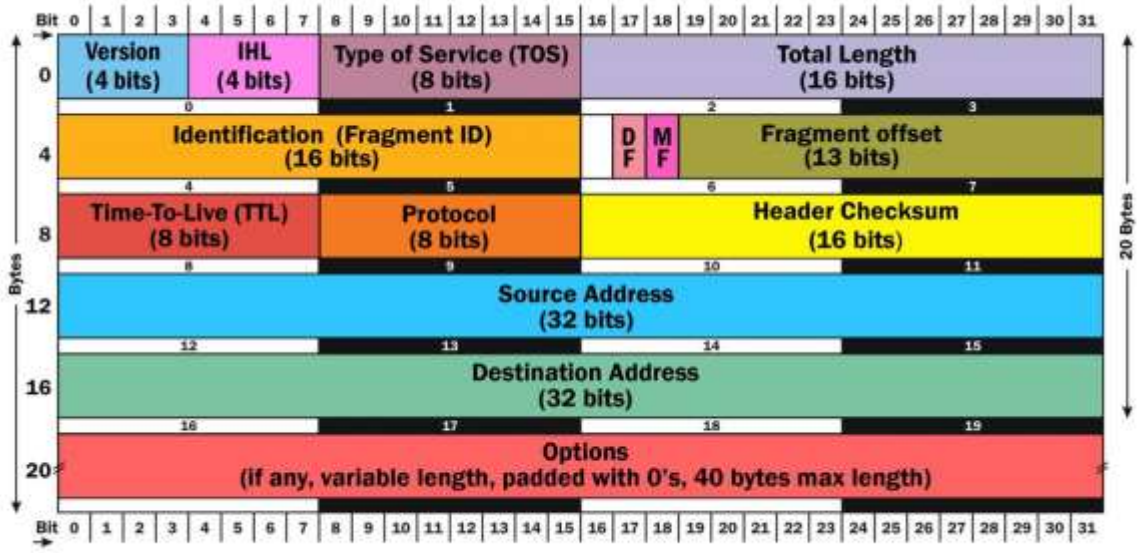
a) N = 1 b) N = 1024 c) N = 2^{23}

a) n = **32** b) n = **22** (Note: 1024 = 2^{23-22}) c) **9**

Part II (Chapter 19)

2.1. [10 points] Can the value of the header length field in an IPv4 packet be less than 5? When is it exactly 5?

The value of the header length field of an IP packet can never be less than 5 because every IP datagram must have at least a base header that has a fixed size of 20 bytes (Five 32-bit words. Or five lines excluding the Options fields).



2.2. [10 points] Explain the use of the (fragmentation offset) field in the IP datagram header.

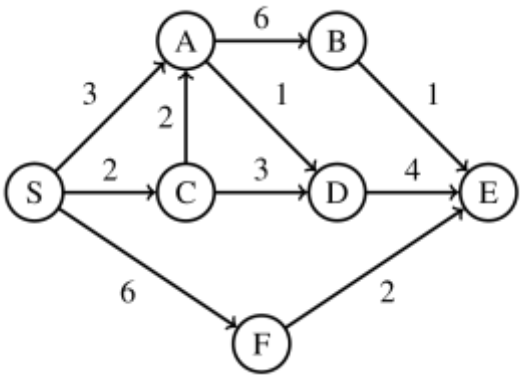
The Fragment Offset field (13 bits) is used in reassembly of fragmented packets. It is measured in 8 byte blocks. The first fragment of a set has an offset of 0. Re-assembly involves putting the fragments together in a buffer, with each new fragment located in the reassembly buffer starting at Fragment Offset * 8 bytes from the beginning of the buffer.

For example, if you had a 2500 byte packet, and were fragmenting it into chunks of 1020 bytes, you would have three fragments as follows (here "data size" includes the length of the ICMPv4 or transport layer header):

Fragment ID	MF Flag	Total Length	Data Size	Offset
1	1	1020	1000	0
2	1	1020	1000	125
3	0	520	500	250

Part III (Chapter 20)

3.1. [**20** points] Run Dijkstra's Algorithm on the following directed graph, starting at vertex S. What is the resulting shortest path for the tree routed at S?



Solution: Dijkstra will visit the vertices in the following order: S, C, A, D, F, E, B. Dijkstra will relax the edge from D to E before the edge from F to E, since D is closer to S than F is. As a result, the parent of each node is: