Midterm Solution

1. Short Answer Questions

(a) Switched Ethernet:

Collision possible if a station transmits at the same time switch sends it a packet.

(b)Tunneling & fragmentation

A tunnel is a logical link & transparent to the rest of the network.

Note: If this were simply a fragmentation issue without tunneling, then one could argue both ways(reassemble @destination or intermediate routers)



(c)Web Proxy Caching:



(d)Intra-domain Routing v/s inter-domain

-Scalability: hierarchical routing scales better -Policy: Allows policy-based routing

2. CSMA/CD(K.R.CH5. Prob17)

(a)Channel alternates between productive & nonproductive states:

(1) find # of slots in unproductive state(x)

Let Y be # of slots until a success, so Y is a Geo R.V.

Probability of a success in mth slot:

 $P(Y=m)=(1-\beta)^{m-1}\beta$

where β = probability of success

 $\beta = N * P * (1-P)^{N-1}$

(2)find the # of wasted slots = $X=E(Y)-1=(1-\beta)/\beta$

 $(E(Y)=1/\beta$ for Geo R.V)

$$E = efficiency = \frac{n}{n+x} = \frac{n}{n+\frac{1-(1-1/N)^{N-1}}{(1-1/N)^{N-1}}}$$

 (b) maximize E: dE/dP=0 more simply: maximize E=minimize x=maximize β: d β/dP=0 so P=1/N

c)substitute p=1/N

$$E = \frac{n}{n + \frac{1 - (1 - 1/N)^{N-1}}{(1 - 1/N)^{N-1}}}$$

$$\lim_{n \to \infty} E = \frac{n}{1 - \frac{1}{e}} = \frac{n}{n + e - 1}$$
$$n + \frac{\frac{1}{e}}{\frac{1}{e}}$$





This leads to unfair share of the channel for 2 TCP sessions

4. Reliable Multicast

Sender does not know the # or identity of the receivers, so we can't use ACKs(won't know how many ACKs to receive). So a NACK-based protocol design is suitable.

Assumption: each receiver receives some but not all packets.

Receiver:

•if receive an in-order packet with no corruption, hand to application all packets so far •if receive out-of-order packet, buffer & send NACKs for missing packet

•if corrupted/already received packet, discard

Sender:

- •Assume infinite buffer size
- •Just keep sending packets & buffer them

•On a NACK, retransmit packet

Essentially, similar to sample exam problem #4 &K.R. Ch3 #11(with minor modification)

(b) State of router:

•buffer packets & answer NACKs

•keep state of NACKs that have been sent to source & do not send a NACK from another receiver if one has been sent already