ECSE-6600: Internet Protocols
Quiz 1
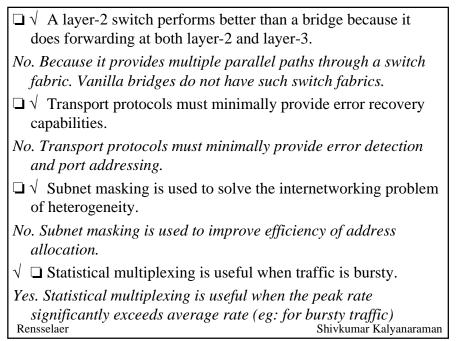
Time: **60 min (strictly enforced)**

Points: **50**

YOUR NAME:

Be brief, but <u>DO NOT</u> omit necessary detail
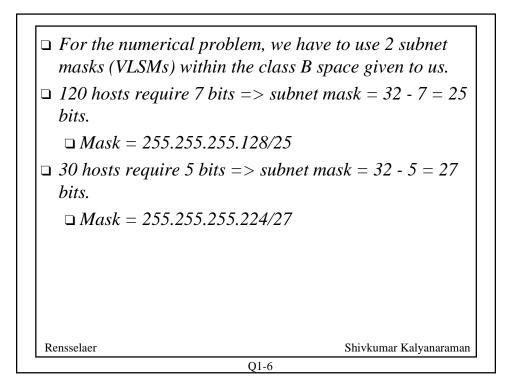

True or False? [2.5*10 = 25]

T or F **[0.5 points]**. Either way, state the correct explanation/reason. **[2 pts]**. <u>Right ideas earn partial (or even full) credit.</u>

❏ √ Cumulative acks are used in TCP because other types of ACKs or NAKs do not work for TCP.

No. Because other types of ACKs or NAKs are inefficient in terms of overhead, or providing reliability on the reverse channel.

❏ √ When a 900-byte packet is fragmented at a link whose MTU = 576 bytes, the fragment offset field in the second fragment is set to 68.

No. The offset is set to 552/8 = 69.   552 is the nearest multiple of 8 to 576-20 = 556.

❏ √ If variable length subnet masks (VLSM) are used in a network, it means that a single subnet can be configured with multiple masks.

No. It means that different subnets can have different length masks.

❏ √ A layer-2 switch performs better than a bridge because it does forwarding at both layer-2 and layer-3.

No. Because it provides multiple parallel paths through a switch fabric. Vanilla bridges do not have such switch fabrics.

❏ √ Transport protocols must minimally provide error recovery capabilities.

No. Transport protocols must minimally provide error detection and port addressing.

❏ √ Subnet masking is used to solve the internetworking problem of heterogeneity.

No. Subnet masking is used to improve efficiency of address allocation.

√ ❏ Statistical multiplexing is useful when traffic is bursty.

Yes. Statistical multiplexing is useful when the peak rate significantly exceeds average rate (eg: for bursty traffic)

√ ❏ TCP uses the 2 MSL wait during connection setup to avoid confusion between multiple connection incarnations.

Yes. MSL= maximum segment lifetime. 2 MSL wait assures TCP that segments belonging to the earlier incarnation have been flushed from the network.

√ ❏ Telephony does not require ARP because it does not have multiple levels of addresses and runs over point-to-point links.

True. ARP is necessary only when there is a "resolution" problem which occurs due to the overlay model of internetworking. Point-to-point links don't need addresses at the link level.

❏ √ When the header checksum fails at a router, the IP packet is dropped and an error message is sent to the source.

No. IP does not send error messages. And even ICMP does not send error messages for this particular error case.

- ❑ [13 pts] Why is classful addressing inefficient ? Explain how subnet masks and VLSMs help to address this problem. Assume that you are given the class B address space 128.113.0.0 and you had to configure 250 subnets with 120 hosts each, and 1000 networks with 30 hosts each. What subnet masks will you use to accomplish this task ?
- ❑ *Classful addressing is inefficient in two ways:*
- ❑ *Internal fragmentation: An enterprise will not be able to use all the class B address space because no single network is that large leading to several <u>host numbers being unused</u>*
- ❑ *External fragmentation: everyone wants class B addresses, and hence the class C and class A <u>network numbers are unused</u>.*
- ❑ *Subnet masks allow sub-division of a class into sub-networks so that each subnet will have fewer host numbers to represent a single broadcast domain.*
- ❑ *VLSMs allow a single class to have multiple lengths of subnet masks. This allows each subnet to have exactly the number of bits necessary to number all its hosts.*

- ❑ *For the numerical problem, we have to use 2 subnet masks (VLSMs) within the class B space given to us.*
- ❑ *120 hosts require 7 bits => subnet mask = 32 - 7 = 25 bits.*
  - ❑ *Mask = 255.255.255.128/25*
- ❑ *30 hosts require 5 bits => subnet mask = 32 - 5 = 27 bits.*
  - ❑ *Mask = 255.255.255.224/27*

- ❑ [12 pts] Explain how IP solves the problems of heterogeneity and scale, and what design tradeoffs does it make in the process. Why is the IP solution better than that provided by bridges ?
- ❑ *Scale:* IP provides a new address space with addressing structure and forwarding procedures to distinguish between direct and indirect connected nodes. The two-level forwarding algorithm is supported by scalable routing infrastructure that enables better filtering at the network level leading to scalability.
- ❑ *Heterogeneity:* IP is a minimal overlay protocol and with a new address space and packet format and which is mapped to/from lower layer protocols. The minimalism allows simple mapping to a variety of lower layer technologies. Similarly, it provides a minimal (best-effort) interface to the higher layer protocols. The mapping of addresses requires a protocol ARP, and the mapping of the packet format requires fragmentation/reassembly support in IP.
- ❑ The design tradeoffs are are follows:
  - ❑ The addressing structure leads to address allocation and address space management problems.

- ❑ The minimalistic IP design leads to the definition of multiple protocols to provide additional functionality (ARP, TCP, DNS, ICMP, Routing).
- ❑ The best-effort model means that new adaptive applications must be written to exploit the new infrastructure.
- ❑ Similarly, special features of lower layers cannot be exploited because of the minimal interface. The performance characteristics of the end-to-end virtual link can vary wildly.
- ❑ IP solution vs Bridges:
  - ❑ Bridges provide only a single level of forwarding and depend upon flat addresses. This means that their forwarding tables are large and require more updating as the size of the network grows. Moreover, when the bridge does not find an entry, it will flood the network whereas a router sends it on a default route. The table setup is also based upon a rudimentary learning algorithm compared to the sophisticated routing algorithms used at the network layer.