

**Homework #4**  
**(Due on 12:00am, Thursday, Nov. 21th, 2013)**

- Why is the Internet Protocol (IP) described as the "narrow waist" of the network stack? What are the advantages and disadvantages of such an architecture?
  
- What are the two key functions of the network layer, that each router performs? Please explain the difference between them.
  
- Which entity residing in a router is responsible for redirecting data from an input port to an output port? What are the different types of this entity?
  
- What is buffering, where does it occur and what are possible consequences of this situation?
- Assume you have a 4,000 byte long datagram which needs to be fragmented for a 1,500 bytes MTU. Please fill the following table:

| Datagram Number | Length | Fragmentation Flag | Offset |
|-----------------|--------|--------------------|--------|
|                 |        |                    |        |
|                 |        |                    |        |
|                 |        |                    |        |

*\*The original 1,400 bytes MTU doesn't make sense, for that it is unable to generate correct offset value due to that  $1,400/8$  is not equal to an integer. We have corrected it into 1,500 bytes. The solution part of this problem is updated. Please refer!*

- Convert the following IP addresses into their binary notion:
  - 134.76.249.227
  - 192.168.0.1
- Convert the following IP address into it's decimal notion
  - 11100011100001100000111110101010
- A provider has been assigned the network 128.30.0.0/23 and wants to divide it among three customers. Customer A needs to accommodate up to 220 hosts, customer B needs to accommodate up to 110 hosts and customer C needs to accommodate up to 80 hosts. Please fill the following table with the details of the sub-networks that the provider can create to fit its customers' needs.

| Subnet No. | Network Address | Netmask | Host range | No. of Hosts |
|------------|-----------------|---------|------------|--------------|
| 1          |                 |         |            |              |
| 2          |                 |         |            |              |

|   |  |  |  |  |
|---|--|--|--|--|
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |

- Consider IP addresses: How does a host get an IP address? How does a network get the subnet part of an IP address? How does a provider get a block of IP addresses? What is the principle behind these procedures?
- What problem is tackled by Network Address Translation (NAT)? Please briefly describe what NAT does and what the NAT traversal problem is.
- Consider IPv6 What are the main differences between IPv4 and IPv6? What are two approaches towards the transition between IPv4 and IPv6?