ECSE-6961:Internet Protocols
Quiz 1: Solutions

Time: 60 min (strictly enforced)

Points: 50

YOUR NAME:

Be brief, but DO NOT omit necessary detail

True or False? [2*15 = 30]

T or F [0.5 points]**. If false, state the correct explanation/reason.** [1.5 pts]**. It is a good idea to justify anyway - right ideas earn partial credit.**

- ❑ √ **In a layered model, the interfaces between layers change more often than the technologies used between interfaces**

False: the technologies change more often than interfaces.

- ❑ √ **A point-to-point link always needs two addresses - one for each endpoint.**

No. A network with just a point to point link requires no addresses.

- ❑ √ **A multi-homed node always needs a table to figure out which output port to send a given packet.**

No, in a fully meshed network, we could use the same address for destination and output port.

T F

❑ √ Connection-oriented means a path is reserved across the network to the destination.

False. A socket pair association is enough to form a connection.

❑ √ As a packet goes through the Internet, some IP header fields are never modified.

False. TTL, checksum fields are always modified.

√ ❑ ARP is used because static table-based address translation involves high administrative cost.

True. Eg: machine moves from one net to another.

❑ √ Transport layer protocols are required minimally because network layer protocols don't provide connection-oriented transmission.

False. Because network layers don't provide enough application level address space.

- ❑ √ **A collision domain boundaries define the boundaries of an Ethernet LAN**

False. Broadcast domain marks the boundaries.

- √ ❑ **An address hierarchy which does not match the routing hierarchy is not aggregatable.**

True. Eg: naming or administrative hierarchies.

- √ ❑ **The end-to-end principle is being complemented by the edge-to-edge principle because some functions (like billing) cannot be trusted to end systems.**

True.

- √ ❑ **A subnet mask tells us which bits of the IP address form the network address.**

True.

- ❑ √ **The reason header length, fragment offset and datagram length fields in the IP headers use different units is because the designers could not agree on a common units.**

False: It is a header encoding issue.

- ❑ √ **SLIP supports dynamic IP address assignment**

False. PPP does. With a just framing bytes, this functionality is not possible.

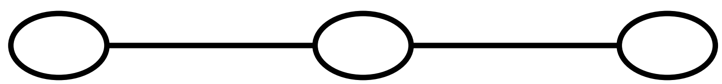
- ❑ √ **When a header checksum error is detected, IP drops the packet and reports the error to the source**

False. IP does not report this error. In any case, ICMP is used to report errors.

- ❑ √ **Batching is used to tradeoff throughput when response time is critical.**

False. You use batching when response time can be traded off.

- **1. [3 pts] Consider the non-meshed, but fully reachable network below. Because of forwarding, the network seems to be like a virtual meshed network where each host has a virtual link to every other host. Where is the multiplexing and indirection done to provide this virtualization?**



The intermediate nodes are multiplexed and the forwarding table at each node provides indirection from the address space to an outgoing port.

- **3. [7 pts] How does IP solve the internetworking problems of heterogeneity and scale ? Discuss how the issues of address resolution, address space aggregation, and fragmentation arise, and how they relate to the above problems?**

IP uses the overlay approach to internetworking. By this we mean that it defines a new address space, a common datagram format, a best-effort connectionless, unreliable service offering and supports these semantics over heterogeneous networks through the protocol actions.

The new common address space is hierarchically organized to support aggregation through the subnet mask mechanism - this is done for scaling of router table sizes and routing traffic.

The new address space has to be mapped to physical addresses for forwarding a datagram to the next hop - need address resolution. This relates to the heterogeneity problem.

IP packets may be as large as 64KB and the transfer is connectionless. Under these conditions fragmentation/reassembly is necessary to support the packet format with expectation of delivery over heterogeneous networks.

- **2) a) (10 pts) An IP *datagram* of length (incl header) 1800 bytes needs to cross an Ethernet (MTU = 1500B) followed by a WAN (MTU = 576B). How many fragments reach the destination ? What are the values of the More bit, Offset, and Length fields in each fragment ?**

IP Datagram 1800B => payload = 1780B > Enet MTU = 1500B

=> Max IP payload = 1480B (1500B - 20B), also a multiple of 8

1st fragment: Length = (1480B + 20B) = 1500B; MF set; Fragoff = 0

2nd fragment: Length = (300B + 20B) = 320B; MF not set;

Fragoff (13-bit quantity) = 1480 >> 3 = 185

WAN MTU = 576B => 1st fragment needs to be fragmented again. Nearest multiple of 8 to (576B - 20B = 556B) is 552B.

Fragment 1a: Length = (552B + 20B) = 572B; MF set; Fragoff = 0

Fragment 1b: Length = (552B + 20B) = 572B; MF set; Fragoff = 69

Fragment 1c: Length = (376B + 20B) = 396B; MF set; Fragoff = 138

Fragment 2 not fragmented further.

Ans: Four **fragments reach the destination with the fields highlighted above.**